AMRITSAR GROUP OF COLLEGES NAAC Grade "A" 3rd Cycle | Autonomous College under Autonomous Category | (Since 2014) Conferred by UGC	**14th BoS Meeting** **Table of Content** **Date:13.05.2026**	**Department of Computer Science and Engineering**

Ref. No. AGC/CSE/2026/022 Date: 05.05.26

Dr. Sandeep Kad, Professor and Head, Department of CSE, AGC Amritsar	Chairman
Dr. Rajesh Kumar, Professor, Department of CSE, TIET, Patiala	Member
Dr. Sarbjeet Singh, Professor, Department of CSE, UIET, Panjab University, Chandigarh	Member
Dr. Krishan Saluja, Professor, Department of CSE, UIET, Panjab University, Chandigarh	Member
Mr. Simarjeet Singh Vansal, Manager, Cyber Security, Dover Corporation, Bengaluru	Member
Dr. Munish Bhatia, Assistant Professor, NIT Kurukshetra	Member
All faculty members of CSE Department, AGC, Amritsar	Member

Subject: 14th Board of Studies Meeting of the Department of Computer Science and Engineering.

Dear Sir/Madam,

The 14th Board of Studies meeting of the Department of Computer Science and Engineering for B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE) is scheduled to be held on 13.05.2026 at 10:30 am in Department of CSE, Amritsar Group of Colleges (physical mode). The agenda of meeting is as follows:

1. To approve the minutes of 13th meeting of Board of Studies.
2. To discuss and finalize the study scheme and detailed syllabi for the 7th and 8th semesters of B.Tech Computer Engineering, applicable from the 2023 batch onwards.
3. To discuss the study scheme for the 3rd to 8th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards, and to finalize the study scheme for the 3rd and 4th semesters for students admitted in 2025 and onwards.
4. To finalize the detailed syllabi and course outcomes for the 3rd and 4th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards.
5. To approve the list of courses to be offered in online mode through the SWAYAM–NPTEL platform for the 3rd Semester (Batch 2025), 5th Semester (Batch 2024), and 7th Semester (Batch 2023) of the B.Tech Computer Science and Engineering and B.Tech Computer Engineering (list of tentative courses for July 2026 available on SWAYAM-NPTEL portal to be discussed).

6. To discuss the inclusion of the Entrepreneurship Mindset Curriculum course in the 3rd and 4th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards, as per the guidelines of IK Gujral Punjab Technical University and the Government of Punjab.
7. To discuss the inclusion of a mandatory course on Disaster Management, as prescribed by All India Council for Technical Education, to be offered in the 3rd year for B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE) (Batch 2025 onwards), subject to the availability of guidelines and syllabus from AICTE/IKGPTU.
8. To approve the allocation of M.Tech thesis supervisor for 09 candidates.
9. To apprise the BoS of the following:
    a. Starting of a new program in B.Tech Artificial Intelligence and Machine Learning (AIML) with an intake of 60 seats from July 2026.
    b. Reduction in intake of 60 seats in the program of B.Tech Computer Engineering (CoE) from July 2026.
    c. Results of Nov 2025 examinations.
    d. Certification course on Artificial Intelligence and Machine Learning (Module-II) conducted for the students of B.Tech Computer Engineering, 4th semester (Batch 2024 admitted).
    e. Academic activities (workshops, guest lectures, and alumni talks) conducted by the Department during the session Jan–Jun 2026.
    f. 5-day Faculty Development Programme on Internet of Things (IoT) conducted by the ICT Academy.
10. Any other agenda with the permission of the chair.

You are requested to kindly confirm your participation in the said meeting. Honorarium shall be paid as per AGC/IKGPTU norms.

With regards,

(Er. Neha Chadha)
Member Secretary,
Board of Studies,
Department of CSE

Neha Chadha <neha.cse@acetedu.in>

Agenda and Invitation of 14th BoS Meeting

6 messages

Neha Chadha <neha.cse@acetedu.in> Tue, May 5, 2026 at 1:01 PM
To: sarbjeet@pu.ac.in, Dr Krishan Kumar <k.salujauiet@gmail.com>, Simarjeet Vansal <rajan.simar@gmail.com>, munish.bhatia@nitkkr.ac.in, rakumar@thapar.edu, "Dr.Sandeep Kad" <hod.cse@acetedu.in>
Bcc: "Dr. Upain Kumar Bhatia" <deanacademics@acetedu.in>, "Dr. Gaurav Tejpal" <principal@acetedu.in>

Dear Sir/Madam,

The 14th Board of Studies meeting of the Department of Computer Science and Engineering for B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE) is scheduled to be held on 13.05.2026 at 10:30 am in Department of CSE, Amritsar Group of Colleges (physical mode). The agenda of meeting is as follows:

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2. To discuss and finalize the study scheme and detailed syllabi for the 7th and 8th semesters of B.Tech Computer Engineering, applicable from the 2023 batch onwards.
3. To discuss the study scheme for the 3rd to 8th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards, and to finalize the study scheme for the 3rd and 4th semesters for students admitted in 2025 and onwards.
4. To finalize the detailed syllabi and course outcomes for the 3rd and 4th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards.
5. To approve the list of courses to be offered in online mode through the SWAYAM–NPTEL platform for the 3rd Semester (Batch 2025), 5th Semester (Batch 2024), and 7th Semester (Batch 2023) of the B.Tech Computer Science and Engineering and B.Tech Computer Engineering (list of tentative courses for July 2026 available on SWAYAM-NPTEL portal to be discussed).
6. To discuss the inclusion of the Entrepreneurship Mindset Curriculum course in the 3rd and 4th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards, as per the guidelines of IK Gujral Punjab Technical University and the Government of Punjab.
7. To discuss the inclusion of a mandatory course on Disaster Management, as prescribed by All India Council for Technical Education, to be offered in the 3rd year for B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE) (Batch 2025 onwards), subject to the availability of guidelines and syllabus from AICTE/IKGPTU.
8. To approve the allocation of M.Tech thesis supervisor for 09 candidates.
9. To apprise the BoS of the following:
    a. Starting of a new program in B.Tech Artificial Intelligence and Machine Learning (AIML) with an intake of 60 seats from July 2026.
    b. Reduction in intake of 60 seats in the program of B.Tech Computer Engineering (CoE) from July 2026.
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    d. Certification course on Artificial Intelligence and Machine Learning (Module-II) conducted for the students of B.Tech Computer Engineering, 4th semester (Batch 2024 admitted).

e. Academic activities (workshops, guest lectures, and alumni talks) conducted by the Department during the session Jan–Jun 2026.

f. 5-day Faculty Development Programme on Internet of Things (IoT) conducted by the ICT Academy.

10. Any other agenda with the permission of the chair.

You are requested to kindly confirm your participation in the said meeting. Honorarium shall be paid as per AGC/IKGPTU norms.

With regards,

(Er. Neha Chadha)
Member Secretary,
Board of Studies,
Department of CSE

Invitation and Agenda of 14th BoS meeting.pdf
742K

Sarbjeet Singh <sarbjeet@pu.ac.in> Tue, May 5, 2026 at 3:16 PM
To: Neha Chadha <neha.cse@acetedu.in>

Acknowledged

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Regards
Sarbjeet Singh
Professor, CSE
UIET, Panjab University
Chandigarh - 160014

[Quoted text hidden]

Munish Bhatia <munish.bhatia@nitkkr.ac.in> Tue, May 5, 2026 at 3:30 PM
To: Neha Chadha <neha.cse@acetedu.in>

Thank you for the information
I will attend it in online.

Best Regards
Dr Munish Bhatia
Assistant Professor
Department of Computer Applications
NIT Kurukshetra
M(+91)- 7837180829

[Quoted text hidden]

RAJESH KUMAR <rakumar@thapar.edu> Tue, May 5, 2026 at 4:29 PM
To: Neha Chadha <neha.cse@acetedu.in>

Thanks for the invitation. I will be there on the said date.

Best Regards

Dr. Rajesh Kumar
(Professor)
Computer Science & Engineering Department
Thapar Institute of Engineering and Technology
Patiala, Punjab

[Quoted text hidden]

Dr Krishan Kumar <k.salujauiet@gmail.com> Wed, May 6, 2026 at 11:59 AM
To: Neha Chadha <neha.cse@acetedu.in>

Okay Maam

Regards

Dr. Krishan Kumar
Professor, Information Technology,
University Institute of Engineering & Technology,
Panjab University, Chandigarh
Linkedin: https://www.linkedin.com/in/krishan-saluja-b81a7489/
Mobile No: +918288012014
E-mail: k.saluja@pu.ac.in
Website: uiet.puchd.ac.in/
https://pu.irins.org/profile/112980
Qualification:
B.Tech. CSE (NIT, Hamirpur), M.S. (BITS, Pilani), Ph.D. (IIT, Roorkee)
Research Credentials:
Web of Science: ResearcherID F-6049-2016
Orcid: https://orcid.org/0000-0001-9877-0238
Scopus: https://www.scopus.com/authid/detail.uri?authorId=26021294900
Google Scholar: https://scholar.google.co.in/citations?user=tTQOc9EAAAAJ&hl=en
Researchgate: https://www.researchgate.net/profile/Dr_Krishan_Saluja

On Tue, 5 May 2026 at 1:01 PM, Neha Chadha <neha.cse@acetedu.in> wrote:
[Quoted text hidden]

Munish Bhatia <munish.bhatia@nitkkr.ac.in> Wed, May 6, 2026 at 1:48 PM
To: Neha Chadha <neha.cse@acetedu.in>

Thank you

As discussed telephonically, i will be available in physical mode on the said date and time

Best Regards
Dr Munish Bhatia
Assistant Professor
Department of Computer Applications
NIT Kurukshetra
M(+91)- 7837180829

[Quoted text hidden]

Ref. No. AGC/CSE/2026/024

Date: 13.05.26

Proceedings of Board of Studies

The 14th Board of Studies meeting of the Department of Computer Science and Engineering for B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE) was held on 13.05.2026 at 10:30 am in Department of CSE, Amritsar Group of Colleges (in physical mode). The various items of the agenda were discussed and the decisions were taken unanimously as under:

S. No.	Agenda	Decisions/Approvals
1.	To approve the minutes of 13th meeting of Board of Studies.	Approved
2.	To discuss and finalize the study scheme and detailed syllabi for the 7th and 8th semesters of B.Tech Computer Engineering, applicable from the 2023 batch onwards.	Discussed and Approved (Annexure-1 attached)
3.	To discuss the study scheme for the 3rd to 8th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards, and to finalize the study scheme for the 3rd and 4th semesters for students admitted in 2025 and onwards.	Discussed and approved the study scheme for the 3rd and 4th semesters of B.Tech CSE and B.Tech CoE for the students admitted in 2025 onwards. However, the proposed study scheme for the 5th to 8th semesters was reviewed and kept open for modifications to be discussed in BOS meeting before the commencement of the July 2027 session. (Annexure-2 attached)
4.	To finalize the detailed syllabi and course outcomes for the 3rd and 4th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards.	Approved (Annexure-3 attached)
5.	To approve the list of courses to be offered in online mode through the SWAYAM–NPTEL platform for the 3rd Semester (Batch 2025), 5th Semester (Batch 2024), and 7th Semester (Batch 2023) of the B.Tech Computer Science and Engineering and B.Tech Computer Engineering (list of tentative courses for July 2026 available on SWAYAM-NPTEL portal to be discussed).	The BoS members authorized the Chairman (BOS) to select NPTEL courses from the final list of SWAYAM courses for July 2026. (Annexure-4 attached)

6.	To discuss the inclusion of the Entrepreneurship Mindset Curriculum course in the 3rd and 4th semesters of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE), applicable from the 2025 batch onwards, as per the guidelines of IK Gujral Punjab Technical University and the Government of Punjab.	The BoS members authorized the Chairman (BOS) the inclusion of the Entrepreneurship Mindset Curriculum course in the 3rd and 4th semesters of B.Tech CSE and B.Tech CoE (2025 batch onwards), as per the guidelines of IKGPTU Kapurthala and the Government of Punjab.
7.	To discuss the inclusion of a mandatory course on Disaster Management, as prescribed by All India Council for Technical Education, to be offered in the 3rd year for B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE) (Batch 2025 onwards), subject to the availability of guidelines and syllabus from AICTE/IKGPTU.	The BoS members authorized the Chairman (BOS) the inclusion of a mandatory Disaster Management course in the 3rd year of B.Tech Computer Science and Engineering (CSE) and B.Tech Computer Engineering (CoE) (Batch 2025 onwards), as prescribed by the All India Council for Technical Education (AICTE), as per the guidelines and syllabus issued by AICTE / IKGPTU.
8.	To approve the allocation of M.Tech thesis supervisor for 09 candidates.	Approved (Annexure-5 attached)
9.	To apprise the BoS of the following: a. Starting of a new program in B.Tech Artificial Intelligence and Machine Learning (AIML) with an intake of 60 seats from July 2026.	Apprised
	b. Reduction in intake of 60 seats in the program of B.Tech Computer Engineering (CoE) from July 2026.	Apprised
	c. Results of Nov 2025 examinations.	Apprised (Annexure-6 attached)
	d. Certification course on Artificial Intelligence and Machine Learning (Module-II) conducted for the students of B.Tech Computer Engineering, 4th semester (Batch 2024 admitted).	Apprised
	e. Academic activities (workshops, guest lectures, and alumni talks) conducted by the Department during the session Jan–Jun 2026.	Apprised
	f. 5-day Faculty Development Programme on Internet of Things (IoT) conducted by the ICT Academy.	Apprised
10.	Any other agenda with the permission of the chair. • Allocation of M.Tech supervisor of 01 M.Tech student and approval of synopsis presentation and topic finalization of 01 M.Tech student. • Starting new course as per market trends	• Approved the allocation of M.Tech supervisor for one student and the synopsis presentation along with finalization of the title of the thesis of the student. (Annexure-7 attached) • The BoS members authorized the chairman to take decision in this regard while keeping in consideration the guidelines of IKGPTU/AICTE

Member Secretary
Board of Studies

13/5/26

Chairman
Board of Studies

13/05/2026

13/05/2026.

13/05/26

13/5/26

Proceedings of the 14th Board of Studies Meeting

2 messages

Neha Chadha <neha.cse@acetedu.in> Mon, 18 May, 2026 at 16:35
To: sarbjeet@pu.ac.in, Simarjeet Vansal <rajan.simar@gmail.com>, munish.bhatia@nitkkr.ac.in, rakumar@thapar.edu, Dr.Sandeep Kad <hod.cse@acetedu.in>, Dr Krishan Kumar <k.salujauiet@gmail.com>
Bcc: Dr. Upain Kumar Bhatia <deanacademics@acetedu.in>, Dr. Gaurav Tejpal <principal@acetedu.in>

Dear Sir/Madam,

The 14th Board of Studies (BoS) Meeting was held on 13.05.2026. The proceedings of the meeting along with the annexures are attached herewith for your kind reference.

Kindly review the attached documents and acknowledge the email.

With regards,

(Er. Neha Chadha)
Member Secretary, Board of Studies
Department of CSE

8 attachments

- Proceedings of 14th BoS Meeting.pdf
  2.1 MB
- 2_Annexure2_Study Scheme2025.pdf
  198 KB
- 1_Annexure1_CoE_7_8sem.pdf
  499 KB
- 5_Annexure5_M.Tech Supervisor.pdf
  155 KB
- 3_Annexure3_Syllabus_50 Internal.pdf
  576 KB
- 6_Annexure6_Nov 2025 Result.pdf
  66 KB
- 10_Any other.pdf
  160 KB
- 4_Annexure4_nptel_CSE_CoE.pdf
  238 KB

Sarbjeet Singh <sarbjeet@pu.ac.in> Mon, 18 May, 2026 at 17:44
To: Neha Chadha <neha.cse@acetedu.in>

Acknowledged.

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Regards
Sarbjeet Singh
Professor, CSE
UIET, Panjab University
Chandigarh - 160014

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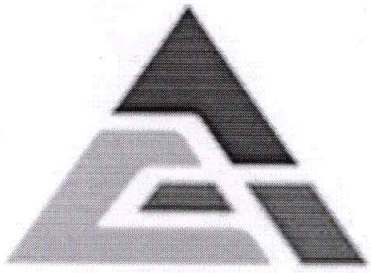
Annexure-1

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



STUDY SCHEME & DETAILED SYLLABUS

Bachelor of Technology

In

Computer Engineering

(Batch 2023 onwards)

Study Scheme for B.Tech. CoE

Semester: 1st/2nd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCH - 21101	Engg. Chemistry	3	1	0	40	60	100	4
AGES - 21101	Environmental Studies	2	0	0	40	60	100	2
AGAM - 21101	Engineering Mathematics-I	3	1	0	40	60	100	4
AGCS - 21101	Programming for Problem Solving	3	0	0	40	60	100	3
AGHU - 21101	English-I	3	0	0	40	60	100	3
AGHU - 21103	English Lab-I	0	0	2	30	20	50	1
AGCH - 21102	Engg. Chemistry Lab	0	0	2	30	20	50	1
AGEG - 21101	Engineering Graphics	1	0	6	30	20	50	4
AGCS - 21102	Programming for Problem Solving Lab	0	0	4	30	20	50	2
		15	**2**	**14**	**320**	**380**	**700**	**24**
		Contact Hours = 31 hrs						

Semester: 1st/2nd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGPH - 21101	Engineering Physics	3	1	0	40	60	100	4
AGAM - 21102	Engineering Mathematics-II	3	1	0	40	60	100	4
AGHU - 21102	English-II	3	0	0	40	60	100	3
AGEE - 21101	Basic Electrical & Electronics Engineering	3	1	0	40	60	100	4
AGHV - 21101	Human Values & Professional Ethics	3	0	0	40	60	100	3
AGPH - 21102	Engineering Physics Lab	0	0	2	30	20	50	1
AGHU - 21104	English Lab-II	0	0	2	30	20	50	1
AGEE - 21102	Basic Electrical & Electronics Engineering Lab	0	0	2	30	20	50	1
AGMP - 21101	Manufacturing Practice	0	0	4	60	40	100	2
AGGF - 21101	General Fitness	0	0	0	100	0	100	1
		15	**3**	**10**	**450**	**400**	**850**	**24**
		Contact Hours = 28 hrs						

Semester: 3rd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS - 21301	Mathematics and Statistics	3	1	-	40	60	100	4
AGCS - 21302	Data Structures	3	1	-	40	60	100	4
AGCS - 21303	Object Oriented Programming using C++	3	-	-	40	60	100	3
AGCS - 21304	Computer Networks	3	-	-	40	60	100	3
AGCS - 21305	Computer Architecture	3	1	-	40	60	100	4
AGCS - 21306	Data Structures Lab	-	-	2	30	20	50	1
AGCS - 21307	Object Oriented Programming using C++ Lab	-	-	2	30	20	50	1
AGCS - 21308	Computer Networks Lab	-	-	2	30	20	50	1
AGFE - 21301	Functional English - I	-	1		50		50	1
AGMC - 21301	Indian Constitution	1	-	-	-	-	-	-
AGCS - 21309	Institutional Training	-	-	2	60	40	100	1
		16	**4**	**8**	**400**	**400**	**800**	**23**
		Contact Hours = 28 hrs						

Semester: 4th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS - 21401	Discrete Structures	3	1	-	40	60	100	4
AGCS - 21402	Relational Database Management Systems	3	1	-	40	60	100	4
AGCS - 21403	Programming in Python	3	-	-	40	60	100	3
AGCS - 21404	Operating Systems	3	-	-	40	60	100	3
AGCS - 21405	Web Development	3	-	-	40	60	100	3
AGCS - 21406	Relational Database Management Systems Lab	-	-	2	30	20	50	1
AGCS - 21407	Programming in Python Lab	-	-	2	30	20	50	1
AGCS - 21408	Operating Systems Lab	-	-	2	30	20	50	1
AGCS - 21409	Web Development Lab			2	30	20	50	1
AGAP - 21401	Engineering Aptitude - I	-	1	-	50	0	50	1
AGFE - 21402	Functional English - II	-	1	-	50	0	50	1
AGMC- 21401	Essence of Indian Knowledge Tradition	1	-	-	-	-	-	-
		16	**4**	**8**	**420**	**380**	**800**	**23**
		Contact Hours = 28 hrs						

Semester: 5th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS - 21501	Design and Analysis of Algorithms	3	1	-	40	60	100	4
AGCS - 21502	Software Engineering	3	1	-	40	60	100	4
AGCS - 21503	Programming in Java	3	-	-	40	60	100	3
AGCoE-21504X	Professional Elective Course-1 (PEC-1)	3	-	-	40	60	100	3
AGCS - 21505	Artificial Intelligence	3	-	-	40	60	100	3
AGCS - 21506	Design and Analysis of Algorithms Lab	-	-	2	30	20	50	1
AGCS - 21507	Software Engineering Lab	-	-	2	30	20	50	1
AGCS - 21508	Programming in Java Lab	-	-	2	30	20	50	1
AGCS - 21509	Artificial Intelligence Lab			2	30	20	50	1
AGAP - 21502	Engineering Aptitude - II	-	1	-	50	0	50	1
AGCS - 21510	Summer Training	-	1	-	60	40	50	1
		15	**4**	**8**	**430**	**420**	**850**	**23**
		Contact Hours = 28 hrs						

Semester: 6th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS - 21601	Machine Learning	3	1	-	40	60	100	4
AGCS - 21602	Cloud Computing	3	1	-	40	60	100	4
AGCS - 21603	Big Data Analytics	3	-	-	40	60	100	3
AGCoE - 21604X	Professional Elective Course-2 (PEC-2)	3	-	-	40	60	100	3
AGCS - 21605	Mobile Application Development	3	-	-	40	60	100	3
AGCS - 21606	Machine Learning Lab	-	-	2	30	20	50	1
AGCS - 21607	Cloud Computing Lab	-	-	2	30	20	50	1
AGCS - 21608	Big Data Analytics Lab	-	-	2	30	20	50	1
AGCS - 21609	Mobile Application Development Lab			2	30	20	50	1
AGFE - 21603	Functional English - III	-	1	-	50	0	50	1
AGAP - 21603	Engineering Aptitude - III	-	1	-	50	0	50	1
		15	**4**	**8**	**420**	**380**	**800**	**23**
		Contact Hours = 28 hrs						

Semester: 7th / 8th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS - 21701	Data Science	3	1	-	40	60	100	4
AGCoE - 21702X	Professional Elective Course-3 (PEC-3)	3	-	-	40	60	100	3
AGCoE - 21702Y	Professional Elective Course-4 (PEC-4)	3	-	-	40	60	100	3
AGOE – 217xx	Open Elective	3	-	-	40	60	100	3
AGCS - 21703	Data Science Lab	-	-	2	30	20	50	1
AGCoE - 21704	Major Project Lab	-	-	4	60	40	100	2
		12	**1**	**6**	**250**	**300**	**550**	**16**
		Contact Hours = 19 hrs						

Semester: 7th / 8th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCoE - 21801	Industrial Training	-	-	-	300	200	500	12
		0	**0**	**0**	**300**	**200**	**500**	**12**
		Contact Hours = 0 hrs						

X	PEC-1	PEC-2
A	Theory of Computations	Information Security
B	Compiler Design	Cyber Security
C	Soft Computing	Blockchain Technology
D	Distributed Systems	Ethical Hacking

X	PEC-3	Y	PEC-4
A	Software Testing	F	Introduction to Internet of Things
B	Deep Learning	G	Social Network Analysis
C	Computer Vision	H	Reinforcement Learning
D	Advanced Computer Networks	I	Object Oriented Analysis and Design using UML
E	Business Intelligence and Analytics	J	Foundations of Cryptography
		K	Natural Language Processing

	List of Open Electives
AGOE - 21701	Air Pollution and Control
AGOE - 21702	Disaster Management
AGOE - 21703	Product Design and Development
AGOE - 21704	Material Management
AGOE - 21705	Non-Conventional Energy Sources
AGOE - 21706	Electrical Power Utilization
AGOE - 21709	Management of Human Resources
AGOE - 21710	Basics of Management

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

B. Tech. (CoE): 7th/8th SEM

7th/8th Semester	AGCS-21701: DATA SCIENCE				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Understanding the foundations and applications of data science
CO-2	Mastering data acquisition and preparation techniques
CO-3	Refining data for analysis and harnessing exploratory insights
CO-4	Analyzing data through probabilistic inference and statistical methods
CO-5	Evaluating and fine-tuning predictive models for real-world application
CO-6	Exploring cutting-edge trends and crafting insights through data visualization

Part	Content	CO
I	**Introduction to data science:** Evolution, need and components of data science, data science process. difference between data science and business intelligence, applications of data science in various fields. ethical issues in data science, data privacy and security, responsible data use.	CO-1
II	**Data collection**: Data collection sources, data collection methods – interviews, questionnaires, databases, web scraping, apis. **Data cleaning techniques**: Handling missing values, data transformation, data normalization and standardization.	CO-2
	Data preprocessing: Data integration – data reduction data transformation and data discretization. exploratory data analysis –basic tools (plots, graphs and summary statistics) of eda, philosophy of eda – the data science process.	CO-3
III	**Probability and statistics:** Basic probability concepts, probability distributions (normal, binomial, poisson), bayes' theorem, inferential statistics, hypothesis testing, confidence intervals. **Understanding data analytics:** Need, characteristics, descriptive (mean, median, mode, variance, and standard deviation) predictive, diagnostic, prescriptive.	CO-4
IV	**Model evaluation and validation:** Linear regression, logistic regression, decision trees, k-nearest neighbors (k-nn), clustering (k-means), model evaluation metrics (RMSE, MAE, r^2), evaluation metrics (accuracy, precision, recall, f1score), train-test split, cross-validation, overfitting and underfitting, model tuning and hyperparameter optimization.	CO-5
	Recent trends: Benefits and best practices, data visualization: introduction to data visualization, acquiring and visualizing data, applications of data visualization, data visualization tools and techniques, **Real world applications:** Object Detection, Plagiarism Detection.	CO-6

References:

- "An Introduction to Statistical Learning: with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
- "The Elements of Statistical Learning: Data Mining, Inference, and Prediction" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman
- "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney
- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

7th/8th Semester	AGCS-21703: DATA SCIENCE LAB				
Internal Marks:	**30**		**L**	**T**	**P**
External Marks:	**20**		**0**	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Performing manipulation of data using Pandas.
CO-2	Performing basic web scraping and apply data cleaning techniques.
CO-3	Implement Exploratory Data Analysis (EDA) and advanced visualizations using matplotlib and seaborn.
CO-4	Applying various probability concepts.
CO-5	Evaluation of supervised learning models.
CO-6	Development and execution of Data Science project

Part	Content	CO
I	Writing Python scripts for basic data manipulation tasks. Importing and exporting data with Pandas. Performing basic data manipulation operations such as filtering, sorting, and grouping.	CO-1
II	Basic web scraping with Beautiful Soup Data Cleaning: Handling missing values, Data transformation and normalization, removing duplicates and dealing with outliers.	CO-2
	Exploratory Data Analysis (EDA) • Descriptive Statistics and Visualization ◦ Calculating summary statistics (mean, median, standard deviation). ◦ Creating basic plots (histograms, box plots) with matplotlib and seaborn. • Advanced Data Visualization ◦ Creating scatter plots, line plots, and bar charts. ◦ Customizing plots (titles, labels, legends, colors).	CO-3
III	Probability and Statistics • Basic Probability ◦ Simulating coin flips and dice rolls. ◦ Calculating probabilities and visualizing probability distributions. • Inferential Statistics ◦ Performing hypothesis tests. ◦ Creating and interpreting confidence intervals.	CO-4
IV	Introduction to Machine Learning • Supervised Learning Basics ◦ Implementing linear regression with scikit-learn. ◦ Evaluating model performance (R^2, MAE, RMSE). • Classification with Logistic Regression ◦ Building a logistic regression model. ◦ Evaluating classification performance (confusion matrix, accuracy, precision, recall). • Decision Trees and k-NN ◦ Implementing decision trees and k-nearest neighbors classifiers. ◦ Visualizing decision boundaries. • Model Evaluation ◦ Performing cross-validation. ◦ Hyperparameter tuning with GridSearchCV.	CO-5

References:

- "An Introduction to Statistical Learning: with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
- "The Elements of Statistical Learning: Data Mining, Inference, and Prediction" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman
- "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney
- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

7th/8th Semester	AGCoE-21704: MAJOR PROJECT LAB				
Internal Marks:	**60**		**L**	**T**	**P**
External Marks:	**40**		**0**	**0**	**4**
Total Marks:	**100**		**Credits**		**2**

General Guidelines for Major Project Lab

1. Introduction

The Major Project is an important component of the B. Tech curriculum aimed at enhancing students' practical knowledge, problem-solving ability and teamwork. Students are expected to apply the concepts learned during the program to develop a real-world software/hardware/research-based solution.

2. Objectives

The major project should enable students to:

- Apply theoretical and practical knowledge to solve real-life problems.
- Develop analytical, design, implementation, and testing skills.
- Gain experience in teamwork, project management, and documentation.
- Enhance presentation and communication skills.
- Encourage innovation, entrepreneurship, and research orientation.

3. Project Group Formation

- Students may work individually or in groups of 2–4 students.
- Group formation should be approved by the Project Coordinator.
- Interdisciplinary projects are encouraged wherever applicable.

4. Selection of Project Topic

The project topic should:

- Be relevant to the branch/specialization.
- Address a real-world problem or innovative idea.
- Have sufficient scope for development and implementation.
- Preferably involve emerging technologies such as:
    - Artificial Intelligence
    - Machine Learning
    - Data Science
    - Cyber Security
    - IoT
    - Cloud Computing
    - Blockchain
    - Mobile/Web Applications
    - Embedded Systems

Students are encouraged to undertake:

- Industry-sponsored projects
- Research-oriented projects
- Socially relevant projects

- Startup/entrepreneurship-based ideas

5. Project Guide

- The guide will monitor progress, provide technical support, and evaluate performance.
- Students must regularly interact with the guide and maintain progress records.

6. Project Phases

The project should normally be carried out in the following phases:

Phase I – Problem Identification & Literature Survey

- Selection of topic
- Requirement analysis

Phase II – Design & Planning

- System architecture/design
- Selection of tools and technologies
- Work distribution and timeline preparation

Phase III – Development & Implementation

- Coding/Hardware development
- Database design
- Integration of modules

Phase IV – Testing & Validation

- Functional testing
- Performance evaluation

Phase V – Documentation & Presentation

- Report preparation
- PPT
- Final viva-voce

7. Deliverables

Students are required to submit:

- Project synopsis
- Requirement specification
- Preliminary design and implementation progress
- Mid-semester presentation
- Final project report
- Source code
- PPT presentation
- Project demonstration

8. Project Report Format

The project report should include:

1. Title Page
2. Acknowledgement
3. Declaration

4. Table of Contents
5. List of Figures/Tables
6. Introduction
7. Objectives
8. Methodology/System Design
9. Implementation Details
10. Conclusion and Future Scope
11. References
12. Appendices (if any)

Formatting Guidelines

- Font: Times New Roman
- Font Size: 12 pt
- Line Spacing: 1.5
- Page Size: A4
- Margins: 1 inch on all sides

9. Attendance

Students must attend all scheduled project reviews.

- Regular progress presentations shall be conducted.
- Unsatisfactory progress may lead to project rejection or re-allotment.

10. Outcome of Major Project

At the completion of the project, students should be able to:

- Design and develop a complete engineering solution.
- Work effectively in teams.
- Present technical work professionally.
- Demonstrate practical and industry-oriented skills.
- Develop confidence for placements, higher studies, or entrepreneurship.

7th/8th Semester	AGCoE-21702A: SOFTWARE TESTING (PEC-3)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Understand the need of software testing
CO-2	Prepare test cases for different types and levels of testing
CO-3	Verify the intended functionality of software
CO-4	Create test plan for variety of applications
CO-5	Test software for specialized environment
CO-6	Understand best practices and industry standards in testing

Part	Content	CO
I	**Introduction to Software Testing -** Importance of software testing, Objectives of testing Types- Functional vs. Non-functional testing, Manual vs. Automated testing, Black-box vs. White-box testing, Regression, Integration, System, Acceptance testing, Test Planning and strategy, Test plan components, Writing and managing test cases, Traceability matrix and Documentation.	CO-1
II	**Techniques and algorithms for functional testing-**Black box testing -Equivalence Partitioning, Boundary Value Analysis, Decision Table Testing, State Transition Testing, Use Case Testing, Exploratory Testing, Model-Based Testing, Graphs based testing- Control Flow Graph, Data Flow Graph (DFG), State Transition Testing, Finite State Machine (FSM), Control Dependency Graph (CDG), Use Case Graph, Graph Matrix Methods, structural coverage criteria, Algorithms for test case design- Random Testing, Combinatorial Testing (Pairwise Testing), Genetic Algorithms, Model-Based Testing (MBT), Constraint-Based Testing, State Transition Testing, Classification Tree Method.	CO-2
	Techniques and algorithms for structural testing - Logic based Testing with predicates, Logic coverage criteria, Path testing, Graph metrices, Loop testing, Data flow testing, Mutation Testing, Specification based Logic Coverage- Predicate coverage, Clause coverage, Combinatorial coverage, Decision Coverage, Condition Coverage, Logic Coverage on Finite State Machines (FSMs)- State Transition Coverage, Path Coverage.	CO-3
III	**Input space partitioning:** Input domain modeling, Combination strategies criteria- Selection from each partition, pairwise testing, Orthogonal Arrays, Mixed strategy testing, Syntax based testing: Coverage criteria based on syntax -Statement Coverage, Branch coverage, Condition Coverage, Multiple condition coverage, path coverage, loop coverage, Mutation testing- Primary and Secondary mutants, mutation testing process.	CO-4
IV	**Testing for specialized environment:** Testing object-oriented software, web-based systems, Agile based software	CO-5
	Emerging Trends in Testing, Industry Best Practices and Standards: AI and machine learning in testing, testing for mobile applications, Cloud-based testing, Testing standards and certifications (e.g., ISTQB), Best practices for effective testing, Emerging trends in software testing, Case studies and real-world examples	CO-6

References:

- Software Testing: Principles and Practices, Srinivasan Desikan, Pearson
- Software Testing Principles and Practices, Naresh Chauhan, Oxford University Press
- Software Testing Techniques, 2nd edition, Boris Beizer, 1990
- Software Testing and Quality Assurance: Theory and Practice by Kshirasagar Naik and Priyadarshi Tripathy, Wiley-Spektrum
- Foundations of Software Testing, Dorothy Graham, Erik van Veenendaal, Isabel Evans, and Rex Black, Cengage

7th/8th Semester	AGCoE-21702B: DEEP LEARNING (PEC-3)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	To understand the basic principles and mathematical foundations of deep learning.
CO-2	To learn and apply neural networks for training deep learning models.
CO-3	To apply autoencoders and generative models for suitable applications.
CO-4	To analyse regularization in deep learning approaches.
CO-5	To provide a more scalable approach to visual detection and recognition tasks using CNN.
CO-6	To understand the vanishing gradient problem present in traditional RNNs

Part	Content	CO
I	**Introduction:** Historical context and motivation for deep learning; Advantages of deep learning over machine learning, Structure and working of deep learning, Detailed explanation of Perceptron, McCulloch Pitts Neuron, Thresholding Logic, Perceptron Learning Algorithm Optimization Techniques- Optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, adaptive sub-gradient method, Batch Optimization	CO-1
II	**Neural Networks:** Layers in the neural network, Multilayer Perceptron model deep networks, Feedforward and backpropagation, regularizing a deep network, model exploration, and hyper parameter tuning.	CO-2
	Autoencoders: Undercomplete autoencoders, regularized autoencoders, sparse autoencoders, Contractive autoencoders, Principal Component Analysis (PCA) and its interpretations, Autoencoders and relation to PCA, Regularization in autoencoders, denoising autoencoders, stochastic encoders and decoders.	CO-3
III	**Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout.	CO-4
IV	**Convolutional Neural Networks:** Introduction to convolution neural networks: stacking, striding and pooling, applications like image, and text classification, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art.	CO-5
	Sequence Modeling: Recurrent Nets: Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks, LSTM networks.	CO-6

References:

- Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016
- Bunduma, N. (2017). Fundamentals of Deep Learning
- Heaton, J.(2015). Deep Learning and Neural Networks, Heaton Research Inc.
- James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.
- Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

7th/8th Semester	AGCoE-21702C: COMPUTER VISION (PEC-3)				
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO-1	Identify basic terminology and analyse the image theories.
CO-2	Study the foundation of image formation and measurement.
CO-3	Analyse the geometric and other image features and methods.
CO-4	Extract meaningful representations from high-dimensional time series data.
CO-5	Study processing and analysing discrete data of image.
CO-6	Assess the methods to solve and analyse the accuracy of the methods.

Part	Content	CO
I	**Fundamentals of Image Processing:** 2-D projective geometry, homogeneous coordinates, Projective Transformations, Invariant Properties, Duality Principle, homography, properties of homography, computer imaging systems, Components of Computer Imaging Systems, Processes in Computer Imaging Systems, Applications of Computer Imaging Systems.	CO-1
II	**Image Formation and Representation:** Image formation and sensing, Image analysis, Image pre-processing, Image Preprocessing Techniques, Edges, Importance of Edges, Edge Detection Methods Lines, Line Detection Methods, Line Representation, Segmentation, Types of Segmentation, Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods.	CO-2
	Image Transformations: Camera geometry, components of camera geometry, Stereo geometry, key concepts and components of stereo geometry, feature detection and description, feature matching and model fitting, colour processing.	CO-3
III	**Image Processing Techniques:** Range image processing, clustering and classification, dimensionality reduction and sparse representation, Morphological filtering, Fourier transform.	CO-4
IV	**Feature Extraction:** Shape, histogram, colour, spectral, texture, CVIP tools, Feature analysis, feature vectors, distance/similarity measures, data pre-processing.	CO-5
	Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi- supervised. Classifiers: Bayes, KNN, ANN models. **Dimensionality Reduction:** PCA, LDA, ICA, and Non- parametric methods, Sparse representation, Recent trends in Activity Recognition, computational photography, Biometrics.	CO-6

References:

- Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.
- Computer Vision: Algorithms & Applications, R. Szeleski, Springer.
- Computer vision: A modern approach: Forsyth and Ponce, Pearson.

7th/8th Semester	AGCoE-21702D: ADVANCED COMPUTER NETWORKS (PEC-3)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Analyze some of the most advanced routing and switching techniques.
CO-2	Understand Packet classification methods and techniques for data transfer.
CO-3	Understand the architecture of SDN and NFV for security in Softwarized Networks.
CO-4	Analyze various Data Planes, P4 Switches in Programmable Networks.
CO-5	Understand the concept of Data Center Networking and its technologies used
CO-6	Understand the concept of content distribution and delivery over internet

Part	Content	CO
I	**High Performance Switching and Routing:** Introduction, performance considerations, IP address lookup, Advanced Switching Techniques, High-Speed Routing Protocols, Algorithms for IP address lookup and optimization, hardware implementation of address lookup.	CO-1
II	**Packet Classification:** Introduction to Packet Classification, Need for packet classification and methods for packet classification, Algorithms and Techniques, Quality of Service, Traffic Polishing, Traffic Shaping, Case Studies and Real-World Applications.	CO-2
	Network Softwarization: Introduction, Software Defined Networking (SDN), Architecture and Concepts, Working with Mininet, Network Function Virtualization (NFV) - Architecture and Concepts, Network Automation and Orchestration, Service Function Chaining (SFC), Security in Softwarized Networks.	CO-3
III	**Programmable Networks:** Introduction to P4, Programmable Data Planes, Smart NICS and P4 switches, Service Function Chaining (SFC), Security in Programmable Networks, Industry Standards and Protocols in P4, Case Study.	CO-4
IV	**Data Center Networking (DCN):** Introduction, Data Center Network Architectures, Data Center Network Topologies, Container Network Interfaces, Data center Network Virtualization, Software-Defined Networking (SDN) in Data Centers, Data Center Interconnect (DCI), High-Performance Networking Technologies, Network Security in Data Centers, Load Balancing and Traffic Management in DCN, Future Trends in DCN.	CO-5
	Content Distribution on the Internet: Introduction, Content Delivery Networks (CDNs), Peer-to-Peer (P2P) Networks, Internet Protocols for Content Distribution, Security in Content Distribution, Information Centric Networking- Introduction, Architectures for Information Centric Networking, Content Naming, Routing and Caching, Security in Named Data Networking.	CO-6

References:

- Information-Centric Networks: A New Paradigm for the Internet (Focus Series in Networks and Telecommunications), Gabriel M. de Brito, Pedro B. Velloso, Igor M. Moraes, Wiley-ISTE; 1st edition, 2013, ISBN: 9781848214491
- Information-Centric Networking (ICN): Content Centric Networking (CCNx) and Named Data Networking (NDN) Terminology, B. Wissingh, C. Wood, A. Afanasyev, L. Zhang, D. Oran and C. Tschudin, RFC 8793, June 2020
- Software-Defined Networks: A Systems Approach, Peterson, Cascone, O'Connor, Vachuska, and Davie, Cloud Networking: Understanding Cloud-based Data Centre Networks, Gary Lee (Author), Morgan Kaufmann (Publisher), 2014, ISBN-139780128007280

7th/8th Semester	AGCoE-21702E: BUSINESS INTELLIGENCE AND ANALYTICS (PEC-3)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Understand the role of business intelligence and analytics in decision-making processes.
CO-2	Understand the concepts of data warehousing, data mining, and data visualization.
CO-3	Understand statistical techniques to analyze and interpret business data.
CO-4	Use BI tools to extract, transform, and load (ETL) data from various sources.
CO-5	Utilize predictive analytics techniques to forecast future trends and outcomes.
CO-6	Understand the ethical and privacy implications of using business intelligence and analytics.

Part	Content	CO
I	**Introduction to Business Intelligence:** Introduction to Business Intelligence & Analytics (BIA), drivers of BIA. Types of analytics: descriptive to prescriptive, vocabulary of business analytics. Technical architecture of BIA, fundamentals of data management, OnLine Transaction Processing (OLTP), design process of databases, Relational databases, normalization, SQL queries.	CO-1
II	**Data Warehousing:** Introduction to data warehousing concepts, Data modeling and schema design, Extract, transform, and load (ETL) processes, Data Mining and Machine Learning, Introduction to data mining techniques, Association analysis, clustering, and classification, Introduction to machine learning algorithms for BI, Data Visualization-Principles of data visualization, Choosing the right chart types, Tools for data visualization (e.g., Python, Tableau, Power BI).	CO-2
	Statistical Analysis for BI: Descriptive and inferential statistics, Hypothesis testing and confidence intervals, Regression analysis for predictive modeling	CO-3
III	**BI Tools and Software:** Overview of popular BI tools and software, Hands-on experience with a BI tool (e.g., Tableau, Power BI) to extract, transform, and load (ETL) data from various sources. Building dashboards and reports.	CO-4
IV	**Advanced Analytics Techniques:** Analytics Techniques to forecast future trends and outcomes. Time series analysis and forecasting, Text analytics and sentiment analysis, Spatial analytics and GIS integration.	CO-5
	Ethics and Privacy in BI: Ethical considerations in BI and analytics, Privacy regulations (e.g. GDPR, HIPAA), Handling sensitive data and ensuring data security. Case Studies and Applications-Real-world case studies in BI and analytics, Applications of BI across different industries.	CO-6

References:

- "Business Intelligence Guidebook: From Data Integration to Analytics" by Rick Sherman
- "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball & Margy Ross
- "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei
- "Building the Agile Enterprise: With Capabilities, Collaborations and Values" by Fred Cummins
- "Competing on Analytics: The New Science of Winning" by Thomas H. Davenport and Jeanne G. Harris

7th/8th Semester	AGCoE-21702F: INTRODUCTION TO INTERNET OF THINGS (PEC-4)

			L	T	P
Internal Marks:	40		3	0	0
External Marks:	60		Credits		3
Total Marks:	100				

Course Outcomes: After studying the course, students will be able to:	
CO-1	Understand the concept of IoT and its Architecture.
CO-2	Learn the function of various components and the communication modules.
CO-3	Understand the physical and application layer protocols for IoT.
CO-4	Implement the interface between hardware and Arduino board using Python Programming.
CO-5	Implementing the various python packages on Raspberry pi Board
CO-6	Analyse applications of IoT in real time scenario.

Part	Content	CO
I	**Introduction**: Characteristics of IoT, Components of IoT, Architecture of IoT, IoT Applications, Functional Blocks of an IoT Ecosystem, Sensors Classes-Vector, Scalar, Analog and Digital, Sensor Types, Actuators and its types- Hydraulic actuators, Pneumatic, Electrical actuators, Thermal actuators, Magnetic actuators and Mechanical actuators, and Smart Objects, Control Units.	CO-1
II	**Communication in IoT:** Internet based communication, IP Addressing in IoT, M2M Communication reasons, features, Six pillars of M2M, Applications and Communication modules- Bluetooth, ZigBee, GPS, GSM, Wi-Fi.	CO-2
	Techniques in IoT: Overview of RFID technology, Types of RFID tags and readers, RFID frequency bands and standards (LF, HF, UHF) HF), RFID Middleware, Applications, MQTT Architecture and operation, QoS Levels, CoAP Architecture and features, AMQ Architecture and use case,6LoWPAN in IoT, IEEE 802.15.4 features	CO-3
III	**Introduction to Arduino:** Introduction to Arduino and Arduino UNO, Pin Configuration, Installing the Software, Sketch structure, Arduino function libraries, Fundamentals of Arduino Programming. Operators in Arduino: Control Statement, Loops, Arrays, String, Math Library, Random Number, Interrupts	CO-4
IV	**Raspberry Pi and IoT:** Introduction to Raspberry, About the Raspberry pi Board: Hardware Layout, Operating Systems on Raspberry, Using GPIO pins, PiCaM, Configuring Raspberry, Programming Raspberry pi with Python Packages XML, JSON, HTTPLib, URLlib, SMTPLib,	CO-5
	IoT Applications: Smart Metering, E-health, Smart City and Home Automation, IoT in Agriculture, Automotive Applications, Smart Energy Management, Smart vehicles parking, communicating data with H/W units, mobiles, tablets.	CO-6

References:

- Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014. (ISBN: 978-8173719547)
- Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

7th/8th Semester	AGCoE-21702G: SOCIAL NETWORK ANALYSIS (PEC-4)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Analyze a social network using various visualization tools.
CO-2	Illustrate large-scale network data and mechanisms used for network growth models.
CO-3	Understand the signed networks and applications of the Link Analysis
CO-4	Acquaint with the community detection and Link Prediction ways
CO-5	Examine social networks analysis and prediction using case studies.
CO-6	Apply appropriate anomaly detection and graph representation method on a network

Part	Content	CO
I	**Society & Network:** Introduction, Use of social networks, defining a network, types of networks (link-centric, node and link centric, local view, temporal view, generalization, real-world network), levels of social network analysis, graph visualization tools (web-based and standalone), applications. **Network Measures:** Network basics, node centrality, assortative, transitivity and reciprocity, similarity, degeneracy	CO-1
II	**Network Growth Models:** Properties of real-world networks, Random Network Model: Degree Distribution of Random Network, Binomial to Poisson Distribution, Evolution of a Random Network, Average Path Length, Clustering Coefficient, Random Network vs. Real-world Network, Ring Lattice Network Model, WattsStrogatz Model: Network Formation, Preferential Attachment Model: Network Formation, Degree Dynamics, Limitations of BA Model	CO-2
	Link Analysis: Application of link analysis, Signed networks: Balance Theory of Undirected Signed Networks, Status Theory of Signed Networks, Triad Balance vs Status, Strong and Weak Ties: Strength of a Tie, Triadic Closure, Dunbar Number, Local Bridges and Importance of Weak Ties, PageRank, Personalized PageRank, DivRank, SimRank, PathSim	CO-3
III	**Community Detection:** Application of community detection, types of communities, community detection methods, Disjoint Community Detection: Node-centric community detection, modularity and community detection, Overlapping Community 08 Detection: Clique Dynamics, Local Community Detection. **Link Prediction:** Applications of link prediction, Evaluating Link Prediction methods, Heuristic models, Probabilistic models, Supervised Random Walk	CO-4
IV	**Cascade Behaviours & Network Effects:** Preliminaries and Important Terminologies, Cascade Models, Probabilistic Cascades, Epidemic Models, Independent Cascade Models, Cascade Prediction.	CO-5
	Anomaly Detection in Networks: Anomaly in Static Networks: Plain and attributed networks, relational learning, Anomaly in Dynamic Networks: Preliminaries, feature and decomposition-based approaches. **Graphical Representation Learning:** Criterion of graph representation learning, pipeline, representation learning methods.	CO-6

References:

- Xiaoming Fu, Jar-Der Luo, Margarete Boos, 'Social Network Analysis Interdisciplinary Approaches and Case Studies', 1 st Edition, CRC Press, 2020.
- Dr. Krishna Raj P.M., Mr. Ankith Mohan, Dr. Srinivasa K.G, "Practical Social Network Analysis with Python (Computer Communications and Networks)", First Edition, Springer, 2019.

- John Scott, "Social Network Analysis", Fourth Edition, SAGE Publications Ltd, 2017.

7th/8th Semester	AGCoE-21702H: REINFORCEMENT LEARNING (PEC-4)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Gain a foundational understanding of deep reinforcement learning principles.
CO-2	Make use of various exploration and exploitation strategies.
CO-3	Understanding eligibility traces and their role in temporal difference learning.
CO-4	Delve into Bellman Optimality and its significance in reinforcement learning algorithms.
CO-5	Explore value-based reinforcement learning approaches with function approximation.
CO-6	Demonstrate various Policy based Reinforcement Learning Algorithms.

Part	Content	CO
I	**Introduction:** Reinforcement Learning, Suitability of RL, Components of Reinforcement Learning -Agent, Environment, Observations, Actions, Example-The Bandit Walk Environment, Agent-Environment interaction cycle, MDP (Markov Decision Process): The engine of the Environment-States, Actions, Transition Function, Reward Signal.	CO-1
II	**Bandit algorithms**: Median Elimination, Policy Gradient, Single-state decision problem (Multi-Armed Bandit (MAB) problem), The cost of exploration, approaches to solve MAB environments, Greedy Strategy, Random Strategy, Epsilon-Greedy Strategy, Decaying Epsilon-Greedy Strategy, Optimistic Initialization strategy, Strategic exploration, Softmax exploration strategy, Bandit algorithms – UCB, Upper confidence bound (UCB), PAC	CO-2
	Bellman Optimality and function approximation: Introduction to Bellman Optimality, Bellman Optimality Equation, Bellman Optimality in Policy Iteration and in value iteration, Least Squares Temporal Difference, Least Squares Policy Iteration.	CO-3
III	**Dynamic Programming and TD methods:** Monte Carlo Prediction (MC), First-Visit MC (FVMC), Every-Visit MC (EVMC), Temporal Difference Learning (TD), Learning to estimate from multiple steps, N-step TD learning, Forward-view TD(λ), Backward-view TD(λ), Generalized policy iteration(GPI), Monte Carlo control, SARSA: On-Policy TD control, Q-learning: Off-Policy TD control, Double Q-learning, SARSA(λ), Watkins's Q(λ). Model Based Reinforcement Learning: Dyna-Q, Trajectory sampling.	CO-4
IV	**Value Based Reinforcement Learning:** Deep reinforcement learning agents with sequential feedback, evaluative feedback, sampled feedback, Function Approximation for Reinforcement Learning- high-dimensional state and action spaces, continuous state and action spaces, state-value function and action-value function with and without function approximation, Neural Fitted Q (NFQ), Deep Q-Network (DQN), Double Deep-Q Networks (DDQN), Dueling DDQN, Prioritized Experience Replay (PER).	CO-5
	Policy Based Reinforcement Learning: Policy Gradient and Actor-Critic Methods—REINFORCE Algorithm and Stochastic Policy Search, Vanilla Policy Gradient(VPG), Asynchronous Advantage Actor-Critic (A3C), Generalized Advantage Estimation (GAE), Advantage Actor-Critic(A2C), Deep Deterministic Policy Gradient (DDPG), Twin-Delayed DDPG (TD3), Soft Actor-Critic (SAC), proximal policy optimization (PPO),representation and solution methods of POMDPs.	CO-6

References:

- Richard S. Sutton and Andrew G. Barto, Reinforcement learning: An Introduction, Second Edition, MIT Press, 2019.

- Marco Wiering, Martijn van Otterlo(Ed),Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series, ALO, volume 12, Springer, 2012.
- 3. Keng, Wah Loon, Graesser, Laura, Foundations of Deep Reinforcement Learning: Theory and Practice in Python, Addison Wesley Data & Analytics Series, 2020.

7th/8th Semester	AGCoE-21702I: OBJECT ORIENTED ANALYSIS & DESIGN USING UML (PEC-4)

Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Exploring Object-Oriented Design and Unified Modeling Language (UML).
CO-2	Understanding Use Case Diagrams and Prioritization Techniques.
CO-3	Mastering Class and Sequence Diagrams along with Advanced Concepts.
CO-4	Delving into State Chart Diagrams, Design Processes, and Anti-Patterns.
CO-5	Introduction to Design Patterns and Addressing Common Pitfalls.
CO-6	Implementing GRASP Patterns and Exploring GoF Patterns in Depth.

Part	Content	CO
I	**Introduction:** Overview of Object-Oriented Design (OOD), Key concepts of OOD: Objects, Classes, Methods, and Attributes, Benefits of OOD in software development, Comparison of OOD with Procedural Programming, Introduction to UML (Unified Modeling Language), Conceptual model of UML, building blocks of UML, Mechanisms in UML, Architecture.	CO-1
II	**Use Case Diagram:** Purpose and benefits of Use Case Diagrams, Factoring Use Cases, Use Case Guidelines, Elements of Use Case Diagrams - Actors, Use Cases, System Boundaries, Relationships in Use Case Diagrams - Include, Extend, and Generalization, Steps to create a Use Case Diagram, Example Use Case Diagrams for various systems. **Use Case Prioritization:** Discuss techniques for prioritizing use cases based on business value, risk, and feasibility, Methods for validating and verifying the correctness and completeness of use case diagrams.	CO-2
	Class Diagram and Sequence Diagrams: Purpose and structure of Class Diagrams, Elements - Classes, Attributes, Methods, Relationships, Unary and binary Associations, Aggregation, Composition, and Inheritance, Implementation of association in General Case, Qualified Association, Dependency relation, Simple Class Diagram examples. Advanced concepts in Class Diagrams, Abstract classes and interfaces, Polymorphism, Realization relationships, Multiplicity in associations, Refining and elaborating Class Diagrams with practical examples **Sequence Diagram:** Purpose of Sequence Diagrams, Synchronous and Asynchronous Messages, Creating Sequence Diagrams for system interactions.	CO-3
III	**State Chart Diagram and Design Process:** Purpose of State Chart Diagrams, States, Transitions, Events, and Actions, Initial and Final States, Guard Conditions, Practical examples of State Chart Diagrams for various scenarios, State Machine Diagrams - Features of State Machine Model, encoding a State Machine-I, encoding a State Machine -II, Interaction Diagrams. **Design Process:** Detailed steps in the design process, Requirement Analysis, System Design vs. Detailed Design, Use of UML in the design process, Case Study - Designing a software system from requirements to detailed design. common anti-patterns and pitfalls in software design, contrasting them with design patterns.	CO-4
IV	**Introduction to Design Patterns:** Importance of design patterns, Types of design patterns- Creational, Structural, Behavioral. Benefits and limitations of using design patterns.	CO-5

	GRASP Patterns and GoF Patterns: Introduction to the Gang of Four (GoF) design patterns, General Responsibility Assignment Software Patterns (GRASP), Key GRASP patterns- Information Expert, Creator, Controller, Low Coupling, High Cohesion, Applying GRASP patterns to improve software design, Pure Fabrication, Law of Demeter, Case studies and examples of GRASP patterns **GoF Pattern:** In-depth study of GoF design patterns, Creational Patterns: Singleton, Factory Method, Abstract Factory, Builder, Prototype, Structural Patterns- Adapter, Decorator, Proxy, Composite, Practical implementation and examples, Continuation of GoF design patterns, Behavioral Patterns - Strategy, Observer, Command, Template Method, State, Application and benefits of Behavioral Patterns in software design, Real-world examples and implementation strategies	CO-6

References:

- Frederick Eddy, James Rumbaugh, Michael Blaha, Willliam Premerlani, William Lorensen: Object-Oriented Modeling and Design, Pearson Education.
- James Rumbaugh, Michael R. Blaha: Object-Oriented Modeling and Design with UML, Pearson Education.
- Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
- Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

7th/8th Semester	AGCoE-21702J: FOUNDATIONS OF CRYPTOGRAPHY (PEC-4)

Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Understand the basics paradigms and principles of Cryptography
CO-2	Understand and Implement Symmetric Key Cryptography
CO-3	Apply message authentication functions in secure communication scenario
CO-4	Understand and Implement Asymmetric Key Cryptography
CO-5	Analyze Public Key Cryptosystems
CO-6	To understand various protocols for network security to protect against the threats in the networks.

Part	Content	CO
I	**Introduction to Cryptography:** Course Overview, Symmetric-key Encryption, Historical Ciphers, Perfect Security and Its Limitations, Computational Security, Semantic Security and Pseudorandom Generators (PRGs) **Mathematical Foundations:** Number theory (modular arithmetic, prime numbers, greatest common divisor), Introduction to finite fields and groups, Basic probability theory in cryptographic contexts	CO-1
II	**Cryptosystems and Symmetric key Cryptography:** Stream Ciphers, Provably-secure Instantiation of PRG, Practical Instantiation of PRG, CPA-security and Pseudo-random Functions (PRFs), CPA-Secure Ciphers from PRF, Modes of Operations of Block Ciphers, Theoretical Constructions of Block Ciphers and Practical Constructions of Block Ciphers, DES, AES and Message Authentication Codes (MAC)	CO-2
	Cryptographic Hash Functions: Information-theoretic Secure MAC, Cryptographic Hash Functions, Ideal-Cipher Model, Davies-Meyer construction and Merkle-Damgård Paradigm Birthday Attacks on Cryptographic Hash Functions, Applications of Hash Functions, Random Oracle Model and Authenticated Encryption	CO-3
III	**Asymmetric Key Cryptography:** Generic Constructions of Authenticated Encryption Schemes, Key-exchange Problem, One-way Trapdoor Functions and Cyclic Groups Discrete-Logarithm Problem, Computational Diffie-Hellman Problem, Decisional Diffie-Hellman Problem, Elliptic-Curve Based Cryptography and Public-Key Encryption	CO-4
IV	**Public Key Cryptosystem:** El Gamal Encryption Scheme, RSA Assumption, RSA Public-key Cryptosystem, KEM-DEM Paradigm and CCA-security in the Public-key Domain, CCA-secure Public-key Hybrid Ciphers Based on Diffie-Hellman Problems and RSA-assumption	CO-5
	Digital Signature: Digital Signatures, RSA Signatures and Schnorr Identification Scheme, Schnorr Signature **Web Security:** Overview of TLS/SSL, Interactive Protocols, Firewall	CO-6

References:

- Cryptography and Network Security, William Stallings, 2nd Edition, Pearson Education Asia
- Cryptography & Network Security, Atul Kahate, TMH.
- Cryptography and Network security Principles and Practices, William Stallings, Pearson/PHI.
- Introduction to Cryptography with coding theory, Wade Trappe, Lawrence C Washington, Pearson
- Information Security, Principles, and Practice: Mark Stamp, Wiley India
- Behrouz A Ferouzan, "Cryptography and Network Security" Tata Mc Graw Hill

7th/8th Semester	AGCoE-21702K: NATURAL LANGUAGE PROCESSING (PEC-4)

Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Understand the basic principles, techniques, and applications of Natural Language Processing.
CO-2	Analyse words based on Morphology and CORPUS.
CO-3	Create CORPUS linguistics based on digestive approach.
CO-4	Use of statistical approaches to machine translation.
CO-5	Perform Part-of-speech tagging technique based on the structure of the language.
CO-6	Understand the techniques for text-based processing.

Part	Content	CO
I	**Introduction:** Basic concepts of Natural language Processing, evolution of NLP, issues and challenges in NLP, basic concepts of phases of natural language processing morphological analysis, syntactic analysis, semantic analysis, pragmatic analysis, tools and techniques used for performing these analysis, ambiguities, Types of ambiguities.	CO-1
II	**Text Preprocessing and Morphology:** Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.	CO-2
	Language Modelling: Statistical Hypothesis Tests for NLP, Hypothesis testing of differences, The t Test, Pearson's chi-square test, Likelihood ratios. **Statistical Inference:** N -gram Model, Importance of order of words in text & NLP, Classification of N-gram Model, N-gram Analysis and Visualization.	CO-3
III	**Word Sense Disambiguation:** Evaluation of WSD, Approaches and Methods to Word Sense Disambiguation (WSD), Applications of Word Sense Disambiguation (WSD), Difficulties in Word Sense Disambiguation (WSD) Disambiguation based on sense, Thesaurus-based disambiguation, Disambiguation based on translations in a second-language corpus.	CO-4
IV	**Markov Model and POS Tagging:** Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to Part-of-speech tagging, Applications of Tagging.	CO-5
	Probabilistic Context Free Grammars and Probabilistic parsing: The Probability of a String, Problems with the Inside-Outside Algorithm, Parsing for disambiguation, Treebanks, Parsing models vs. language models, Phrase structure grammars and dependency, Lexicalized models using derivational histories, Dependency-based models	CO-6

References:

- Nitin Indurkhya, Fred J. Damerau "Handbook of Natural Language Processing". 2nd Edition, CRC Press,2010.
- James Allen "Natural Language Understanding". Pearson Publication 8th Edition.2012. Hobson lane Cole Howard, Hannes Hapke, "Natural Language Processing in action" MANNING Publications,2019.

- Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application". PACKT publisher, 2018.

7th/8th Semester	AGOE-21701: AIR POLLUTION AND CONTROL (OE)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Identify the impacts of air pollution on humans, animals, water bodies, and soil.
CO-2	Analyse the lapse rate and air quality monitoring.
CO-3	Understand the emissions inventory and applications of remote sensing.
CO-4	Understand indoor air pollution, its sources, types, and health impacts.
CO-5	Know air pollution control devices and equipment.
CO-6	Know the emerging technologies and strategies to mitigate air pollution.

Part	Content	CO
I	**Air Pollution:** Introduction and impacts of air pollution on human health, vegetation, animals, building materials, structures, and atmosphere, soil and water bodies. Sources, classification and formation/transformation of air pollutants: Meteorology and Atmospheric Stability. **Lapse Rate,** Plume Behaviour, and Air Quality Monitoring, Air Quality Index (AQI). Air Quality Modelling, Gaussian dispersion models: point, line, and area source models	CO-1 & CO-2
II	**Emissions Inventory:** Transport, Industrial, Agricultural, Residential and Commercial sectors. Application of Remote sensing/Satellite data in emission inventory and source apportionment using receptor modelling.	CO-3
III	**Indoor air pollution:** Sources, types and health impacts. Sampling, assessment and evaluation of Indoor air quality. Global and regional environmental issues of air pollution: Ozone depletion, Climate change, Global warming, Acid rain. **Air pollution control devices, and equipment:** Air pollution emission standards, National and international policies, acts, rules, and regulations.	CO-4 & CO-5
IV	**Emerging technologies and strategies** to mitigate air pollution, Current challenges and way forward. Lab-based measurements of air pollutants.	CO-6

References:

- Wark, K., Warner, C.F., and Davis, W.T., "Air Pollution: Its Origin and Control", Addison-Wesley Longman. 1998.
- Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., "Fundamentals of Air Pollution", Academic Press. 2005.
- Seinfeld, J.H., Pandis, S.N., "Atmospheric Chemistry and Physics", John Wiley. 2006.
- Lodge, J.P. (Ed.), "Methods of Air Sampling and Analysis", CRC Press. 1988.
- Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), "Air Pollution: Health and Environmental Impacts", CRC Press. 2010.

7th/8th Semester	AGOE-21702: DISASTER MANAGEMENT (OE)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Students will be able to understand different level of disasters in various regions.
CO-2	To able to understand the prevent and preparedness against the disaster.
CO-3	To be able to understand the risk and management for disaster.
CO-4	Know about the various government and non-government agencies role in management.
CO-5	To be able to understood the various tools and techniques to identify the level of disaster.
CO-6	To be able to understand about the method of dissemination and learn from experiences.

Part	Content	CO
I	**Introduction to Disaster Management:** Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle. **Disaster Mitigation and Preparedness:** Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought etc. **Man-made hazards:** causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.	CO-1 & CO-2
II	**Hazard and Risk Assessment:** Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems. **Emergency Management Systems (EMS):** Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.	CO-3
III	**Capacity Building:** Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other international agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines. **Application of Geoinformatics and Advanced Techniques:** Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.	CO-4 & CO-5
IV	**Integration of public policy**: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management. **Case Studies:** Lessons and experiences from various important disasters with specific reference to Civil Engineering.	CO-6

References:

- Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill.Pub
- Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leiceste

7th/8th Semester	AGOE-21703: PRODUCT DESIGN AND DEVELOPMENT (OE)

Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Describe the product design and role of designer in product design.
CO-2	Explain the basic principle of value engineering in product design.
CO-3	Discuss the various types of fasteners and joining details.
CO-4	Classify various design tools and understand the concept of ergonomics in product design.
CO-5	Explain the design guidelines, manufacturing and economics aspects.
CO-6	Develop proficiency in 3D printing techniques and identify real-world applications of 3D printing.

Part	Content	CO
I	**Introduction to product design:** Introduction to course, product life-cycle, product policy of an organization. selection of a profitable product, product design process, product analysis. **Value engineering and functional analysis:** Value engineering in product design; advantages, applications in product design, problem identification and selection, anatomy of function, functional analysis system technique (FAST).	CO-1 & CO-2
II	**Product detailing:** Standard fastening and joining details in different materials, temporary and permanent joints, detailing for plastic products and fabricated products in sheet metal.	CO-3
III	**Product design tools:** Introduction to product design tools, QFD, Computer Aided Design, Robust design, DFX, DFM, DFA, ergonomics in product design. **Design guidelines:** DFMA guidelines, Product design for manual assembly, Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc.	CO-4 & CO-5
IV	Rapid prototyping, needs, advantages, working principle of SLA, LOM and SLS.	CO-6

References:

- W.H. Mayal, Industrial Design for Engineers, London Liifee Books Ltd.
- Huchingson R. Dale, New Horizons for Human Factors in Design, McGraw Hill.
- N.L. Svensson, Engineering Design, London: Pitman.
- R. Matousek, Engineering Design, Blackie & Son.
- K.J. Mccormick (Ed), Human Factor Engineering, McGraw Hill.

7th/8th Semester	AGOE-21704: MATERIAL MANAGEMENT (OE)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Describe the concept of material management.
CO-2	Explain the basic techniques of material planning.
CO-3	Identify and analyze the key factors that influence consumer purchase decisions.
CO-4	Provide students with a comprehensive understanding of fundamental principles and concepts of inventory control and management.
CO-5	Familiarize students with inventory management tools that aid in monitoring of physical inventory.
CO-6	Design efficient storage layouts to maximize space utilization and improve workflow in warehouses.

Part	Content	CO
I	**Introduction:** Meaning, definition, functions of materials management, concept of integrated material management, relationship of material management with other organizational functions. **Material planning & budgeting:** Need for material planning, factors affecting material planning, techniques of material planning, material classification, codification and standardization, material budgeting - meaning and need, techniques of material budgeting.	CO-1 & CO-2
II	**Purchasing:** Purchasing principles, procedures and systems, functions of purchasing, make-or-buy decision, vendor development and vendor rating, factors affecting purchase decisions, legal aspects of purchasing, documentation and procedure for import.	CO-3
III	**Inventory control:** Need and meaning of inventory, types of inventory, functions of inventory control, inventory costs. **Physical control of inventory:** fixed order, two bin and Kardex systems - material requirement planning (MRP-I), spare parts control for maintenance purposes, evaluation of inventory control performance. concept of just-in-time (JIT), use of computers for inventory control.	CO-4 & CO-5
IV	**Storage:** Functions and importance of store keeping, types of stores, store accounting and store verification, legal aspects of store keeping, management of surplus, scrap and obsolete items, importance of material handling in store keeping, handling equipment.	CO-6

References:

- M.M. Verma, Materials Management, S. Chand and Co.
- Gopal Krishnan and Sundaresan, Material Management - An Integrated Approach, Prentice Hall
- Dobbler and Burt, Purchasing and materials management, Tata McGraw Hill
- M. Starr and D. Miller, Inventory control, Prentice Hall.

7th/8th Semester	AGOE-21705: NON-CONVENTIONAL ENERGY SOURCES (OE)				
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO-1	Focus on the non - conventional resources that are available for electric power generation.
CO-2	Study principle, types and application of MHD generator.
CO-3	Study principle, types and application of thermoelectric generator.
CO-4	Explore photovoltaic effect and solar collector, solar furnaces and its application.
CO-5	Study principle, description, types and application of fuel cell.
CO-6	Application and description of various sources like geothermal, wind power, tidal.

Part	Content	CO
I	**INTRODUCTION:** Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation. **MHD GENERATORS:** Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of magneto - hydro - dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.	CO-1 & CO-2
II	**THERMO - ELECTRIC GENERATORS:** Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect.	CO-3
III	**PHOTOVOLTAIC EFFECT AND SOLAR ENERGY:** Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.	CO-4 & CO-5
IV	**FUEL CELLS:** Principle of action, Gibb's free energy, general description of fuel cells, types, construction, operational characteristics and application. **MISCELLANEOUS SOURCES:** Geothermal system, hydro - electric plants, wind power, tidal energy, Bio -mass energy.	CO-6

References:

- Gupta B. R., Generation of Electrical Energy, S. Chand.
- Rai, G.D., Non-Conventional Energy Sources, Khanna Publishers (2005).
- Rao, S. and Parulekar, B.B., Energy Technology: Non-Conventional, Renewable and Conventional, Khanna Publishers (2005).

7th/8th Semester	AGOE-21706: ELECTRICAL POWER UTILIZATION (OE)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Understand various types of industrial drives and PLC based drives.
CO-2	Identify the various traction systems.
CO-3	Use various welding and heating techniques in real life.
CO-4	Explore the knowledge gained for project work related to design of lighting schemes.
CO-5	Use techniques, skills related to refrigeration system for engineering practice.
CO-6	Understand the applications of different motors and drives in industries and domestic life.

Part	Content	CO
I	**Electric Drives:** Electrical drives and Mechanical drives, Concept of electrical drives, Basic features of industrial drives, review of operating and starting characteristics of different types of electric motors for various drives (AC and DC motors). Estimation of rating and heating of motors, Load equalization (Fly wheel effect), Drives for particular services.	CO-1 & CO-2
II	**Electric Traction:** Introduction to Indian railways system, Electric Locomotive Classes, Various types of Traction system, single phase feeding arrangement prevalent in India. Substation. arrangements, Different Types of Catenary construction and line insulation, Span and dropper design Calculations. **Electric Heating and Welding:** Methods of electric heating, types of electric heating, constructional details and performance of resistance heating furnace. Dielectric heating. Alternating current (AC).and Direct current (DC) Welding, Resistance and Arc Welding. Electric Beam Welding, Laser Welding. Typical construction of electrical welding AC and DC set.	CO-3 & CO-4
III	**Illumination:** Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles, Design of lighting schemes and equipment used for indoor, industrial and flood lighting.	CO-5
IV	**Refrigeration and Air conditioning:** Refrigeration system, Domestic refrigeration, Air conditioner, Comfort Air conditioning, Effective temperature. **Electrolysis:** Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis.	CO-6

References:

- Wark, K., Warner, C.F., and Davis, W.T., "Air Pollution: Its Origin and Control", Addison-Wesley Longman. 1998.
- Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., "Fundamentals of Air Pollution", Academic Press. 2005.
- Seinfeld, J.H., Pandis, S.N., "Atmospheric Chemistry and Physics", John Wiley. 2006.
- Lodge, J.P. (Ed.), "Methods of Air Sampling and Analysis", CRC Press. 1988.
- Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), "Air Pollution: Health and Environmental Impacts", CRC Press. 2010.

7th/8th Semester	AGOE-21709: MANAGEMENT OF HUMAN RESOURCES (OE)

Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Develop the understanding of the concept of human resource management and HRP to understand its relevance in organizations.
CO-2	Understand the concept of Recruitment and take systematic steps for adoption of Selection and Training process.
CO-3	Analyse the strategic issues and strategies required to select and develop manpower resources.
CO-4	Develop necessary skill set for application of various HR issues by Motivating and handling cordial relations among employees. .
CO-5	Integrate the knowledge of HR concepts to manage Industrial disputes and take correct business decisions.
CO-6	Acquaintance with the fundamental contracts of Human Resource Management and understands future challenges in HRM.

Part	Content	CO
I	**Introduction to Human Resource Management** and its definition, functions of Human Resource Management & its relation to other managerial functions. Nature, Scope and Importance of Human Resource Management in Industry, Procurement and Placement: Need and Process of Human Resource Planning. **Methods of Recruitment;** Psychological tests and interviewing; Meaning and Importance of Placement and Induction, The Contract Labour (Regulation & Abolition) Act 1970.Training & Development: Difference between training and Development; Principles of Training	CO-1 & CO-2
II	**Employee Development**; Promotion-Merit v/s seniority Performance Appraisal, Career Development &Planning. Job analysis & Design: Job Analysis: Job Description & Job Specification and Job Satisfaction	CO-3
III	**Motivation,** Factors affecting motivation, and its Theories, Workers ' Participation, Quality of work life. The Compensation Function: Basic concepts in wage administration, company's wage policy. Job Evaluation, Issues in wage administration, Bonus & Incentives, Payment of Wages Act-1936, Minimum Wages Act-1961, Human Relations and Industrial Relations, Factors required for good Human Relation Policy in Industry. **Employee, Employer relationship** Causes and Effects of Industrial disputes; Employe Grievances &their Redressal, Absenteeism, Labour Turnover, Changing face of the Indian work force and their environment, Importance of collective Bargaining;	CO-4 & CO-5
IV	**Role of Trade unions** in maintaining cordial Industrial Relations, Fringe &retirement terminal benefits, administration of welfare amenities. **Meaning and Importance of Employee Safety**, Accidents-Causes & their Prevention, Safety Previsions under the Factories Act 1948; Welfare of Employees and its Importance, Social security, Family Pension Scheme, ESI act 1948, Workmen's Gratuity Act 1972, Future challenges for Human Resource Management	CO-6

References:

- Lowin B. Flippo – Principles of personnel Management (Mc Graw-Hill)T.N.Chhabra
- Human Resource Management (Dhanpat Rai & Co.)Strength of Materials: Rajput

7th/8th Semester	AGOE-21710: BASICS OF MANAGEMENT (OE)				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO-1	Describe Evolution and fundamental concepts of management. Role and responsibility of managers and various approaches of management.
CO-2	Learn about the functions of management including planning and its concepts, Different approaches of management such as MBO and decision making.
CO-3	Analyze various organizational structure, departmentalization and teamwork.
CO-4	Understand the importance of staffing, recruitment, concept of directing and motivation.
CO-5	Explain about authority and responsibility and the concept of centralization vs decentralization
CO-6	Understand the various controlling techniques in management.

Part	Content	CO
I	**INTRODUCTION:** Meaning, Definition, Nature, Scope, Importance, Functions & Principles of management, Managerial roles and skills. Evolution of management thought: Contribution of F.W. Taylor and Henry Fayol. Quantitative approach, behavioral approach, system approach, contingency approach. **PLANNING:** Meaning, Need & Importance, Types of Plans, Steps in Planning process. MBO: concept and process. Decision Making: meaning, types and process.	CO-1 & CO-2
II	**ORGANIZING:** Concept, Importance, Process, Formal VS Informal organizing, Organizational Structure, Types of organizational structure, factors affecting organization structure, features of good organization. **DEPARTMENTALIZATION:** concept and basis. Teamwork: meaning, types and stages of team building. **STAFFING:** Nature & Scope of Staffing, Recruitment, Selection, Training & development and performance management. Directing: Meaning, Nature & Scope. Motivation: Meaning, Importance and motivational theories.	CO-3 & CO-4
III	**AUTHORITY & RESPONSIBILITY:** Definition, types, responsibility and accountability, delegation, decentralization v/s centralization, determinants of effective decentralization.	CO-5
IV	**CONTROLLING:** Need, Nature, Process, Techniques of controlling and significance. Trends and challenges of management in global scenario, emerging issues in management: Introduction to Total Quality Management (TQM), Just in Time (JIT), Business process reengineering (BPR).	CO-6

References:

- Principles and practices of Management: L.M. PRASAD (S. Chand publishers)
- Management: Stephen Robbins (Pearson publishers)
- VSP Rao & V H Krishna, Management, Excel books.
- Harold Koontz, and Heinz Weihrich, Essentials of Management: An International Perspective, New Delhi, McGraw-Hill, 2010.
- Richard L Daft, The New Era of Management, New Delhi, Thomson, 2007 Stephen P Robbins, Mary Coulter and Neharika Vohra, Management, New Delhi, Pearson, 2011.

7th/8th Semester	AGCoE-21801: INDUSTRIAL TRAINING				
Internal Marks:	300		L	T	P
External Marks:	200		0	0	0
Total Marks:	500		Credits		12

General Guidelines for Industrial Training

1. **Objective of Industrial Training**

The industrial training semester is intended to provide students with practical exposure to the software industry, IT services, research organizations, startups, or related technical domains. It aims to bridge the gap between academic learning and professional practice.

2. **Duration of Training**

The duration of the training shall be as per the dates shared by the department before the commencement of the training.

3. **Approved Organizations**

Students may undergo training in:

- IT companies
- Software development firms
- Government organizations
- Research laboratories
- Startups
- Industries relevant to Computer Science & Engineering

4. **Training Approval**

Prior approval from the department/institute is mandatory before joining the organization. Students must submit: Offer letter / Joining letter

5. **Project/Application Development During Training**

Students are encouraged to work on real-time projects, software modules, web/mobile applications, automation tools, or industry-oriented technical assignments during the training period. The work carried out should demonstrate practical learning, technical contribution, and application of engineering concepts.

6. **Attendance and Discipline**

Students must maintain discipline, punctuality, and professional ethics during the training period. Attendance rules of the host organization shall be strictly followed.

7. **Progress Monitoring**

Students are required to submit periodic progress reports/log books duly signed by the industry mentor and faculty supervisor.

8. **Training Report**

At the completion of training, students must submit a detailed training report containing:

- Introduction of organization
- Objectives of training
- Technologies/tools used
- Work carried out
- Learning outcomes
- Conclusion

9. Presentation and Viva-Voce

Students shall deliver a seminar/presentation and appear for viva-voce examination before the departmental evaluation committee.

10. Training Report

At the completion of training, students must submit a detailed training report containing:

Introduction of organization

Objectives of training

Technologies/tools used

Project or application developed/work carried out

Learning outcomes

Conclusion

11. Assessment Criteria

Evaluation may be based on:

- Attendance and conduct
- Industry mentor feedback
- Progress reports
- Training report
- Presentation and viva-voce

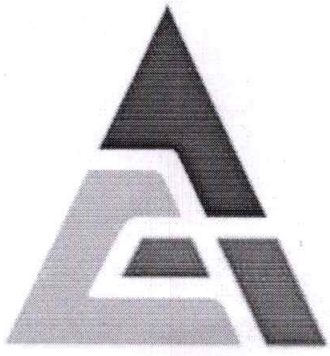
12. Final Submission

All reports, certificates, evaluation forms, and presentation materials must be submitted within the stipulated timeline prescribed by the department.

Annexure -2

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



STUDY SCHEME

Bachelor of Technology

In

Computer Science and Engineering

(Batch 2025 onwards)

Semester: 1st/2nd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGPH-25101	Applied Physics	3	1		40	60	100	4
AGHU-25101	Professional Communication- I	3			40	60	100	3
AGAM-25101	Applied Mathematics-I	3	1		40	60	100	4
AGHV-21101	Human Values & Professional Ethics	3			40	60	100	3
AGEE-25101	Fundamentals of Electrical & Electronics Engineering	3	1		40	60	100	4
AGHU-25102	Professional Communication Lab- I			2	30	20	50	1
AGPH-25102	Applied Physics Lab			2	30	20	50	1
AGEE-25102	Fundamentals of Electrical & Electronics Engineering Lab			2	30	20	50	1
AGMP-21101	Manufacturing Practice			4	60	40	100	2
		15	**3**	**10**	**350**	**400**	**750**	**23**
		Contact Hours = 28 Hrs						

Semester: 1st/2nd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCH-25101	Applied Chemistry	3	1	0	40	60	100	4
AGHU-25201	Professional Communication- II	3	0	0	40	60	100	3
AGAM-25201	Applied Mathematics-II	3	1	0	40	60	100	4
AGES-25101	Environment Education	2	0	0	40	60	100	2
AGCS-25101	Fundamentals of C Programming	3	0	0	40	60	100	3
AGHU-25202	Professional Communication Lab-II			2	30	20	50	1
AGCH-25102	Applied Chemistry Lab			2	30	20	50	1
AGCS-25102	Fundamentals of C Programming Lab			4	30	20	50	2
AGME-25101	Engineering Graphics & Design			4	30	20	50	2
EMC - 25101	Entrepreneurship Setup and Launch			4	60	40	100	2
		14	**2**	**16**	**380**	**420**	**800**	**24**
		Contact Hours = 32 Hrs						

Semester: 3rd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25301	Probability and Statistics	3	1		40	60	100	4
AGCS-25302	Object Oriented Programming using C++	3			40	60	100	3
AGCS-25303	Data Structures	3	1		40	60	100	4
AGCS-25304	Computer Organization and Architecture	3			40	60	100	3
AGCS-25305	Emerging Trends in Computer Science	3			40	60	100	3
AGCS-25306	Object Oriented Programming using C++ Lab			2	50		50	1
AGCS-25307	Data Structures Lab			2	50		50	1
AGCS-25308	Artificial Intelligence Tools and Applications Lab			2	50		50	1
AGCS-25309	Problem Solving using Python Lab			2	50		50	1
AGMC-25001	Indian Constitution	1						0
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		18	**2**	**8**	**400**	**300**	**700**	**23**
		Contact Hours = 28 Hrs						

Semester: 4th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25401	Discrete Mathematics	3	1		40	60	100	4
AGCS-25402	Design and Analysis of Algorithms	3			40	60	100	3
AGCS-25403	Relational Database Management System	3	1		40	60	100	4
AGCS-25404	Operating Systems	3			40	60	100	3
AGCS-25405	Computer Networks	3			40	60	100	3
AGCS-25406	Design and Analysis of Algorithms Lab			2	50		50	1
AGCS-25407	Relational Database Management System Lab			2	50		50	1
AGCS-25408	Operating Systems Lab			2	50		50	1
AGCS-25409	Computer Networks Lab			2	50		50	1
AGMC-25002	Essence of Indian Knowledge Tradition	1						0
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		18	**2**	**8**	**400**	**300**	**700**	**23**
		Contact Hours = 28 Hrs						

Semester: 5th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25501	Theory of Computation	3	1		40	60	100	4
AGCS-25502	Software Engineering	3			40	60	100	3
AGCS-25503	Machine Learning	3	1		40	60	100	4
AGCS-25504	Statistics Analysis and Data Visualization	3			40	60	100	3
AGCS-25505X	Professional Elective Course-1 (PEC-1)	3			40	60	100	3
AGCS-25506	Software Engineering Lab			2	50		50	1
AGCS-25507	Machine Learning Lab			2	50		50	1
AGCS-25508	Statistics Analysis and Data Visualization Lab			2	50		50	1
AGCS-25509	Summer Training				100		100	1
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		17	**2**	**6**	**450**	**300**	**750**	**23**
		Contact Hours = 25 Hrs						

Semester: 6th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25601	Data Science	3	1		40	60	100	4
AGCS-25602	Big Data Analytics	3			40	60	100	3
AGCS-25603	Internet of Things	3			40	60	100	3
AGCS-25604	Cloud Computing	3			40	60	100	3
AGCS-25605X	Professional Elective Course-2 (PEC-2)	3			40	60	100	3
AGCS-25606	Data Science Lab			2	50		50	1
AGCS-25607	Big Data Analytics Lab			2	50		50	1
AGCS-25608	Internet of Things Lab			2	50		50	1
AGCS-25609	Cloud Computing Lab			2	50		50	1
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		17	**1**	**8**	**400**	**300**	**700**	**22**
		Contact Hours = 26 Hrs						

Semester: 7th / 8th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25701	Generative AI	3			40	60	100	3
AGCS-25702X	Professional Elective Course-3 (PEC-3)	3			40	60	100	3
AGCS-25702Y	Professional Elective Course-4 (PEC-4)	3			40	60	100	3
AGOE-257xx	Open Elective	3			40	60	100	3
AGCS-25703	Generative AI Lab			2	50		50	1
AGCS-25704	Major Project Lab			4	100		100	2
		12	**0**	**6**				
		Contact Hours = 18 Hrs			**310**	**240**	**550**	**15**

Semester: 7th / 8th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25801	Industrial Training	-	-	-	500		500	12
		0	**0**	**0**				
		Contact Hours = 0 Hrs			**500**		**500**	**12**

X	PEC-1
A	Cyber Security
B	Distributed Systems
C	Real Time Systems
D	Advanced Computer Networks

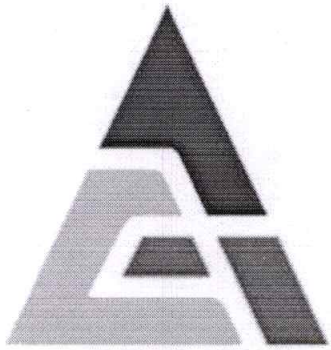
X	PEC-2
A	Foundations of Cryptography
B	Parallel Computing Architecture
C	Design, Thinking and Innovation
D	Compiler Design

X	PEC-3
A	Software Testing
B	Deep Learning
C	Computer Vision
D	Business Intelligent Analysis
E	Human Computer Interaction

Y	PEC-4
F	Natural Language Processing
G	Social Network
H	Reinforcement Learning
I	Blockchain and its applications
J	Introduction to LLM

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



STUDY SCHEME

Bachelor of Technology

In

Computer Engineering

(Batch 2025 onwards)

Semester: 1st/2nd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGPH-25101	Applied Physics	3	1		40	60	100	4
AGHU-25101	Professional Communication- I	3			40	60	100	3
AGAM-25101	Applied Mathematics-I	3	1		40	60	100	4
AGHV-21101	Human Values & Professional Ethics	3			40	60	100	3
AGEE-25101	Fundamentals of Electrical & Electronics Engineering	3	1		40	60	100	4
AGHU-25102	Professional Communication Lab- I			2	30	20	50	1
AGPH-25102	Applied Physics Lab			2	30	20	50	1
AGEE-25102	Fundamentals of Electrical & Electronics Engineering Lab			2	30	20	50	1
AGMP-21101	Manufacturing Practice			4	60	40	100	2
		15	**3**	**10**	**350**	**400**	**750**	**23**
		Contact Hours = 28 Hrs						

Semester: 1st/2nd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCH-25101	Applied Chemistry	3	1	0	40	60	100	4
AGHU-25201	Professional Communication- II	3	0	0	40	60	100	3
AGAM-25201	Applied Mathematics-II	3	1	0	40	60	100	4
AGES-25101	Environment Education	2	0	0	40	60	100	2
AGCS-25101	Fundamentals of C Programming	3	0	0	40	60	100	3
AGHU-25202	Professional Communication Lab-II			2	30	20	50	1
AGCH-25102	Applied Chemistry Lab			2	30	20	50	1
AGCS-25102	Fundamentals of C Programming Lab			4	30	20	50	2
AGME-25101	Engineering Graphics & Design			4	30	20	50	2
EMC - 25101	Entrepreneurship Setup and Launch			4	60	40	100	2
		14	**2**	**16**	**380**	**420**	**800**	**24**
		Contact Hours = 32 Hrs						

Semester: 3rd								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25301	Probability and Statistics	3	1		40	60	100	4
AGCS-25302	Object Oriented Programming using C++	3			40	60	100	3
AGCS-25303	Data Structures	3	1		40	60	100	4
AGCS-25304	Computer Organization and Architecture	3			40	60	100	3
AGCS-25305	Emerging Trends in Computer Science	3			40	60	100	3
AGCS-25306	Object Oriented Programming using C++ Lab			2	50		50	1
AGCS-25307	Data Structures Lab			2	50		50	1
AGCS-25308	Artificial Intelligence Tools and Applications Lab			2	50		50	1
AGCS-25309	Problem Solving using Python Lab			2	50		50	1
AGMC-25001	Indian Constitution	1						0
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		18	**2**	**8**	**400**	**300**	**700**	**23**
		Contact Hours = 28 Hrs						

Semester: 4th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25401	Discrete Mathematics	3	1		40	60	100	4
AGCS-25402	Design and Analysis of Algorithms	3			40	60	100	3
AGCS-25403	Relational Database Management System	3	1		40	60	100	4
AGCS-25404	Operating Systems	3			40	60	100	3
AGCS-25405	Computer Networks	3			40	60	100	3
AGCS-25406	Design and Analysis of Algorithms Lab			2	50		50	1
AGCS-25407	Relational Database Management System Lab			2	50		50	1
AGCS-25408	Operating Systems Lab			2	50		50	1
AGCS-25409	Computer Networks Lab			2	50		50	1
AGMC-25001	Essence of Indian Knowledge Tradition	1						0
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		18	**2**	**8**	**400**	**300**	**700**	**23**

Semester: 5th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25501	Theory of Computation	3	1		40	60	100	4
AGCS-25502	Software Engineering	3			40	60	100	3
AGCS-25503	Machine Learning	3	1		40	60	100	4
AGCS-25504	Statistics Analysis and Data Visualization	3			40	60	100	3
AGCS-25xxx	Professional Elective Course-1 (PEC-1)	3			40	60	100	3
AGCS-25506	Software Engineering Lab			2	50		50	1
AGCS-25507	Machine Learning Lab			2	50		50	1
AGCS-25508	Statistics Analysis and Data Visualization Lab			2	50		50	1
AGCoE-25509	Summer Training				100		100	1
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		17	**2**	**6**				
		Contact Hours = 25 Hrs			**450**	**300**	**750**	**23**

Semester: 6th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25601	Data Science	3	1		40	60	100	4
AGCS-25602	Big Data Analytics	3			40	60	100	3
AGCS-25603	Internet of Things	3			40	60	100	3
AGCS-25604	Cloud Computing	3			40	60	100	3
AGCS-25605X	Professional Elective Course-2 (PEC-2)	3			40	60	100	3
AGCS-25606	Data Science Lab			2	50		50	1
AGCS-25607	Big Data Analytics Lab			2	50		50	1
AGCS-25608	Internet of Things Lab			2	50		50	1
AGCS-25609	Cloud Computing Lab			2	50		50	1
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		17	**1**	**8**				
		Contact Hours = 26 Hrs			**400**	**300**	**700**	**22**

Semester: 7th / 8th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCS-25701	Generative AI	3			40	60	100	3
AGCS-25702X	Professional Elective Course-3 (PEC-3)	3			40	60	100	3
AGCS-25702Y	Professional Elective Course-4 (PEC-4)	3			40	60	100	3
AGOE-257xx	Open Elective	3			40	60	100	3
AGCS-25703	Generative AI Lab			2	50		50	1
AGCoE-25704	Major Project Lab			4	100		100	2
		12	**0**	**6**				
		Contact Hours = 18 Hrs			**310**	**240**	**550**	**15**

Semester: 7th / 8th								
Course code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credit
		L	T	P	Internal	External		
AGCoE-25801	Industrial Training	-	-	-	500		500	12
		0	**0**	**0**				
		Contact Hours = 0 Hrs			**500**		**500**	**12**

X	PEC-1
A	Cyber Security
B	Distributed Systems
C	Real Time Systems
D	Advanced Computer Networks

X	PEC-2
A	Foundations of Cryptography
B	Parallel Computing Architecture
C	Design, Thinking and Innovation
D	Compiler Design

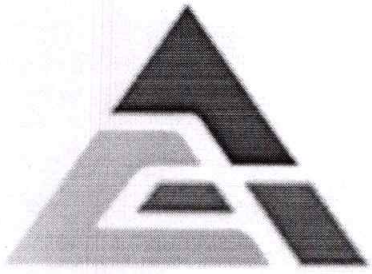
X	PEC-3
A	Software Testing
B	Deep Learning
C	Computer Vision
D	Business Intelligent Analysis
E	Human Computer Interaction

Y	PEC-4
F	Natural Language Processing
G	Social Network
H	Reinforcement Learning
I	Blockchain and its applications
J	Introduction to LLM

Annexure-3

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



DETAILED SYLLABUS

Bachelor of Technology

In

Computer Science and Engineering

(Batch 2025 onwards)

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

B. Tech. (CSE) 3rd SEM

3rd Semester	AGCS 25301: PROBABILITY AND STATISTICS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain fundamental concepts of probability and uncertainty.
CO2	Apply random variables and probability distributions for data analysis.
CO3	Analyze probabilistic models to solve statistical problems.
CO4	Analyze statistical relationships and patterns within datasets.
CO5	Apply regression and data preprocessing techniques for predictive analysis.
CO6	Evaluate hypotheses and infer conclusions using statistical testing methods.

Content	CO
Probability Fundamentals: Introduction to probability, sample space, events, types of events, axioms of probability, conditional probability, independent events including mutually exclusive and exhaustive events, Bayes' theorem and its applications in classification problems.	CO1
Random Variables and Probability Distributions: Concept of random variables including discrete and continuous random variables, probability distributions, Probability Mass Function (PMF), Probability Density Function (PDF), Cumulative Distribution Function (CDF), expected value, variance, skewness and kurtosis.	CO2
Standard Probability Distributions: Binomial distribution, Poisson distribution, normal distribution, and applications and numerical problems based on these probability distributions.	CO3
Statistical Measures and Data Analysis: Measures of central tendency including mean, median and mode, measures of dispersion including variance, standard deviation and mean deviation, covariance, Karl Pearson's coefficient of correlation, Spearman's rank correlation, interpretation of correlation between variables, and correlation versus causation.	CO4
Data Preprocessing and Regression Analysis: Normalization using min-max scaling, standardization using Z-score normalization, simple linear regression, least squares curve fitting, model interpretation including interpretation of coefficients, slope, and intercept, errors and residuals, and performance metrics such as Mean Squared Error (MSE), Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and coefficient of determination (R^2).	CO5
Statistical Inference and Hypothesis Testing: Sampling techniques including random sampling and stratified sampling, confidence intervals, hypothesis testing including null and alternative hypotheses, t-test, z-test for mean, F-test, chi-square test for goodness of fit, and interpretation of p-value.	CO6

References:

- Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor. Sultan Chand & Sons.
- Higher Engineering Mathematics, B. V. Ramana. McGraw Hill Education.
- Biostatistics, P. N. Arora and P. K. Malhan. Himalaya Publishing House.
- Probability and Statistics for Engineers, J. Ravichandran. Wiley India.
- Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger. Wiley.

3rd Semester	AGCS 25302: OBJECT ORIENTED PROGRAMMING USING C++				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain OOP concepts and implement classes, constructors, and dynamic memory.
CO2	Design class hierarchies using inheritance and operator overloading.
CO3	Analyze polymorphism, abstract classes, and RTTI in C++.
CO4	Apply templates and STL for generic programming.
CO5	Implement file handling and exception-safe C++ programs.
CO6	Evaluate smart pointers, multithreading, and development tools.

Content	CO
C++ Classes and Data Abstraction: Specifying a class, creating class objects, accessing class members, access specifiers- private, public, protected, empty class and its size, static data members and static member functions, const member functions and const objects, friend functions and friend classes, nested classes, Difference between class and a structure. **Pointers and Dynamic Memory Management:** Dynamic memory allocation, new and delete operators, memory leaks and dangling pointers, dynamic arrays and object allocation. **Constructors and Destructor:** Definition and characteristics, need for constructors and destructors, types of constructors- Default, Parameterized and copy constructor, constructor overloading, dynamic constructors and destructors.	CO1
Inheritance: Defining a class hierarchy, base and derived class construction, types of inheritance- single, multiple, multilevel, hierarchical, hybrid, access to base class members, function overriding, virtual base classes, diamond problem, order of constructor and destructor execution. **Operator overloading:** Need for operator overloading, rules for operator overloading, overloading unary operators, overloading binary operators, member vs friend function overloading, stream operator overloading (<<, >>)	CO2
Virtual Functions and Polymorphism: Compile-time polymorphism, run-time polymorphism, virtual functions- static and dynamic binding, virtual functions, dynamic binding through virtual functions, virtual function call mechanism- vtable, vptr internals, pure virtual functions, abstract classes, virtual destructors, runtime type information (RTTI), type casting and safe downcasting.	CO3
Templates and Standard Template Library (STL): function templates, class templates, variadic templates, generic programming concepts, STL architecture-STL components and generic programming, sequence containers- vector, list, deque, associative containers: set, map, unordered containers: unordered_set, unordered_map, container adapters: stack, queue, priority_ queue, iterator categories and iterator invalidation rules.	CO4
File Handling and: File stream hierarchy, file opening modes, text file I/O, binary file I/O, random file access- seekg(), seekp(), tellg(),tellp() command-line arguments, error state flags. **Exception Handling:** exception handling using try, throw, catch, types of exceptions- divide by zero,,array index out of bounds, file handling exceptions, memory allocation exceptions, user-defined exceptions, stack unwinding and exception hierarchy, exception safety and noexcept, Resource Acquisition Is Initialization (RAII) and resource-safe programming.	CO5
Modern C++ Language Features: `auto` and `decltype`, range-based loops, structured bindings, `nullptr` and `constexpr`, lambda expressions- lambda syntax and capture modes, generic and mutable	CO6

lambdas, lambdas as callbacks and, comparators, storing and passing lambdas, smart pointers- limitations of raw pointers, `unique_ptr`, `shared_ptr`, `weak_ptr`, ownership models and memory safety, passing smart pointers to functions, multithreading in C++- introduction to processes and threads, need for multithreading, creating threads using std::thread, passing functions to threads, joining threads using join(), detaching threads using detach(), thread synchronization basics.	

References:

- E. Balagurusamy, Object Oriented Programming with C++, McGraw Hill.
- Robert Lafore, Object-Oriented Programming in C++, Pearson Education.
- Scott Meyers, Effective Modern C++, O'Reilly Media.
- Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo, C++ Primer, Pearson Education.
- Bruce Eckel, Thinking in C++, Pearson Education.

3rd Semester	AGCS 25303: DATA STRUCTURES				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain fundamental concepts of data organization, algorithm design, and complexity analysis.
CO2	Apply suitable techniques for data storage, searching, sorting, and processing in computational problems.
CO3	Analyze dynamic memory-based structures and their operations for efficient data management.
CO4	Apply dynamic linear data handling techniques to solve computational and application-oriented problems.
CO5	Analyze hierarchical and network-based structures for efficient representation and processing of relationships among data elements.
CO6	Evaluate efficient storage and retrieval mechanisms for optimizing data access and performance.

Content	CO
Introduction: Concept of data, data types, abstract data types (ADT), classification of data structures, linear and non-linear data structures, operations on data structures, algorithm design concepts, time and space complexity, asymptotic notations (Big-O, Big-Ω, Big-Θ).	CO1
Arrays: One-dimensional and multi-dimensional arrays, representation of arrays, row-major and column-major representation, sparse matrices and storage techniques. **Searching & Sorting:** Linear search, Binary search, Internal Sorting Techniques-Bubble Sort, Selection Sort, Insertion Sort, Radix Sort, Counting Sort, Bucket Sort, Shell Sort.	CO2
Linked Lists: Introduction to linked lists, singly linked list operations, circular linked list, circular linked list operations, doubly linked list, header linked list, applications of linked lists, comparison between arrays and linked lists.	CO3
Stacks: Sequential and linked representation of stacks, stack operations, postfix expression evaluation, infix to postfix conversion, recursion implementation using stacks. **Queues:** Linear queue, circular queue, linked queue, deque (double ended queue), priority queue, applications of queues.	CO4
Trees: Tree terminology, representation of trees, tree traversal techniques (preorder, inorder, postorder). **Binary Search Trees:** Searching, insertion and deletion operations in BST. **Balanced Trees:** AVL tree, rotations in AVL trees, operations on AVL trees. **Advanced Trees:** B-tree and its operations. **Graphs:** Graph terminology, directed and undirected graphs, graph representation using adjacency matrix and adjacency list, graph traversal algorithms including BFS and DFS. **Shortest Path Algorithms:** Dijkstra's algorithm and Floyd-Warshall algorithm.	CO5
Hashing: Hash functions, hash tables, concept of load factor and its impact on performance, collision resolution techniques including open addressing (linear probing, quadratic probing, double hashing) and separate chaining, rehashing techniques and dynamic resizing of hash tables.	CO6

References:

- Schaum's Outline of Data Structures by Seymour Lipschutz, McGraw Hill.
- Data Structures and Algorithms Made Easy by Narasimha Karumanchi, CareerMonk Publications.
- Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, MIT Press.
- Data Structures and Algorithm Analysis in C++ by Mark Allen Weiss, Pearson Education.
- Algorithms by Robert Sedgewick and Kevin Wayne, Addison-Wesley Professional.

3rd Semester	AGCS 25304: COMPUTER ORGANIZATION AND ARCHITECTURE				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain data representation, number systems, Boolean algebra, and basic digital components.
CO2	Apply register transfer and micro-operations for performing data processing tasks.
CO3	Explain basic computer organization and instruction cycle.
CO4	Analyze control unit design, and CPU organization.
CO5	Apply input-output organization and data transfer techniques including DMA and interrupts.
CO6	Analyze memory organization, cache mapping techniques, and pipeline processing.

Content	CO
Data Representation and Digital Components: Introduction to number system, conversions (binary, octal and hexadecimal),1's compliment & 2's compliment, binary addition and subtraction, boolean algebra logic operations, map simplification, combinational circuits. Introduction to flip flops, decoders, encoders, multiplexer, demultiplexer, registers and counters.	CO1
Register Transfer and Micro operations: Register transfer language, register transfer, bus and memory transfer, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic shift unit.	CO2
Computer Organisation and Instruction Cycle: Instruction codes, stored program organization, direct and indirect address, basic computer registers, common bus system, computer instructions- instruction formats, instruction set, timing and control. Instruction Cycle- Fetch & decode, determine the type of instruction, register reference instructions, memory reference instructions and its flowchart, input/output and interrupt, design of basic computer.	CO3
Control Unit Design and Central Processing Unit: Control memory, address sequencing, design of control unit- micro programmed, hardwired. Central Processing Unit- Stack organization, register stack and memory stack, instruction formats, addressing modes- program control, RISC and CISC architecture.	CO4
Input-Output Organization: Peripheral devices, I/O interface, asynchronous data transfer- strobe control, handshaking, modes of transfer, priority interrupt -daisy Chaining priority, interrupt cycle, Direct Memory Access (DMA)- DMA controller (architecture 8237A) and DMA transfer, I/O processor-CPU-IOP communication.	CO5
Memory Organisation & Parallel Processing: Memory hierarchy, main memory, associative memory-hardware organization, cache memory-associative mapping, direct mapping, set-associative mapping, parallel processing, concept of pipeline, arithmetic pipeline, instruction pipeline (four-segment instruction pipeline), pipeline conflicts, array processors.	CO6

References:

- Computer System Architecture, M. Morris Mano, Pearson Education.
- Computer Organization and Architecture, William Stallings, Pearson Education.
- Computer Architecture, David A Patterson, Pearson Education.
- Computer Organization and Design, P. Pal Chaudhuri, Prentice Hall India.
- John L. Hennessy and David A. Patterson, *Computer Architecture: A Quantitative Approach*, Morgan Kaufmann.

3rd Semester	AGCS 25305: EMERGING TRENDS IN COMPUTER SCIENCE				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain concepts, types, and applications of Artificial Intelligence technologies.
CO2	Describe cloud computing models, virtualization concepts, and cloud platforms.
CO3	Explain IoT architecture, communication technologies, and real-world applications.
CO4	Explain cyber security threats, security mechanisms, blockchain concepts in computing applications.
CO5	Describe AR/VR technologies, components, and immersive computing applications.
CO6	Explain principles, concepts, and applications of quantum computing.

Content	CO
Artificial Intelligence: introduction to artificial intelligence, human vs machine intelligence, history and evolution of AI, components of ai systems (learning, reasoning, perception, language), types of AI- narrow AI, general AI, and super AI, applications of AI in healthcare, education, finance, agriculture, and automation, basics of machine learning and deep learning, introduction to Generative AI and AI tools, intelligent agents and expert systems, turing test and its significance, ethical issues in AI- bias and fairness, privacy and security considerations in AI systems, challenges in AI.	CO1
Cloud Computing: Introduction to cloud computing, characteristics and advantages of cloud computing, cloud service models including IaaS, PaaS, and SaaS, cloud deployment models including public cloud, private cloud, and hybrid cloud, introduction to virtualization and virtual machines, data centers (overview), introduction to cloud security and privacy, applications and challenges of cloud computing, popular cloud platforms such as AWS, Azure, and Google Cloud (introductory concepts).	CO2
Internet of Things (IoT): Introduction to Internet of Things (IoT), characteristics and architecture of IoT systems, components of IoT including sensors, actuators, connectivity, and cloud integration, IoT communication technologies such as Wi-Fi, Bluetooth, and RFID, smart home and smart city applications, industrial IoT and healthcare IoT applications, IoT security and privacy issues, challenges and future trends in IoT.	CO3
Cyber Security & Blockchain: Introduction to cyber security, security goals including confidentiality, integrity, and availability, common cyber threats such as malware, phishing, ransomware, and social engineering, authentication and password security, basics of network security and firewalls, introduction to encryption and digital signatures. Introduction to blockchain technology, features of blockchain including decentralization, transparency, and immutability, blocks, hashing, and distributed ledger, cryptocurrency and Bitcoin (basic idea), smart contracts (introductory concept), applications of blockchain in banking, supply chain, healthcare, and digital records.	CO4
Augmented Reality and Virtual Reality (AR/VR): Introduction to Augmented Reality (AR) and Virtual Reality (VR), difference between AR, VR, and Mixed Reality (MR), components of AR/VR systems including sensors, displays, and controllers, working principle of AR/VR systems, applications in gaming, healthcare, education, defense, and industry, introduction to metaverse concept, challenges in AR/VR technologies such as cost, motion sickness, and hardware limitations, future trends in immersive technologies.	CO5
Quantum Computing: Introduction to quantum computing, classical computing vs quantum computing, qubits and quantum states, superposition and entanglement (basic concepts), quantum gates and quantum circuits (introductory idea), quantum parallelism (basic concept), applications of quantum computing in cryptography, optimization, and drug discovery, challenges and limitations of quantum computing,	CO6

future scope of quantum technologies.	

References:

- Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Pearson Education.
- Cloud Computing, Rajkumar Buyya, James Broberg and Andrzej Goscinski, Wiley India.
- Internet of Things: A Hands-On Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press.
- Cryptography and Network Security, William Stallings, Pearson Education.
- Blockchain Basics, Daniel Drescher, Apress.
- Learning Virtual Reality, Tony Parisi, O'Reilly Media.
- Quantum Computing for Everyone, Chris Bernhardt, MIT Press.

3rd Semester	AGCS 25306: OBJECT ORIENTED PROGRAMMING USING C++ LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement C++ programs using classes, constructors, destructors, and dynamic memory.
CO2	Develop applications using inheritance and operator overloading.
CO3	Implement runtime polymorphism using virtual and abstract classes.
CO4	Apply templates and STL for generic programming.
CO5	Develop applications using file handling, exception handling, and modern C++ features.
CO6	Create a mini project integrating OOPS, STL and file handling.

Content	**CO**
Classes and objects, access specifiers, constructors, destructors, copy constructors, dynamic memory allocation, and use of pointers with objects.	CO1
Single, multilevel, and multiple inheritance, constructor invocation in inheritance hierarchies, and operator overloading for unary and binary operators.	CO2
Function overriding, virtual functions, runtime polymorphism, pure virtual functions, and abstract classes.	CO3
Function templates, class templates, Standard Template Library (STL) containers, iterators, algorithms, and lambda expressions.	CO4
Text and binary file handling, exception handling, smart pointers, namespaces, and selected modern C++ features like multithreading, lambda expressions etc.	CO5
Design and development of a mini project involving problem analysis, software design, implementation, testing, debugging, and documentation by integrating concepts covered in CO-1 to CO-5.	CO6

3rd Semester	AGCS 25307: DATA STRUCTURES LAB			
Internal Marks:	**50**	**L**	**T**	**P**
		0	**0**	**2**
Total Marks:	**50**	**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement basic operations for data organization and manipulation using programming constructs.
CO2	Apply searching and sorting techniques to solve computational problems efficiently.
CO3	Implement dynamic data handling techniques using linked lists for efficient storage and retrieval.
CO4	Analyze and implement stack and queue operations for efficient data processing and problem-solving.
CO5	Implement and analyze tree traversal techniques for hierarchical data processing.
CO6	Implement graph traversal techniques for solving computational problems.

Content	**CO**
• Development of menu-driven programs for performing insertion (at end and at specific position), deletion (by value and by position), and display operations on arrays. • Implementation of sparse matrices.	CO1
• Implementation of Searching Techniques: Linear Search, Binary Search • Implementation of Sorting Techniques: Bubble Sort, Selection Sort, Insertion Sort, Bucket Sort, Counting Sort	CO2
• Implementation of singly linked lists with insertion (at beginning, after a given node, and in a sorted linked list), deletion, searching, and display operations. • Implementation of insertion, deletion, and display operations in doubly linked lists. • Implementation of insertion, deletion, and display operations in circular linked lists.	CO3
• Implementation of push and pop operations using arrays and linked list. • Conversion of arithmetic expressions from infix notation to postfix notation and evaluation of postfix expressions using stacks. • Implementation of recursion-based programs. • Implementation of Insert and Delete operations in Queues using arrays and linked list. • Implementation of Priority Queue.	CO4
• Implementation of preorder, inorder, and postorder traversals in binary search trees.	CO5
• Implementation of Breadth First Search (BFS) and Depth First Search (DFS) traversal techniques for graphs.	CO6

3rd Semester	AGCS 25308: ARTIFICIAL INTELLIGENCE TOOLS AND APPLICATIONS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Demonstrate the concepts, capabilities, limitations, and ethical use of AI tools in computing applications.
CO2	Apply prompt engineering techniques for generating structured outputs.
CO3	Apply AI-assisted tools for programming and collaborative development.
CO4	Explore and analyze datasets using AI-assisted data exploration techniques.
CO5	Apply multimodal AI tools for content generation and transformation.
CO6	Design AI-based solutions for real-world applications using modern AI tools.

Content	CO
Introduction to AI Tools: Concept of AI tools and their applications in modern computing. Using AI tools for text, image, and conversational tasks. Applications of AI tools such as ChatGPT, Google Gemini, and Claude for text generation, coding assistance, image generation, and basic data analysis. Understanding capabilities and limitations of AI tools. Ethical and responsible use of AI-generated content, along with data privacy and security considerations.	CO1
Prompt Engineering Fundamentals: Basics of prompt engineering and components of effective prompts. Zero-shot prompting, few-shot prompting, and role-based prompting. Techniques for prompt refinement and optimization. Applications of prompt engineering in generating study notes, code explanations, and structured outputs.	CO2
Code Assistants: Understanding GitHub for version control, storing, sharing, collaboration, and managing source code and software projects using repositories and workflows. Use of GitHub Copilot for code generation, debugging assistance. AI-assisted debugging and improvement of code quality.	CO3
Data exploration: Understanding datasets and data formats such as CSV, JSON, XML, and Excel (XLS/XLSX). Exploring, filtering, and summarizing datasets using AI tools like ChatGPT and Google Gemini. Working with real-world datasets from repositories such as UCI Machine Learning Repository and Kaggle.	CO4
Generative AI Tools: Creating presentations, Speech-to-text, Text-to-speech, Text-to-image and Text-to-video generation. Suggested tools- Gamma AI, Microsoft Copilot, Wispr Flow, ElevenLabs, Speechify, Amazon Polly, Sora, Pika Labs, and HeyGen.	CO5
Integrated AI Application: Resume and LinkedIn profile building using AI-assisted tools such as ChatGPT, Google Gemini, Claude, Microsoft Copilot, and Canva.	CO6

Note: The AI tools mentioned in this syllabus **(AGCS-25308)** are suggestive in nature. Equivalent or related AI tools/platforms may also be used for demonstrating and performing the prescribed activities and concepts. Open-source technologies to be opted preferably.

3rd Semester	AGCS 25309: PROBLEM SOLVING USING PYTHON LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Develop Python programs using control statements, strings, and built-in functions.
CO2	Implement modular programs using functions, recursion, modules, and packages.
CO3	Analyze and manipulate data using Python data structures and comprehensions.
CO4	Design object-oriented Python programs with exception and file handling.
CO5	Develop data-centric applications using CSV/JSON, databases, and visualization libraries.
CO6	Create an end-to-end Python application integrating concepts from CO-1 to CO-5.

Content	**CO**
Python programming environment, program structure, variables, data types, operators, formatted input/output, string handling, built-in functions, conditional statements, iterative constructs, and basic problem-solving programs.	CO1
User-defined functions, parameter passing, return values, recursion, lambda expressions, modules, packages, and standard libraries including math, random, os, and sys.	CO2
Lists, tuples, sets, dictionaries, collections, slicing, sorting, searching, and list and dictionary comprehensions.	CO3
Classes, objects, constructors, inheritance, polymorphism, exception handling, text and binary file processing, and directory operations.	CO4
CSV and JSON processing, database connectivity, introductory NumPy and Pandas, and data visualization using Matplotlib.	CO5
Design and development of a mini project/small applications involving problem analysis, software design, implementation, testing, debugging, and documentation by integrating concepts covered in CO-1 to CO-5.	CO6

3rd Semester	AGMC 25001: INDIAN CONSTITUTION				
Internal Marks:	-		**L**	**T**	**P**
			1	**0**	**0**
Total Marks:	-		**Credits**		**0**

Content
• Historical perspective of the Constitution of India. • Salient features and characteristics of the Constitution of India. • Scheme of the fundamental rights. • The scheme of the Fundamental Duties and its legal status. • The Directive Principles of State Policy – Its importance and implementation. • Federal structure and distribution of legislative and financial powers between theUnion and the States. • Parliamentary Form of Government in India – The constitution powers and status ofthe President of India. • Amendment of the Constitutional Powers and Procedure. • The historical perspectives of the constitutional amendments in India. • Emergency Provisions: National Emergency, President Rule, Financial Emergency. • Local Self Government – Constitutional Scheme in India. • Scheme of the Fundamental Right to Equality. • Scheme of the Fundamental Right to certain Freedom under Article 19. • Scope of the Right to Life and Personal Liberty under Article 21

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

B. Tech. (CSE): 4th SEM

4th Semester	AGCS 25401: DISCRETE MATHEMATICS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain sets, relations, and functions and their properties.
CO2	Apply logical reasoning and proof techniques to solve problems.
CO3	Apply combinatorial techniques and recurrence relations in problem solving.
CO4	Analyze graphs and trees using traversal and structural properties.
CO5	Apply Boolean algebra and number theory concepts in computing problems.
CO6	Evaluate algebraic structures and their applications in computing.

Content	CO
Sets, Relations and Functions: Introduction, proofs of general identities of sets, basic operations on sets, cartesian products, disjoint union, power sets, De Morgan's laws (including for difference of sets), relations: types and operations on relations, properties of relations, equivalence relations, partial order relations and Hasse diagrams, functions: types of functions (injective, surjective, bijective), composition and inverse of functions.	CO1
Propositional Logic and Predicate Logic: Syntax and semantics, logical equivalence, tautologies, contradiction, normal forms (CNF, DNF), rules of inference, proof system, validity and satisfiability, deduction theorem, mathematical induction, proof by contradiction, proof by contrapositive, introduction to predicate logic, quantifiers, decision problems of propositional logic.	CO2
Combinatorial Mathematics: Basic counting principles, permutations and combinations, inclusion-exclusion principle, pigeonhole principle, recurrence relations (substitution method, recurrence tree method, characteristic equation method), introduction to generating functions.	CO3
Graph Theory and Trees: Introduction, directed and undirected graphs, representation of graphs, subgraphs, paths, connected graphs, Euler and Hamiltonian graphs, planar graphs, graph colouring, isomorphism and homomorphism, graph traversal algorithms (BFS and DFS), trees, properties of trees, spanning trees, minimum spanning tree, Kruskal's algorithm.	CO4
Boolean Algebra and Number Theory (with Computing Applications): Boolean algebra, boolean expressions, laws of boolean algebra, simplification techniques, logic gates, divisibility, prime numbers, greatest common divisor (GCD), Euclidean algorithm, modular arithmetic, congruence relations, basic application in computing such as cryptography.	CO5
Algebraic Structures (Introductory): Semigroups, monoids and groups, integer modulo m, order of group, abelian group, applications in computing such as modular arithmetic and basic coding theory concepts.	CO6

References:

- Discrete Structures, Satinder Bal Gupta and C. P. Gandhi.
- Discrete Structures, S. B. Singh, Jai Kishore, Ekata.
- Discrete Mathematical Structures, Dr. D. S. Chandrasekharaiah.
- Discrete Mathematics: An Open Introduction, Oscar Levin.
- Mathematics of Discrete Structures for Computer Science, Gordon J. Pace.

4th Semester	AGCS 25402: DESIGN AND ANALYSIS OF ALGORITHMS			
Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**0**	**0**
Total Marks:	**100**	**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Apply asymptotic notations and recurrence relation methods (substitution, recursion tree, Master Theorem) to determine the time complexity of algorithms.
CO2	Apply divide & conquer and dynamic programming techniques to solve problems such as sorting, matrix chain multiplication, longest common subsequence, and knapsack.
CO3	Analyze the efficiency and correctness of different algorithmic strategies and compare their performance for solving the same problem.
CO4	Analyze graph-based algorithms including minimum spanning trees and shortest path algorithms using Greedy techniques.
CO5	Evaluate and justify the use of appropriate problem-solving techniques such as Greedy, backtracking, and Branch & Bound for given computational problems.
CO6	Evaluate computational complexity of problems and classify them into P, NP, NP-Hard, and NP-Complete using reduction techniques.

Content	CO
Introduction: Basics of algorithms, time and space complexity of an algorithm, comparison of performance of different algorithms for the same problem, asymptotic notations and order of growth. Methods for analysis of recurrence relations- substitution method, recurrence tree method, and Master Theorem.	CO1
Divide & Conquer: General method, applications including Binary Search, Merge Sort, Quick Sort, Randomized Quick Sort, Heap Sort, analysis of their running times.	CO2
Dynamic programming: General Method and applications including Matrix Chain Multiplication, Longest Common Subsequence, 0/1 Knapsack Problem, Travelling Salesman Problem, and Floyd–Warshall Algorithm	CO3
Greedy Strategy: General Method and applications including Fractional Knapsack, Minimum Spanning Trees using Kruskal's and Prim's Algorithms, Topological Sorting, and Single-Source Shortest Path Algorithms in Graphs- Dijkstra and Bellman–Ford Algorithms.	CO4
Backtracking: General approach, applications including 0/1 Knapsack Problem, N-Queens Problem, and Graph Coloring Problem. **Branch & Bound**: General method, Travelling Salesman Problem, Knapsack Problem, and Job Assignment Problem.	CO5
Pattern matching algorithms: Naive string matcher, Knuth-Morris-Pratt algorithm, Rabin Karp algorithm **NP-Completeness:** Definition of class NP, NP-hard and NP-complete problems, proving a problem to be NP-complete using polynomial-time reductions, examples of NP complete problems: 3SAT, vertex cover problem, clique problem, Cooks Theorem	CO6

References:

- Introduction to Algorithms, 2nd Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, The MIT Press, Cambridge; McGraw-Hill Book Company.
- Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, Silicon Press, 2008.
- The Design and Analysis of Algorithms, Nitin Upadhyay, S. K. Kataria & Sons, 2008.
- The Design and Analysis of Algorithms, 3rd Edition, Gajendra Sharma, Khanna Book Publishing Company, Delhi.
- Algorithms, Robert Sedgewick and Kevin Wayne, Addison-Wesley Professional.

4th Semester	AGCS 25403: RELATIONAL DATABASE MANAGEMENT SYSTEM				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain DBMS architecture, relational concepts, and SQL for database operations.
CO2	Apply SQL functions and PL/SQL constructs for procedural database programming.
CO3	Design ER models and convert them into relational schemas.
CO4	Analyze functional dependencies and apply normalization techniques.
CO5	Analyze transaction processing and concurrency control mechanisms.
CO6	Evaluate NoSQL databases, indexing, and query optimization techniques.

Content	CO
Introduction to Database Systems: Database systems and DBMS concepts, file system versus DBMS, components of DBMS, advantages and limitations of DBMS, data abstraction and three-level architecture, physical and logical data independence, overview of relational database systems, SQL fundamentals- SQL as DDL, DML and DCL, SQL data types. Database objects- tables and views. DDL commands- CREATE, ALTER, DROP. DML Commands: INSERT, UPDATE, DELETE. DCL commands- GRANT, REVOKE, roles and privileges. Integrity constraints- Primary key, foreign key, UNIQUE, NOT NULL, CHECK, DEFAULT, naming constraints. SQL querying- SELECT statement, WHERE, ORDER BY, GROUP BY, HAVING.	CO1
SQL Functions and Queries: Numeric functions, character functions, date functions, aggregate functions, single-row and multi-row subqueries, SQL joins- Inner join, Outer join, Self join, PL/SQL programming- Introduction and advantages of PL/SQL, structure of PL/SQL block, data types and variables, SELECT INTO statement. Control statements- IF, CASE, LOOP, WHILE, FOR. Cursors- implicit cursors, explicit cursors, parameterized cursors, cursor FOR loop. Exception handling- Predefined exceptions, user-defined exceptions. Database program units: Procedures and functions, IN, OUT and IN OUT parameters, packages, triggers and their applications.	CO2
Data Models: Relational data model, overview of hierarchical and network models, DBMS versus RDBMS, Entity relationship modelling: Entities and attributes, relationships and constraints, strong and weak entities, ER diagrams and symbols, cardinality and participation constraints. Relational Database Design- ER to relational model conversion, schema design concepts, introduction to database design methodologies.	CO3
Database Keys: Primary key, foreign key, candidate key, super key, alternate key. Functional dependency- Concept and types of dependencies, full, partial and transitive dependency. Normalization- Need for normalization, First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF),Boyce-Codd Normal Form (BCNF), multivalued dependency, denormalization.	CO4
Transaction Management: Transactions and operations, ACID properties, transaction states, concurrent transactions. Schedules and Serializability- Serial and non-serial schedules, serializable schedules, conflict serializability. Concurrency Problems- Lost update problem, dirty read problem, inconsistent retrieval problem. Concurrency Control Techniques- Lock-based protocols, shared and exclusive locks, two-phase locking protocol.	CO5
Introduction to NoSQL: Need for NoSQL databases, RDBMS versus NoSQL databases, types of NoSQL Databases- Key-value stores, document databases, Column-family databases, graph databases. MongoDB Fundamentals- Collections and documents, CRUD operations, JSON/BSON concepts,	CO6

MongoDB atlas overview. Query processing and optimization: query processing overview, query execution plans, query optimization techniques, cost-based optimization, performance tuning basics.	

References:

- Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, McGraw Hill.
- Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education.
- Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw Hill.
- C. J. Date, An Introduction to Database Systems, Pearson Education.
- Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publications.

4th Semester	AGCS 25404: OPERATING SYSTEMS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain basic operating system concepts, structures, and services.
CO2	Apply process scheduling and inter-process communication techniques.
CO3	Analyze synchronization mechanisms and deadlock handling methods.
CO4	Analyze memory management and page replacement techniques.
CO5	Apply file system and storage management concepts.
CO6	Evaluate security and protection mechanisms in operating systems.

Content	CO
Introduction to Operating Systems: Definition and functions of operating system, user view and system view of OS. Types of operating systems- Batch, time-sharing, real-time, distributed, mobile. Computer system architecture- Single processor, multiprocessor, clustered systems. Operating system operations- multiprogramming, multitasking, dual mode and multimode operations, resource management and OS services. System calls- Concept and types. operating system structures- monolithic, layered, microkernel. Introduction to virtualization and virtual machines	CO1
Processes and CPU Scheduling: Process concept and process states, Process Control Block (PCB) , threads and multithreading (user-level and kernel-level threads), operations on processes. Inter-Process Communication (IPC)- Independent and cooperative Processes. CPU scheduling concepts and criteria, Types of schedulers- Long-term, Short-term, Medium-term. Scheduling algorithms: FCFS, SJF (Preemptive & Non-preemptive), priority scheduling, round robin, context switching, real-time scheduling(introduction).	CO2
Process Synchronization: Principle of concurrency, critical section problem, Peterson's solution. Synchronization tools- Mutex locks, semaphores. Classical problems of synchronization- producer-consumer, readers-writers. **Deadlocks: S**ystem model and characterization, methods of handling deadlocks, deadlock prevention and avoidance (Banker's algorithm), deadlock detection and recovery.	CO3
Memory Management: Memory management concepts and memory hierarchy, logical and physical address space, address binding, contiguous and non-contiguous memory allocation, fragmentation and compaction. Paging- Concept, hardware support, protection and sharing, segmentation, Translation Lookaside Buffer (TLB). Virtual memory and demand paging. Page replacement algorithms- FIFO, Optimal, LRU. Allocation of frames and thrashing, introduction to copy-on-write	CO4
Storage Management and File Systems: Mass storage structure overview. Disk scheduling algorithms: FCFS, SSTF, SCAN, C-SCAN. Device management concepts, RAID structure (basic idea), HDD vs SSD (conceptual comparison). File concept and access methods, directory structure, file system structure. File allocation methods- Contiguous, Linked, Indexed. Free space management. Overview of Linux file system	CO5
Security and Protection: Security Problems in operating systems, Program threats- Malware (Trojan horse, spyware, ransomware, logic bomb, trapdoor). System threats- Viruses, worms, denial of service attacks. Authentication mechanisms- Passwords, one-time passwords, multi-factor authentication, Protection mechanisms- Goals and principles of protection, domain of protection, access matrix, capability lists	CO6

References:

- Operating System Concepts, A Silberschatz, Peter B. Galvin and G. Gagne. Wiley.
- Systems Programming & Operating Systems, Dhamdhere, Tata McGraw Hill.
- Operating Systems Concepts, Gary Nutt, Pearson.
- Operating Systems by Madnick Donovan, Tata McGraw Hill. Strength of Materials by Gere, Cengage Learning.
- Modern Operating System by Andrew S. Tanenbaum, Pearson.

4th Semester	AGCS 25405: COMPUTER NETWORKS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain concepts of data communication, network topologies, transmission modes, and layered network architectures.
CO2	Apply physical layer concepts and transmission media characteristics in data communication.
CO3	Apply error detection, flow control, and medium access protocols for reliable data transmission.
CO4	Analyze routing, addressing, and congestion control mechanisms in computer networks.
CO5	Analyze transport and session layer protocols for communication management.
CO6	Evaluate presentation layer services, application layer protocols, and network security techniques for secure communication.

Content	CO
Introduction to Computer Networks: Data communication system and its components, protocols and standards, line configuration, topologies (mesh, star, tree, bus, ring and hybrid). **Transmission Mode:** Simplex and duplex, categories of computer networks: LAN, MAN, WAN, wireless and wired networks, broadcast and point to point networks. **Network Software:** Concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP protocol suite.	CO1
Physical Layer: Concept of analog & digital signal, frequency spectrum and bandwidth, bit interval bit rate and baud rate, sampling, Nyquist formula, Shannon formula. **Transmission Media and Impairments:** Twisted pair, coaxial cable, fiber optics, wireless transmission (radio, microwave, infrared), attenuation, distortion, noise.	CO2
Data Link Layer: Design issues, framing, checksum, error detection and correction codes (VRC, LRC, and CRC, hamming code). **Flow Control and Error Control:** Stop and wait, sliding window protocol, ARQ, Stop & Wait ARQ, Go-back-N ARQ, selective repeat ARQ. **Data link protocols and Medium Access Sub-Layer:** HDLC and PPP, static and dynamic channel allocation. **Random Access:** ALOHA, CSMA protocols, controlled access, polling, token passing, IEEE 802.3 frame format, Ethernet cabling, collision detection in IEEE 802.3, binary exponential backoff algorithm, token bus, token ring.	CO3
Switching: Circuit switching, message switching, packet switching & their comparisons. **Network Layer:** Design issues, network and internetworking devices, repeaters, bridges, routers and gateways. **Routing Algorithms and Congestion Control:** Distance vector and link state routing, IPv4 classful and classless addressing, ARP, RARP, ICMP, IGMP, BGP, subnetting, principles of congestion control, congestion prevention policies, leaky bucket and token bucket algorithms.	CO4
Transport Layer: Duties of transport layer, introduction to TCP/UDP protocols and their comparison.	CO5

Session Layer: Session and transport layer interaction, synchronization points, session protocol data unit.	
Presentation Layer: Translation, encryption and decryption techniques, authentication, data compression. **Application Layer:** WWW, DNS, E-mail, Protocols-FTP, SMTP, TFTP, TELNET,DHCP, HTTP, HTTPS. **Network Security:** Introduction to network security, goals, common network threats-malware, phishing, spoofing, secure communication protocols overview, firewalls.	CO6

References:

- Computer Networks, Andrew S. Tanenbaum, Pearson Education.
- Data Communication & Networking, Behrouz A. Forouzan, Tata McGraw Hill.
- Computer Networking, James F. Kurose and Keith W. Ross, Pearson Education.
- Data and Computer Communications, William Stallings, Pearson Education.
- Computer Networks and Internets, Douglas E. Comer, Pearson Education.

4th Semester	AGCS 25406: DESIGN AND ANALYSIS OF ALGORITHMS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement searching techniques such as Linear Search and Binary Search to locate elements and analyze their operational efficiency.
CO2	Develop sorting algorithms including Merge Sort, Quick Sort, and Heap Sort for arranging data efficiently.
CO3	Analyze dynamic programming approaches to solve optimization problems such as Matrix Chain Multiplication, Longest Common Subsequence, and 0/1 Knapsack Problem.
CO4	Examine graph-based algorithms including Kruskal's, Prim's, and Dijkstra's algorithms for solving spanning tree and shortest path problems.
CO5	Evaluate backtracking and branch & bound techniques for solving complex combinatorial problems such as N-Queens, Graph Coloring, and Travelling Salesman Problem.
CO6	Assess the efficiency and suitability of string-matching algorithms including Naive String Matching, KMP, and Rabin-Karp for pattern searching applications.

Content	**CO**
• Write a program to implement Linear Search for finding an element in an array and count the number of comparisons performed. • Write a program to implement Binary Search using recursive method and analyze its efficiency.	CO1
• Write a program to sort a list of elements using Merge Sort technique. • Write a program to implement Quick Sort using suitable pivot selection. • Write a program to implement Heap Sort using Max Heap.	CO2
• Write a program to determine the optimal order of matrix multiplication using Dynamic Programming. • Write a program to find the Longest Common Subsequence between two strings. • Write a program to solve the 0/1 Knapsack Problem using Dynamic Programming.	CO3
• Write a program to construct the Minimum Spanning Tree using Kruskal's Algorithm. • Write a program to construct the Minimum Spanning Tree using Prim's Algorithm. • Write a program to find shortest paths from a source vertex using Dijkstra Algorithm.	CO4
• Write a program to solve the N-Queens problem using Backtracking. • Write a program to solve the Graph Coloring problem using Backtracking. • Write a program to solve Travelling Salesman Problem using Branch and Bound technique.	CO5
• Write a program to perform pattern matching using Naive String-Matching Algorithm. • Write a program to perform pattern matching using KMP Algorithm. • Write a program to perform pattern matching using Rabin-Karp Algorithm.	CO6

4th Semester	AGCS 25407: RELATIONAL DATABASE MANAGEMENT SYSTEM LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement SQL commands and integrity constraints for database operations.
CO2	Apply SQL functions, joins, subqueries, and views for data retrieval.
CO3	Implement PL/SQL programs using control structures, cursors, and exception handling.
CO4	Develop procedures, functions, packages, and triggers.
CO5	Analyze MongoDB operations and NoSQL concepts.
CO6	Create a database application using SQL, PL/SQL, and MongoDB.

Content	CO
Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL), Transaction Control Language (TCL), and integrity constraints including primary key, foreign key, unique, check, and not null.	CO1
SQL functions, joins, nested queries, subqueries, set operators, grouping, aggregate functions, and views for data retrieval and analysis.	CO2
PL/SQL blocks, variables, control structures, cursors, records and exception handling mechanisms.	CO3
Stored procedures and functions, packages, and database triggers for implementing reusable and automated database operations.	CO4
Introduction to NoSQL databases, MongoDB installation and configuration, databases and collections, document model, and CRUD operations.	CO5
Design and development of a mini database application involving schema design, query development, procedural programming, testing, and documentation by integrating concepts covered in CO-1 to CO-5.	CO6

4th Semester	AGCS 25408: OPERATING SYSTEMS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain operating system installation, virtualization, and Linux/Unix environment concepts.
CO2	Apply Linux commands, file management, and shell scripting techniques.
CO3	Implement process creation and CPU scheduling algorithms using system calls.
CO4	Analyze synchronization problems using semaphores and related techniques.
CO5	Analyze deadlock handling and memory allocation techniques.
CO6	Evaluate page replacement algorithms for efficient memory management.

Content	CO
• Installation of operating system Windows/Linux • Concept of virtualization, installation of virtual machine software and installation of operating system on virtual machine.	CO1
• Study of Linux/Unix operating system environment and basic commands. • Practice of file, directory management commands and implementation of file permissions and user management commands. • Shell scripting programs using decision making and looping statements.	CO2
• Write programs to demonstrate process creation using fork(), exec(), and wait(). • Implement CPU scheduling algorithms: ➢ FCFS ➢ SJF ➢ Priority Scheduling ➢ Round Robin	CO3
• Implement Producer-Consumer problem and Reader-Writer problem using semaphores	CO4
• Implement Banker's Algorithm for deadlock avoidance. • Implement memory allocation techniques: ➢ First Fit ➢ Best Fit ➢ Worst Fit	CO5
• Implement page replacement algorithms: ➢ FIFO ➢ LRU ➢ Optimal	CO6

4th Semester	AGCS 25409: COMPUTER NETWORKS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Configure networking devices, IP addressing, subnet masks, and transmission media to establish communication between computer systems.
CO2	Analyze network topologies, transmission media characteristics, and packet flow behavior using network analysis tools.
CO3	Evaluate the effectiveness of error detection and correction techniques such as CRC and Hamming Code for reliable data communication.
CO4	Implement network utility commands and resource-sharing techniques to verify connectivity and communication in a network environment.
CO5	Examine and interpret protocol headers, routing paths, and network traffic using tools such as Wireshark and networking utilities.
CO6	Assess network security mechanisms, firewall configurations, and client-server communication performance for secure and efficient networking operations.

Content	CO
• Familiarization with networking components and devices: LAN adapters, hubs, switches, routers.	CO1
• Study twisted pair cable, coaxial cable, fiber optic cable transmission media with their characteristics and applications. • Co-axial cable, UTP cable, crimping tool, connectors etc. • Preparing straight and cross cables. • Connect networking devices using suitable transmission media and verify successful data communication between systems.	CO2
• Write a program to implement Cyclic Redundancy Check (CRC) technique for error detection in data. • Write a program to generate and detect errors using Hamming Code.	CO3
• Configure IP address, subnet mask, and default gateway on a system using network configuration commands. • Use networking commands such as `ping`, `ipconfig/ifconfig`, `racert/traceroute`, and `netstat` to analyze network connectivity and status. • Implementation of file and printer sharing.	CO4
• Subnet planning and its implementation. • Generating IP address range using subnet mask calculator and using WHOIS domain tools. • Write a program for TCP-based client-server communication using socket programming.	CO5
• Study the working and packet flow of HTTP, FTP, SMTP, and DNS protocols using network analyzer tools. • Capture and analyze network packets using Wireshark and identify different protocol headers • Configure firewall settings and study network security mechanisms for secure communication	CO6

4th Semester	AGMC 25002: ESSENCE OF INDIAN KNOWLEDGE TRADITION				
Internal Marks:	-		**L**	**T**	**P**
			1	**0**	**0**
Total Marks:	-		**Credits**		**0**

Content

INTRODUCTION TO TRADITIONAL KNOWLEDGE: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physicaland social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

PROTECTION OF TRADITIONAL KNOWLEDGE: Protection of traditional knowledge:The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

LEGAL FRAMEWORK AND TK:

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006,Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); TheBiological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indicators act 2003.

TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY

Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS: Traditional knowledge andengineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Foodsecurity of the country and protection of TK. 139.

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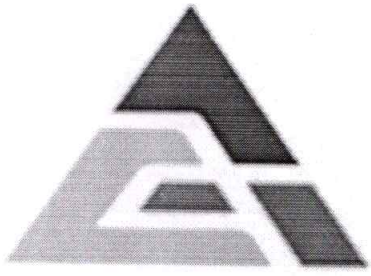


DETAILED SYLLABUS

Bachelor of Technology

In

Computer Engineering

(Batch 2025 onwards)

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

B. Tech. (CoE): 3rd SEM

3rd Semester	AGCS 25301: PROBABILITY AND STATISTICS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain fundamental concepts of probability and uncertainty.
CO2	Apply random variables and probability distributions for data analysis.
CO3	Analyze probabilistic models to solve statistical problems.
CO4	Analyze statistical relationships and patterns within datasets.
CO5	Apply regression and data preprocessing techniques for predictive analysis.
CO6	Evaluate hypotheses and infer conclusions using statistical testing methods.

Content	CO
Probability Fundamentals: Introduction to probability, sample space, events, types of events, axioms of probability, conditional probability, independent events including mutually exclusive and exhaustive events, Bayes' theorem and its applications in classification problems.	CO1
Random Variables and Probability Distributions: Concept of random variables including discrete and continuous random variables, probability distributions, Probability Mass Function (PMF), Probability Density Function (PDF), Cumulative Distribution Function (CDF), expected value, variance, skewness and kurtosis.	CO2
Standard Probability Distributions: Binomial distribution, Poisson distribution, normal distribution, and applications and numerical problems based on these probability distributions.	CO3
Statistical Measures and Data Analysis: Measures of central tendency including mean, median and mode, measures of dispersion including variance, standard deviation and mean deviation, covariance, Karl Pearson's coefficient of correlation, Spearman's rank correlation, interpretation of correlation between variables, and correlation versus causation.	CO4
Data Preprocessing and Regression Analysis: Normalization using min-max scaling, standardization using Z-score normalization, simple linear regression, least squares curve fitting, model interpretation including interpretation of coefficients, slope, and intercept, errors and residuals, and performance metrics such as Mean Squared Error (MSE), Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and coefficient of determination (R^2).	CO5
Statistical Inference and Hypothesis Testing: Sampling techniques including random sampling and stratified sampling, confidence intervals, hypothesis testing including null and alternative hypotheses, t-test, z-test for mean, F-test, chi-square test for goodness of fit, and interpretation of p-value.	CO6

References:

- Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor. Sultan Chand & Sons.
- Higher Engineering Mathematics, B. V. Ramana. McGraw Hill Education.
- Biostatistics, P. N. Arora and P. K. Malhan. Himalaya Publishing House.
- Probability and Statistics for Engineers, J. Ravichandran. Wiley India.
- Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger. Wiley.

3rd Semester	AGCS 25302: OBJECT ORIENTED PROGRAMMING USING C++				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain OOP concepts and implement classes, constructors, and dynamic memory.
CO2	Design class hierarchies using inheritance and operator overloading.
CO3	Analyze polymorphism, abstract classes, and RTTI in C++.
CO4	Apply templates and STL for generic programming.
CO5	Implement file handling and exception-safe C++ programs.
CO6	Evaluate smart pointers, multithreading, and development tools.

Content	CO
C++ Classes and Data Abstraction: Specifying a class, creating class objects, accessing class members, access specifiers- private, public, protected, empty class and its size, static data members and static member functions, const member functions and const objects, friend functions and friend classes, nested classes, Difference between class and a structure. **Pointers and Dynamic Memory Management:** Dynamic memory allocation, new and delete operators, memory leaks and dangling pointers, dynamic arrays and object allocation. **Constructors and Destructor:** Definition and characteristics, need for constructors and destructors, types of constructors- Default, Parameterized and copy constructor, constructor overloading, dynamic constructors and destructors.	CO1
Inheritance: Defining a class hierarchy, base and derived class construction, types of inheritance- single, multiple, multilevel, hierarchical, hybrid, access to base class members, function overriding, virtual base classes, diamond problem, order of constructor and destructor execution. **Operator overloading:** Need for operator overloading, rules for operator overloading, overloading unary operators, overloading binary operators, member vs friend function overloading, stream operator overloading (<<, >>)	CO2
Virtual Functions and Polymorphism: Compile-time polymorphism, run-time polymorphism, virtual functions- static and dynamic binding, virtual functions, dynamic binding through virtual functions, virtual function call mechanism- vtable, vptr internals, pure virtual functions, abstract classes, virtual destructors, runtime type information (RTTI), type casting and safe downcasting.	CO3
Templates and Standard Template Library (STL): function templates, class templates, variadic templates, generic programming concepts, STL architecture-STL components and generic programming, sequence containers- vector, list, deque, associative containers: set, map, unordered containers: unordered_set, unordered_map, container adapters: stack, queue, priority_ queue, iterator categories and iterator invalidation rules.	CO4
File Handling and: File stream hierarchy, file opening modes, text file I/O, binary file I/O, random file access- seekg(), seekp(), tellg(),tellp() command-line arguments, error state flags. **Exception Handling:** exception handling using try, throw, catch, types of exceptions- divide by zero,,array index out of bounds, file handling exceptions, memory allocation exceptions, user-defined exceptions, stack unwinding and exception hierarchy, exception safety and noexcept, Resource Acquisition Is Initialization (RAII) and resource-safe programming.	CO5
Modern C++ Language Features: `auto` and `decltype`, range-based loops, structured bindings, `nullptr` and `constexpr`, lambda expressions- lambda syntax and capture modes, generic and mutable	CO6

lambdas, lambdas as callbacks and, comparators, storing and passing lambdas, smart pointers- limitations of raw pointers, `unique_ptr`, `shared_ptr`, `weak_ptr`, ownership models and memory safety, passing smart pointers to functions, multithreading in C++- introduction to processes and threads, need for multithreading, creating threads using std::thread, passing functions to threads, joining threads using join(), detaching threads using detach(), thread synchronization basics.	

References:

- E. Balagurusamy, Object Oriented Programming with C++, McGraw Hill.
- Robert Lafore, Object-Oriented Programming in C++, Pearson Education.
- Scott Meyers, Effective Modern C++, O'Reilly Media.
- Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo, C++ Primer, Pearson Education.
- Bruce Eckel, Thinking in C++, Pearson Education.

3rd Semester	AGCS 25303: DATA STRUCTURES				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain fundamental concepts of data organization, algorithm design, and complexity analysis.
CO2	Apply suitable techniques for data storage, searching, sorting, and processing in computational problems.
CO3	Analyze dynamic memory-based structures and their operations for efficient data management.
CO4	Apply dynamic linear data handling techniques to solve computational and application-oriented problems.
CO5	Analyze hierarchical and network-based structures for efficient representation and processing of relationships among data elements.
CO6	Evaluate efficient storage and retrieval mechanisms for optimizing data access and performance.

Content	CO
Introduction: Concept of data, data types, abstract data types (ADT), classification of data structures, linear and non-linear data structures, operations on data structures, algorithm design concepts, time and space complexity, asymptotic notations (Big-O, Big-Ω, Big-Θ).	CO1
Arrays: One-dimensional and multi-dimensional arrays, representation of arrays, row-major and column-major representation, sparse matrices and storage techniques. **Searching & Sorting:** Linear search, Binary search, Internal Sorting Techniques-Bubble Sort, Selection Sort, Insertion Sort, Radix Sort, Counting Sort, Bucket Sort, Shell Sort.	CO2
Linked Lists: Introduction to linked lists, singly linked list operations, circular linked list, circular linked list operations, doubly linked list, header linked list, applications of linked lists, comparison between arrays and linked lists.	CO3
Stacks: Sequential and linked representation of stacks, stack operations, postfix expression evaluation, infix to postfix conversion, recursion implementation using stacks. **Queues:** Linear queue, circular queue, linked queue, deque (double ended queue), priority queue, applications of queues.	CO4
Trees: Tree terminology, representation of trees, tree traversal techniques (preorder, inorder, postorder). **Binary Search Trees:** Searching, insertion and deletion operations in BST. **Balanced Trees:** AVL tree, rotations in AVL trees, operations on AVL trees. **Advanced Trees:** B-tree and its operations. **Graphs:** Graph terminology, directed and undirected graphs, graph representation using adjacency matrix and adjacency list, graph traversal algorithms including BFS and DFS. **Shortest Path Algorithms:** Dijkstra's algorithm and Floyd-Warshall algorithm.	CO5
Hashing: Hash functions, hash tables, concept of load factor and its impact on performance, collision resolution techniques including open addressing (linear probing, quadratic probing, double hashing) and separate chaining, rehashing techniques and dynamic resizing of hash tables.	CO6

References:

- Schaum's Outline of Data Structures by Seymour Lipschutz, McGraw Hill.
- Data Structures and Algorithms Made Easy by Narasimha Karumanchi, CareerMonk Publications.
- Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, MIT Press.
- Data Structures and Algorithm Analysis in C++ by Mark Allen Weiss, Pearson Education.
- Algorithms by Robert Sedgewick and Kevin Wayne, Addison-Wesley Professional.

3rd Semester	AGCS 25304: COMPUTER ORGANIZATION AND ARCHITECTURE				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain data representation, number systems, Boolean algebra, and basic digital components.
CO2	Apply register transfer and micro-operations for performing data processing tasks.
CO3	Explain basic computer organization and instruction cycle.
CO4	Analyze control unit design, and CPU organization.
CO5	Apply input-output organization and data transfer techniques including DMA and interrupts.
CO6	Analyze memory organization, cache mapping techniques, and pipeline processing.

Content	CO
Data Representation and Digital Components: Introduction to number system, conversions (binary, octal and hexadecimal),1's compliment & 2's compliment, binary addition and subtraction, boolean algebra logic operations, map simplification, combinational circuits. Introduction to flip flops, decoders, encoders, multiplexer, demultiplexer, registers and counters.	CO1
Register Transfer and Micro operations: Register transfer language, register transfer, bus and memory transfer, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic shift unit.	CO2
Computer Organisation and Instruction Cycle: Instruction codes, stored program organization, direct and indirect address, basic computer registers, common bus system, computer instructions- instruction formats, instruction set, timing and control. Instruction Cycle- Fetch & decode, determine the type of instruction, register reference instructions, memory reference instructions and its flowchart, input/output and interrupt, design of basic computer.	CO3
Control Unit Design and Central Processing Unit: Control memory, address sequencing, design of control unit- micro programmed, hardwired. Central Processing Unit- Stack organization, register stack and memory stack, instruction formats, addressing modes- program control, RISC and CISC architecture.	CO4
Input-Output Organization: Peripheral devices, I/O interface, asynchronous data transfer- strobe control, handshaking, modes of transfer, priority interrupt -daisy Chaining priority, interrupt cycle, Direct Memory Access (DMA)- DMA controller (architecture 8237A) and DMA transfer, I/O processor-CPU-IOP communication.	CO5
Memory Organisation & Parallel Processing: Memory hierarchy, main memory, associative memory-hardware organization, cache memory-associative mapping, direct mapping, set-associative mapping, parallel processing, concept of pipeline, arithmetic pipeline, instruction pipeline (four-segment instruction pipeline), pipeline conflicts, array processors.	CO6

References:

- Computer System Architecture, M. Morris Mano, Pearson Education.
- Computer Organization and Architecture, William Stallings, Pearson Education.
- Computer Architecture, David A Patterson, Pearson Education.
- Computer Organization and Design, P. Pal Chaudhuri, Prentice Hall India.
- John L. Hennessy and David A. Patterson, *Computer Architecture: A Quantitative Approach*, Morgan Kaufmann.

3rd Semester	AGCS 25305: EMERGING TRENDS IN COMPUTER SCIENCE				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain concepts, types, and applications of Artificial Intelligence technologies.
CO2	Describe cloud computing models, virtualization concepts, and cloud platforms.
CO3	Explain IoT architecture, communication technologies, and real-world applications.
CO4	Explain cyber security threats, security mechanisms, blockchain concepts in computing applications.
CO5	Describe AR/VR technologies, components, and immersive computing applications.
CO6	Explain principles, concepts, and applications of quantum computing.

Content	CO
Artificial Intelligence: introduction to artificial intelligence, human vs machine intelligence, history and evolution of AI, components of ai systems (learning, reasoning, perception, language), types of AI- narrow AI, general AI, and super AI, applications of AI in healthcare, education, finance, agriculture, and automation, basics of machine learning and deep learning, introduction to Generative AI and AI tools, intelligent agents and expert systems, turing test and its significance, ethical issues in AI- bias and fairness, privacy and security considerations in AI systems, challenges in AI.	CO1
Cloud Computing: Introduction to cloud computing, characteristics and advantages of cloud computing, cloud service models including IaaS, PaaS, and SaaS, cloud deployment models including public cloud, private cloud, and hybrid cloud, introduction to virtualization and virtual machines, data centers (overview), introduction to cloud security and privacy, applications and challenges of cloud computing, popular cloud platforms such as AWS, Azure, and Google Cloud (introductory concepts).	CO2
Internet of Things (IoT): Introduction to Internet of Things (IoT), characteristics and architecture of IoT systems, components of IoT including sensors, actuators, connectivity, and cloud integration, IoT communication technologies such as Wi-Fi, Bluetooth, and RFID, smart home and smart city applications, industrial IoT and healthcare IoT applications, IoT security and privacy issues, challenges and future trends in IoT.	CO3
Cyber Security & Blockchain: Introduction to cyber security, security goals including confidentiality, integrity, and availability, common cyber threats such as malware, phishing, ransomware, and social engineering, authentication and password security, basics of network security and firewalls, introduction to encryption and digital signatures. Introduction to blockchain technology, features of blockchain including decentralization, transparency, and immutability, blocks, hashing, and distributed ledger, cryptocurrency and Bitcoin (basic idea), smart contracts (introductory concept), applications of blockchain in banking, supply chain, healthcare, and digital records.	CO4
Augmented Reality and Virtual Reality (AR/VR): Introduction to Augmented Reality (AR) and Virtual Reality (VR), difference between AR, VR, and Mixed Reality (MR), components of AR/VR systems including sensors, displays, and controllers, working principle of AR/VR systems, applications in gaming, healthcare, education, defense, and industry, introduction to metaverse concept, challenges in AR/VR technologies such as cost, motion sickness, and hardware limitations, future trends in immersive technologies.	CO5
Quantum Computing: Introduction to quantum computing, classical computing vs quantum computing, qubits and quantum states, superposition and entanglement (basic concepts), quantum gates and quantum circuits (introductory idea), quantum parallelism (basic concept), applications of quantum computing in cryptography, optimization, and drug discovery, challenges and limitations of quantum computing,	CO6

future scope of quantum technologies.	

References:

- Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Pearson Education.
- Cloud Computing, Rajkumar Buyya, James Broberg and Andrzej Goscinski, Wiley India.
- Internet of Things: A Hands-On Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press.
- Cryptography and Network Security, William Stallings, Pearson Education.
- Blockchain Basics, Daniel Drescher, Apress.
- Learning Virtual Reality, Tony Parisi, O'Reilly Media.
- Quantum Computing for Everyone, Chris Bernhardt, MIT Press.

3rd Semester	AGCS 25306: OBJECT ORIENTED PROGRAMMING USING C++ LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement C++ programs using classes, constructors, destructors, and dynamic memory.
CO2	Develop applications using inheritance and operator overloading.
CO3	Implement runtime polymorphism using virtual and abstract classes.
CO4	Apply templates and STL for generic programming.
CO5	Develop applications using file handling, exception handling, and modern C++ features.
CO6	Create a mini project integrating OOPS, STL and file handling.

Content	**CO**
Classes and objects, access specifiers, constructors, destructors, copy constructors, dynamic memory allocation, and use of pointers with objects.	CO1
Single, multilevel, and multiple inheritance, constructor invocation in inheritance hierarchies, and operator overloading for unary and binary operators.	CO2
Function overriding, virtual functions, runtime polymorphism, pure virtual functions, and abstract classes.	CO3
Function templates, class templates, Standard Template Library (STL) containers, iterators, algorithms, and lambda expressions.	CO4
Text and binary file handling, exception handling, smart pointers, namespaces, and selected modern C++ features like multithreading, lambda expressions etc.	CO5
Design and development of a mini project involving problem analysis, software design, implementation, testing, debugging, and documentation by integrating concepts covered in CO-1 to CO-5.	CO6

3rd Semester	AGCS 25307: DATA STRUCTURES LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement basic operations for data organization and manipulation using programming constructs.
CO2	Apply searching and sorting techniques to solve computational problems efficiently.
CO3	Implement dynamic data handling techniques using linked lists for efficient storage and retrieval.
CO4	Analyze and implement stack and queue operations for efficient data processing and problem-solving.
CO5	Implement and analyze tree traversal techniques for hierarchical data processing.
CO6	Implement graph traversal techniques for solving computational problems.

Content	**CO**
• Development of menu-driven programs for performing insertion (at end and at specific position), deletion (by value and by position), and display operations on arrays. • Implementation of sparse matrices.	CO1
• Implementation of Searching Techniques: Linear Search, Binary Search • Implementation of Sorting Techniques: Bubble Sort, Selection Sort, Insertion Sort, Bucket Sort, Counting Sort	CO2
• Implementation of singly linked lists with insertion (at beginning, after a given node, and in a sorted linked list), deletion, searching, and display operations. • Implementation of insertion, deletion, and display operations in doubly linked lists. • Implementation of insertion, deletion, and display operations in circular linked lists.	CO3
• Implementation of push and pop operations using arrays and linked list. • Conversion of arithmetic expressions from infix notation to postfix notation and evaluation of postfix expressions using stacks. • Implementation of recursion-based programs. • Implementation of Insert and Delete operations in Queues using arrays and linked list. • Implementation of Priority Queue.	CO4
• Implementation of preorder, inorder, and postorder traversals in binary search trees.	CO5
• Implementation of Breadth First Search (BFS) and Depth First Search (DFS) traversal techniques for graphs.	CO6

3rd Semester	AGCS 25308: ARTIFICIAL INTELLIGENCE TOOLS AND APPLICATIONS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Demonstrate the concepts, capabilities, limitations, and ethical use of AI tools in computing applications.
CO2	Apply prompt engineering techniques for generating structured outputs.
CO3	Apply AI-assisted tools for programming and collaborative development.
CO4	Explore and analyze datasets using AI-assisted data exploration techniques.
CO5	Apply multimodal AI tools for content generation and transformation.
CO6	Design AI-based solutions for real-world applications using modern AI tools.

Content	CO
Introduction to AI Tools: Concept of AI tools and their applications in modern computing. Using AI tools for text, image, and conversational tasks. Applications of AI tools such as ChatGPT, Google Gemini, and Claude for text generation, coding assistance, image generation, and basic data analysis. Understanding capabilities and limitations of AI tools. Ethical and responsible use of AI-generated content, along with data privacy and security considerations.	CO1
Prompt Engineering Fundamentals: Basics of prompt engineering and components of effective prompts. Zero-shot prompting, few-shot prompting, and role-based prompting. Techniques for prompt refinement and optimization. Applications of prompt engineering in generating study notes, code explanations, and structured outputs.	CO2
Code Assistants: Understanding GitHub for version control, storing, sharing, collaboration, and managing source code and software projects using repositories and workflows. Use of GitHub Copilot for code generation, debugging assistance. AI-assisted debugging and improvement of code quality.	CO3
Data exploration: Understanding datasets and data formats such as CSV, JSON, XML, and Excel (XLS/XLSX). Exploring, filtering, and summarizing datasets using AI tools like ChatGPT and Google Gemini. Working with real-world datasets from repositories such as UCI Machine Learning Repository and Kaggle.	CO4
Generative AI Tools: Creating presentations, Speech-to-text, Text-to-speech, Text-to-image and Text-to-video generation. Suggested tools- Gamma AI, Microsoft Copilot, Wispr Flow, ElevenLabs, Speechify, Amazon Polly, Sora, Pika Labs, and HeyGen.	CO5
Integrated AI Application: Resume and LinkedIn profile building using AI-assisted tools such as ChatGPT, Google Gemini, Claude, Microsoft Copilot, and Canva.	CO6

Note: The AI tools mentioned in this syllabus **(AGCS-25308)** are suggestive in nature. Equivalent or related AI tools/platforms may also be used for demonstrating and performing the prescribed activities and concepts. Open-source technologies to be opted preferably.

3rd Semester	AGCS 25309: PROBLEM SOLVING USING PYTHON LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Develop Python programs using control statements, strings, and built-in functions.
CO2	Implement modular programs using functions, recursion, modules, and packages.
CO3	Analyze and manipulate data using Python data structures and comprehensions.
CO4	Design object-oriented Python programs with exception and file handling.
CO5	Develop data-centric applications using CSV/JSON, databases, and visualization libraries.
CO6	Create an end-to-end Python application integrating concepts from CO-1 to CO-5.

Content	CO
Python programming environment, program structure, variables, data types, operators, formatted input/output, string handling, built-in functions, conditional statements, iterative constructs, and basic problem-solving programs.	CO1
User-defined functions, parameter passing, return values, recursion, lambda expressions, modules, packages, and standard libraries including math, random, os, and sys.	CO2
Lists, tuples, sets, dictionaries, collections, slicing, sorting, searching, and list and dictionary comprehensions.	CO3
Classes, objects, constructors, inheritance, polymorphism, exception handling, text and binary file processing, and directory operations.	CO4
CSV and JSON processing, database connectivity, introductory NumPy and Pandas, and data visualization using Matplotlib.	CO5
Design and development of a mini project/small applications involving problem analysis, software design, implementation, testing, debugging, and documentation by integrating concepts covered in CO-1 to CO-5.	CO6

3rd Semester	AGMC 25001: INDIAN CONSTITUTION				
Internal Marks:	-		**L**	**T**	**P**
			1	**0**	**0**
Total Marks:	-		**Credits**		**0**

Content
• Historical perspective of the Constitution of India. • Salient features and characteristics of the Constitution of India. • Scheme of the fundamental rights. • The scheme of the Fundamental Duties and its legal status. • The Directive Principles of State Policy – Its importance and implementation. • Federal structure and distribution of legislative and financial powers between theUnion and the States. • Parliamentary Form of Government in India – The constitution powers and status ofthe President of India. • Amendment of the Constitutional Powers and Procedure. • The historical perspectives of the constitutional amendments in India. • Emergency Provisions: National Emergency, President Rule, Financial Emergency. • Local Self Government – Constitutional Scheme in India. • Scheme of the Fundamental Right to Equality. • Scheme of the Fundamental Right to certain Freedom under Article 19. • Scope of the Right to Life and Personal Liberty under Article 21

AMRITSAR GROUP OF COLLEGES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

B. Tech. (CoE): 4th SEM

4th Semester	AGCS 25401: DISCRETE MATHEMATICS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain sets, relations, and functions and their properties.
CO2	Apply logical reasoning and proof techniques to solve problems.
CO3	Apply combinatorial techniques and recurrence relations in problem solving.
CO4	Analyze graphs and trees using traversal and structural properties.
CO5	Apply Boolean algebra and number theory concepts in computing problems.
CO6	Evaluate algebraic structures and their applications in computing.

Content	CO
Sets, Relations and Functions: Introduction, proofs of general identities of sets, basic operations on sets, cartesian products, disjoint union, power sets, De Morgan's laws (including for difference of sets), relations: types and operations on relations, properties of relations, equivalence relations, partial order relations and Hasse diagrams, functions: types of functions (injective, surjective, bijective), composition and inverse of functions.	CO1
Propositional Logic and Predicate Logic: Syntax and semantics, logical equivalence, tautologies, contradiction, normal forms (CNF, DNF), rules of inference, proof system, validity and satisfiability, deduction theorem, mathematical induction, proof by contradiction, proof by contrapositive, introduction to predicate logic, quantifiers, decision problems of propositional logic.	CO2
Combinatorial Mathematics: Basic counting principles, permutations and combinations, inclusion-exclusion principle, pigeonhole principle, recurrence relations (substitution method, recurrence tree method, characteristic equation method), introduction to generating functions.	CO3
Graph Theory and Trees: Introduction, directed and undirected graphs, representation of graphs, subgraphs, paths, connected graphs, Euler and Hamiltonian graphs, planar graphs, graph colouring, isomorphism and homomorphism, graph traversal algorithms (BFS and DFS), trees, properties of trees, spanning trees, minimum spanning tree, Kruskal's algorithm.	CO4
Boolean Algebra and Number Theory (with Computing Applications): Boolean algebra, boolean expressions, laws of boolean algebra, simplification techniques, logic gates, divisibility, prime numbers, greatest common divisor (GCD), Euclidean algorithm, modular arithmetic, congruence relations, basic application in computing such as cryptography.	CO5
Algebraic Structures (Introductory): Semigroups, monoids and groups, integer modulo m, order of group, abelian group, applications in computing such as modular arithmetic and basic coding theory concepts.	CO6

References:

- Discrete Structures, Satinder Bal Gupta and C. P. Gandhi.
- Discrete Structures, S. B. Singh, Jai Kishore, Ekata.
- Discrete Mathematical Structures, Dr. D. S. Chandrasekharaiah.
- Discrete Mathematics: An Open Introduction, Oscar Levin.
- Mathematics of Discrete Structures for Computer Science, Gordon J. Pace.

4th Semester	AGCS 25402: DESIGN AND ANALYSIS OF ALGORITHMS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Apply asymptotic notations and recurrence relation methods (substitution, recursion tree, Master Theorem) to determine the time complexity of algorithms.
CO2	Apply divide & conquer and dynamic programming techniques to solve problems such as sorting, matrix chain multiplication, longest common subsequence, and knapsack.
CO3	Analyze the efficiency and correctness of different algorithmic strategies and compare their performance for solving the same problem.
CO4	Analyze graph-based algorithms including minimum spanning trees and shortest path algorithms using Greedy techniques.
CO5	Evaluate and justify the use of appropriate problem-solving techniques such as Greedy, backtracking, and Branch & Bound for given computational problems.
CO6	Evaluate computational complexity of problems and classify them into P, NP, NP-Hard, and NP-Complete using reduction techniques.

Content	CO
Introduction: Basics of algorithms, time and space complexity of an algorithm, comparison of performance of different algorithms for the same problem, asymptotic notations and order of growth. Methods for analysis of recurrence relations- substitution method, recurrence tree method, and Master Theorem.	CO1
Divide & Conquer: General method, applications including Binary Search, Merge Sort, Quick Sort, Randomized Quick Sort, Heap Sort, analysis of their running times.	CO2
Dynamic programming: General Method and applications including Matrix Chain Multiplication, Longest Common Subsequence, 0/1 Knapsack Problem, Travelling Salesman Problem, and Floyd–Warshall Algorithm	CO3
Greedy Strategy: General Method and applications including Fractional Knapsack, Minimum Spanning Trees using Kruskal's and Prim's Algorithms, Topological Sorting, and Single-Source Shortest Path Algorithms in Graphs- Dijkstra and Bellman–Ford Algorithms.	CO4
Backtracking: General approach, applications including 0/1 Knapsack Problem, N-Queens Problem, and Graph Coloring Problem. **Branch & Bound**: General method, Travelling Salesman Problem, Knapsack Problem, and Job Assignment Problem.	CO5
Pattern matching algorithms: Naive string matcher, Knuth-Morris-Pratt algorithm, Rabin Karp algorithm **NP-Completeness:** Definition of class NP, NP-hard and NP-complete problems, proving a problem to be NP-complete using polynomial-time reductions, examples of NP complete problems: 3SAT, vertex cover problem, clique problem, Cooks Theorem	CO6

References:

- Introduction to Algorithms, 2nd Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, The MIT Press, Cambridge; McGraw-Hill Book Company.
- Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, Silicon Press, 2008.
- The Design and Analysis of Algorithms, Nitin Upadhyay, S. K. Kataria & Sons, 2008.
- The Design and Analysis of Algorithms, 3rd Edition, Gajendra Sharma, Khanna Book Publishing Company, Delhi.
- Algorithms, Robert Sedgewick and Kevin Wayne, Addison-Wesley Professional.

4th Semester	AGCS 25403: RELATIONAL DATABASE MANAGEMENT SYSTEM				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**1**	**0**
Total Marks:	**100**		**Credits**		**4**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain DBMS architecture, relational concepts, and SQL for database operations.
CO2	Apply SQL functions and PL/SQL constructs for procedural database programming.
CO3	Design ER models and convert them into relational schemas.
CO4	Analyze functional dependencies and apply normalization techniques.
CO5	Analyze transaction processing and concurrency control mechanisms.
CO6	Evaluate NoSQL databases, indexing, and query optimization techniques.

Content	CO
Introduction to Database Systems: Database systems and DBMS concepts, file system versus DBMS, components of DBMS, advantages and limitations of DBMS, data abstraction and three-level architecture, physical and logical data independence, overview of relational database systems, SQL fundamentals- SQL as DDL, DML and DCL, SQL data types. Database objects- tables and views. DDL commands- CREATE, ALTER, DROP. DML Commands: INSERT, UPDATE, DELETE. DCL commands- GRANT, REVOKE, roles and privileges. Integrity constraints- Primary key, foreign key, UNIQUE, NOT NULL, CHECK, DEFAULT, naming constraints. SQL querying- SELECT statement, WHERE, ORDER BY, GROUP BY, HAVING.	CO1
SQL Functions and Queries: Numeric functions, character functions, date functions, aggregate functions, single-row and multi-row subqueries, SQL joins- Inner join, Outer join, Self join, PL/SQL programming- Introduction and advantages of PL/SQL, structure of PL/SQL block, data types and variables, SELECT INTO statement. Control statements- IF, CASE, LOOP, WHILE, FOR. Cursors- implicit cursors, explicit cursors, parameterized cursors, cursor FOR loop. Exception handling- Predefined exceptions, user-defined exceptions. Database program units: Procedures and functions, IN, OUT and IN OUT parameters, packages, triggers and their applications.	CO2
Data Models: Relational data model, overview of hierarchical and network models, DBMS versus RDBMS, Entity relationship modelling: Entities and attributes, relationships and constraints, strong and weak entities, ER diagrams and symbols, cardinality and participation constraints. Relational Database Design- ER to relational model conversion, schema design concepts, introduction to database design methodologies.	CO3
Database Keys: Primary key, foreign key, candidate key, super key, alternate key. Functional dependency- Concept and types of dependencies, full, partial and transitive dependency. Normalization- Need for normalization, First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF),Boyce-Codd Normal Form (BCNF), multivalued dependency, denormalization.	CO4
Transaction Management: Transactions and operations, ACID properties, transaction states, concurrent transactions. Schedules and Serializability- Serial and non-serial schedules, serializable schedules, conflict serializability. Concurrency Problems- Lost update problem, dirty read problem, inconsistent retrieval problem. Concurrency Control Techniques- Lock-based protocols, shared and exclusive locks, two-phase locking protocol.	CO5
Introduction to NoSQL: Need for NoSQL databases, RDBMS versus NoSQL databases, types of NoSQL Databases- Key-value stores, document databases, Column-family databases, graph databases. MongoDB Fundamentals- Collections and documents, CRUD operations, JSON/BSON concepts,	CO6

MongoDB atlas overview. Query processing and optimization: query processing overview, query execution plans, query optimization techniques, cost-based optimization, performance tuning basics.	

References:

- Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, McGraw Hill.
- Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education.
- Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw Hill.
- C. J. Date, An Introduction to Database Systems, Pearson Education.
- Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publications.

4th Semester	AGCS 25404: OPERATING SYSTEMS			
Internal Marks:	**40**	**L**	**T**	**P**
External Marks:	**60**	**3**	**0**	**0**
Total Marks:	**100**	**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain basic operating system concepts, structures, and services.
CO2	Apply process scheduling and inter-process communication techniques.
CO3	Analyze synchronization mechanisms and deadlock handling methods.
CO4	Analyze memory management and page replacement techniques.
CO5	Apply file system and storage management concepts.
CO6	Evaluate security and protection mechanisms in operating systems.

Content	CO
Introduction to Operating Systems: Definition and functions of operating system, user view and system view of OS. Types of operating systems- Batch, time-sharing, real-time, distributed, mobile. Computer system architecture- Single processor, multiprocessor, clustered systems. Operating system operations- multiprogramming, multitasking, dual mode and multimode operations, resource management and OS services. System calls- Concept and types. operating system structures- monolithic, layered, microkernel. Introduction to virtualization and virtual machines	CO1
Processes and CPU Scheduling: Process concept and process states, Process Control Block (PCB) , threads and multithreading (user-level and kernel-level threads), operations on processes. Inter-Process Communication (IPC)- Independent and cooperative Processes. CPU scheduling concepts and criteria, Types of schedulers- Long-term, Short-term, Medium-term. Scheduling algorithms: FCFS, SJF (Preemptive & Non-preemptive), priority scheduling, round robin, context switching, real-time scheduling(introduction).	CO2
Process Synchronization: Principle of concurrency, critical section problem, Peterson's solution. Synchronization tools- Mutex locks, semaphores. Classical problems of synchronization- producer-consumer, readers-writers. **Deadlocks: S**ystem model and characterization, methods of handling deadlocks, deadlock prevention and avoidance (Banker's algorithm), deadlock detection and recovery.	CO3
Memory Management: Memory management concepts and memory hierarchy, logical and physical address space, address binding, contiguous and non-contiguous memory allocation, fragmentation and compaction. Paging- Concept, hardware support, protection and sharing, segmentation, Translation Lookaside Buffer (TLB). Virtual memory and demand paging. Page replacement algorithms- FIFO, Optimal, LRU. Allocation of frames and thrashing, introduction to copy-on-write	CO4
Storage Management and File Systems: Mass storage structure overview. Disk scheduling algorithms: FCFS, SSTF, SCAN, C-SCAN. Device management concepts, RAID structure (basic idea), HDD vs SSD (conceptual comparison). File concept and access methods, directory structure, file system structure. File allocation methods- Contiguous, Linked, Indexed. Free space management. Overview of Linux file system	CO5
Security and Protection: Security Problems in operating systems, Program threats- Malware (Trojan horse, spyware, ransomware, logic bomb, trapdoor). System threats- Viruses, worms, denial of service attacks. Authentication mechanisms- Passwords, one-time passwords, multi-factor authentication, Protection mechanisms- Goals and principles of protection, domain of protection, access matrix, capability lists	CO6

References:

- Operating System Concepts, A Silberschatz, Peter B. Galvin and G. Gagne. Wiley.
- Systems Programming & Operating Systems, Dhamdhere, Tata McGraw Hill.
- Operating Systems Concepts, Gary Nutt, Pearson.
- Operating Systems by Madnick Donovan, Tata McGraw Hill. Strength of Materials by Gere, Cengage Learning.
- Modern Operating System by Andrew S. Tanenbaum, Pearson.

4th Semester	AGCS 25405: COMPUTER NETWORKS				
Internal Marks:	**40**		**L**	**T**	**P**
External Marks:	**60**		**3**	**0**	**0**
Total Marks:	**100**		**Credits**		**3**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain concepts of data communication, network topologies, transmission modes, and layered network architectures.
CO2	Apply physical layer concepts and transmission media characteristics in data communication.
CO3	Apply error detection, flow control, and medium access protocols for reliable data transmission.
CO4	Analyze routing, addressing, and congestion control mechanisms in computer networks.
CO5	Analyze transport and session layer protocols for communication management.
CO6	Evaluate presentation layer services, application layer protocols, and network security techniques for secure communication.

Content	CO
Introduction to Computer Networks: Data communication system and its components, protocols and standards, line configuration, topologies (mesh, star, tree, bus, ring and hybrid). **Transmission Mode:** Simplex and duplex, categories of computer networks: LAN, MAN, WAN, wireless and wired networks, broadcast and point to point networks. **Network Software:** Concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP protocol suite.	CO1
Physical Layer: Concept of analog & digital signal, frequency spectrum and bandwidth, bit interval bit rate and baud rate, sampling, Nyquist formula, Shannon formula. **Transmission Media and Impairments:** Twisted pair, coaxial cable, fiber optics, wireless transmission (radio, microwave, infrared), attenuation, distortion, noise.	CO2
Data Link Layer: Design issues, framing, checksum, error detection and correction codes (VRC, LRC, and CRC, hamming code). **Flow Control and Error Control:** Stop and wait, sliding window protocol, ARQ, Stop & Wait ARQ, Go-back-N ARQ, selective repeat ARQ. **Data link protocols and Medium Access Sub-Layer:** HDLC and PPP, static and dynamic channel allocation. **Random Access:** ALOHA, CSMA protocols, controlled access, polling, token passing, IEEE 802.3 frame format, Ethernet cabling, collision detection in IEEE 802.3, binary exponential backoff algorithm, token bus, token ring.	CO3
Switching: Circuit switching, message switching, packet switching & their comparisons. **Network Layer:** Design issues, network and internetworking devices, repeaters, bridges, routers and gateways. **Routing Algorithms and Congestion Control:** Distance vector and link state routing, IPv4 classful and classless addressing, ARP, RARP, ICMP, IGMP, BGP, subnetting, principles of congestion control, congestion prevention policies, leaky bucket and token bucket algorithms.	CO4
Transport Layer: Duties of transport layer, introduction to TCP/UDP protocols and their comparison.	CO5

Session Layer: Session and transport layer interaction, synchronization points, session protocol data unit.	
Presentation Layer: Translation, encryption and decryption techniques, authentication, data compression. **Application Layer:** WWW, DNS, E-mail, Protocols-FTP, SMTP, TFTP, TELNET, DHCP, HTTP, HTTPS. **Network Security:** Introduction to network security, goals, common network threats-malware, phishing, spoofing, secure communication protocols overview, firewalls.	CO6

References:

- Computer Networks, Andrew S. Tanenbaum, Pearson Education.
- Data Communication & Networking, Behrouz A. Forouzan, Tata McGraw Hill.
- Computer Networking, James F. Kurose and Keith W. Ross, Pearson Education.
- Data and Computer Communications, William Stallings, Pearson Education.
- Computer Networks and Internets, Douglas E. Comer, Pearson Education.

4th Semester	AGCS 25406: DESIGN AND ANALYSIS OF ALGORITHMS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement searching techniques such as Linear Search and Binary Search to locate elements and analyze their operational efficiency.
CO2	Develop sorting algorithms including Merge Sort, Quick Sort, and Heap Sort for arranging data efficiently.
CO3	Analyze dynamic programming approaches to solve optimization problems such as Matrix Chain Multiplication, Longest Common Subsequence, and 0/1 Knapsack Problem.
CO4	Examine graph-based algorithms including Kruskal's, Prim's, and Dijkstra's algorithms for solving spanning tree and shortest path problems.
CO5	Evaluate backtracking and branch & bound techniques for solving complex combinatorial problems such as N-Queens, Graph Coloring, and Travelling Salesman Problem.
CO6	Assess the efficiency and suitability of string-matching algorithms including Naive String Matching, KMP, and Rabin-Karp for pattern searching applications.

Content	**CO**
• Write a program to implement Linear Search for finding an element in an array and count the number of comparisons performed. • Write a program to implement Binary Search using recursive method and analyze its efficiency.	CO1
• Write a program to sort a list of elements using Merge Sort technique. • Write a program to implement Quick Sort using suitable pivot selection. • Write a program to implement Heap Sort using Max Heap.	CO2
• Write a program to determine the optimal order of matrix multiplication using Dynamic Programming. • Write a program to find the Longest Common Subsequence between two strings. • Write a program to solve the 0/1 Knapsack Problem using Dynamic Programming.	CO3
• Write a program to construct the Minimum Spanning Tree using Kruskal's Algorithm. • Write a program to construct the Minimum Spanning Tree using Prim's Algorithm. • Write a program to find shortest paths from a source vertex using Dijkstra Algorithm.	CO4
• Write a program to solve the N-Queens problem using Backtracking. • Write a program to solve the Graph Coloring problem using Backtracking. • Write a program to solve Travelling Salesman Problem using Branch and Bound technique.	CO5
• Write a program to perform pattern matching using Naive String-Matching Algorithm. • Write a program to perform pattern matching using KMP Algorithm. • Write a program to perform pattern matching using Rabin-Karp Algorithm.	CO6

4th Semester	AGCS 25407: RELATIONAL DATABASE MANAGEMENT SYSTEM LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement SQL commands and integrity constraints for database operations.
CO2	Apply SQL functions, joins, subqueries, and views for data retrieval.
CO3	Implement PL/SQL programs using control structures, cursors, and exception handling.
CO4	Develop procedures, functions, packages, and triggers.
CO5	Analyze MongoDB operations and NoSQL concepts.
CO6	Create a database application using SQL, PL/SQL, and MongoDB.

Content	CO
Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL), Transaction Control Language (TCL), and integrity constraints including primary key, foreign key, unique, check, and not null.	CO1
SQL functions, joins, nested queries, subqueries, set operators, grouping, aggregate functions, and views for data retrieval and analysis.	CO2
PL/SQL blocks, variables, control structures, cursors, records and exception handling mechanisms.	CO3
Stored procedures and functions, packages, and database triggers for implementing reusable and automated database operations.	CO4
Introduction to NoSQL databases, MongoDB installation and configuration, databases and collections, document model, and CRUD operations.	CO5
Design and development of a mini database application involving schema design, query development, procedural programming, testing, and documentation by integrating concepts covered in CO-1 to CO-5.	CO6

4th Semester	AGCS 25408: OPERATING SYSTEMS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Explain operating system installation, virtualization, and Linux/Unix environment concepts.
CO2	Apply Linux commands, file management, and shell scripting techniques.
CO3	Implement process creation and CPU scheduling algorithms using system calls.
CO4	Analyze synchronization problems using semaphores and related techniques.
CO5	Analyze deadlock handling and memory allocation techniques.
CO6	Evaluate page replacement algorithms for efficient memory management.

Content	CO
• Installation of operating system Windows/Linux • Concept of virtualization, installation of virtual machine software and installation of operating system on virtual machine.	CO1
• Study of Linux/Unix operating system environment and basic commands. • Practice of file, directory management commands and implementation of file permissions and user management commands. • Shell scripting programs using decision making and looping statements.	CO2
• Write programs to demonstrate process creation using fork(), exec(), and wait(). • Implement CPU scheduling algorithms: ➢ FCFS ➢ SJF ➢ Priority Scheduling ➢ Round Robin	CO3
• Implement Producer-Consumer problem and Reader-Writer problem using semaphores	CO4
• Implement Banker's Algorithm for deadlock avoidance. • Implement memory allocation techniques: ➢ First Fit ➢ Best Fit ➢ Worst Fit	CO5
• Implement page replacement algorithms: ➢ FIFO ➢ LRU ➢ Optimal	CO6

4th Semester	AGCS 25409: COMPUTER NETWORKS LAB				
Internal Marks:	**50**		**L**	**T**	**P**
			0	**0**	**2**
Total Marks:	**50**		**Credits**		**1**

Course Outcomes: After studying the course, students will be able to:	
CO1	Configure networking devices, IP addressing, subnet masks, and transmission media to establish communication between computer systems.
CO2	Analyze network topologies, transmission media characteristics, and packet flow behavior using network analysis tools.
CO3	Evaluate the effectiveness of error detection and correction techniques such as CRC and Hamming Code for reliable data communication.
CO4	Implement network utility commands and resource-sharing techniques to verify connectivity and communication in a network environment.
CO5	Examine and interpret protocol headers, routing paths, and network traffic using tools such as Wireshark and networking utilities.
CO6	Assess network security mechanisms, firewall configurations, and client-server communication performance for secure and efficient networking operations.

Content	CO
• Familiarization with networking components and devices: LAN adapters, hubs, switches, routers.	CO1
• Study twisted pair cable, coaxial cable, fiber optic cable transmission media with their characteristics and applications. • Co-axial cable, UTP cable, crimping tool, connectors etc. • Preparing straight and cross cables. • Connect networking devices using suitable transmission media and verify successful data communication between systems.	CO2
• Write a program to implement Cyclic Redundancy Check (CRC) technique for error detection in data. • Write a program to generate and detect errors using Hamming Code.	CO3
• Configure IP address, subnet mask, and default gateway on a system using network configuration commands. • Use networking commands such as `ping`, `ipconfig/ifconfig`, `racert/traceroute`, and `netstat` to analyze network connectivity and status. • Implementation of file and printer sharing.	CO4
• Subnet planning and its implementation. • Generating IP address range using subnet mask calculator and using WHOIS domain tools. • Write a program for TCP-based client-server communication using socket programming.	CO5
• Study the working and packet flow of HTTP, FTP, SMTP, and DNS protocols using network analyzer tools. • Capture and analyze network packets using Wireshark and identify different protocol headers • Configure firewall settings and study network security mechanisms for secure communication	CO6

4th Semester	AGMC 25002: ESSENCE OF INDIAN KNOWLEDGE TRADITION				
Internal Marks:	-		L	T	P
			1	0	0
Total Marks:	-		Credits		0

Content
INTRODUCTION TO TRADITIONAL KNOWLEDGE: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physicaland social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge **PROTECTION OF TRADITIONAL KNOWLEDGE:** Protection of traditional knowledge:The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK. **LEGAL FRAMEWORK AND TK:** The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indicators act 2003. **TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY:** Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge. **TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS:** Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Foodsecurity of the country and protection of TK. 139.

Annexure - 4

AMRITSAR GROUP OF COLLEGES NAAC Grade "A" 3rd Cycle | Autonomous College	**Offering online courses through Swayam – NPTEL to B.Tech Computer Science and Engineering**	**Department of Computer Science and Engineering**

Semester: 3rd								
Course code	**Course Name**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Credit**
		L	**T**	**P**	**Internal**	**External**		
AGCS-25301	Probability and Statistics	3	1		40	60	100	4
AGCS-25302	Object Oriented Programming using C++	3			40	60	100	3
AGCS-25303	Data Structures	3	1		40	60	100	4
AGCS-25304	**Computer Organization and Architecture***	3			40	60	100	3
AGCS-25305	Emerging Trends in Computer Science	3			40	60	100	3
AGCS-25306	Object Oriented Programming using C++ Lab			2	50		50	1
AGCS-25307	Data Structures Lab			2	50		50	1
AGCS-25308	Artificial Intelligence Tools and Applications Lab			2	50		50	1
AGCS-25309	Problem Solving using Python Lab			2	50		50	1
AGMC-25001	Indian Constitution	1						0
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		18	**2**	**8**				
		Contact Hours = 28 Hrs			**400**	**300**	**700**	**23**

* AGCS-25305 (Computer Organization and Architecture) shall be offered in online mode through Swayam – NPTEL platform during the session Jul-Dec,2026.

The details of the course opted for under AGCS-21304 (Computer Organization and Architecture) is as follows:

	AGCS-21304 Computer Organization and Architecture
Title	Computer Architecture
SME	Prof. Smruti Ranjan Sarangi
Institute	IIT Delhi

Semester: 5th								
Course code	**Course Name**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Credit**
		L	**T**	**P**	**Internal**	**External**		
AGCS - 21501	Design and Analysis of Algorithms	3	1	-	40	60	100	4
AGCS - 21502	**Software Engineering***	3	1	-	40	60	100	4
AGCS - 21503	Programming in Java	3	-	-	40	60	100	3
AGCS - 21504X	**Professional Elective Course-1 (PEC-1)***	3	1	-	40	60	100	4
AGCS - 21505	Artificial Intelligence	3	-	-	40	60	100	3
AGCS - 21506	Design and Analysis of Algorithms Lab	-	-	2	30	20	50	1
AGCS - 21507	Software Engineering Lab	-	-	2	30	20	50	1
AGCS - 21508	Programming in Java Lab	-	-	2	30	20	50	1
AGCS - 21509	Artificial Intelligence Lab	-	-	2	30	20	50	1
AGAP - 21502	Engineering Aptitude - II	-	1	-	50		50	1
AGCS - 21510	Summer Training	-	-	-	60	40	100	1
		15	**4**	**8**	**430**	**420**	**850**	**24**
		Contact Hours = 27 hrs						

* AGCS-21502 (Software Engineering) and AGCS-21504A (Professional Elective Course-1) shall be offered in online mode through Swayam – NPTEL platform during the session Jul-Dec,2026

The details of the courses opted for under AGCS-21502 (Software Engineering) and AGCS-21504A (Professional Elective Course-1) are as follows:

X	**PEC-1**
A	**Theory of Computations***
B	Compiler Design
C	Soft Computing
D	Distributed Systems

	AGCS-21502 Software Engineering	**AGCS-21504A Theory of Computations**
Title	Software Engineering	Theory of Computation
SME	Prof. Rajib Mall	Prof. Raghunath Tewari
Institute	IIT Kharagpur	IIT Kanpur

Semester: 7th								
Course code	**Course Name**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Credit**
		L	**T**	**P**	**Internal**	**External**		
AGCS - 21701	Data Science	3	1	-	40	60	100	4
AGCS - 21702X	**Professional Elective Course-3 (PEC-3)***	**3**	**-**	**-**	**40**	**60**	**100**	**3**
AGCS - 21702Y	**Professional Elective Course-4 (PEC-4)***	**3**	**-**	**-**	**40**	**60**	**100**	**3**
AGOE	Open Elective	3	-	-	40	60	100	3
AGCS - 21703	Data Science Lab	-	-	2	30	20	50	1
AGCS - 21704	Major Project Lab	-	-	4	60	40	100	2
		12	**1**	**6**	**250**	**300**	**550**	**16**
		Contact Hours = 19 hrs						

X	PEC-3	Y	PEC-4
#A	**Software Testing**	**#F**	**Introduction to Internet of Things**
#B	**Deep Learning**	**#G**	**Social Network Analysis**
#C	**Computer Vision**	**#H**	**Reinforcement Learning**
D	Advanced Computer Networks	**I**	Object Oriented Analysis and Design using UML
E	Business Intelligence and Analytics	**J**	Foundations of Cryptography
		K	Natural Language Processing

* AGCS-21702X (Professional Elective Course-3) and AGCS-21702Y (Professional Elective Course-4) shall be offered in online mode through Swayam – NPTEL platform during the session Jan,2025-Jun,2025.

#The details of the course opted for under AGCS-21702X (Professional Elective Course-3) and AGCS-21702Y (Professional Elective Course-4) are as follows:

	AGCS-21702A Software Testing	**AGCS-21702B Deep Learning**	**AGCS-21702C Computer Vision**
Title	Software Testing	Deep Learning - IIT Ropar	Computer Vision
SME	Prof. Meenakshi D'souza	Prof. Sudarshan Iyengar	Prof. Jayanta Mukhopadhyay
Institute	IIIT Bangalore	IIT Ropar	IIT Kharagpur

	AGCS-21702F Introduction to Internet of Things	**AGCS-21702G Social Network Analysis**	**AGCS-21702H Reinforcement Learning**
Title	Introduction to Internet of Things	Social Network Analysis	Reinforcement Learning
SME	Prof. Sudip Misra	Prof. Tanmoy Chakraborty	Prof. Balaraman Ravindran
Institute	IIT Kharagpur	IIT Delhi	IIT Madras

AMRITSAR GROUP OF COLLEGES NAAC Grade "A" 3rd Cycle | Autonomous College	**Offering online courses through Swayam – NPTEL to B.Tech Computer Engineering**	**Department of Computer Science and Engineering**

Semester: 3rd								
Course code	**Course Name**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Credit**
		L	**T**	**P**	**Internal**	**External**		
AGCS-25301	Probability and Statistics	3	1		40	60	100	4
AGCS-25302	Object Oriented Programming using C++	3			40	60	100	3
AGCS-25303	Data Structures	3	1		40	60	100	4
AGCS-25304	**Computer Organization and Architecture***	3			40	60	100	3
AGCS-25305	Emerging Trends in Computer Science	3			40	60	100	3
AGCS-25306	Object Oriented Programming using C++ Lab			2	50		50	1
AGCS-25307	Data Structures Lab			2	50		50	1
AGCS-25308	Artificial Intelligence Tools and Applications Lab			2	50		50	1
AGCS-25309	Problem Solving using Python Lab			2	50		50	1
AGMC-25001	Indian Constitution	1						0
XXXX-xxxxx	Entrepreneurship Mindset Curriculum	2						2
		18	**2**	**8**				
		Contact Hours = 28 Hrs			**400**	**300**	**700**	**23**

* AGCS-25305 (Computer Organization and Architecture) shall be offered in online mode through Swayam – NPTEL platform during the session Jul-Dec,2026.

The details of the course opted for under AGCS-21304 (Computer Organization and Architecture) is as follows:

	AGCS-21304 Computer Organization and Architecture
Title	Computer Architecture
SME	Prof. Smruti Ranjan Sarangi
Institute	IIT Delhi

Semester: 5th								
Course code	**Course Name**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Credit**
		L	**T**	**P**	**Internal**	**External**		
AGCS - 21501	Design and Analysis of Algorithms	3	1	-	40	60	100	4
AGCS - 21502	**Software Engineering***	3	1	-	40	60	100	4
AGCS - 21503	Programming in Java	3	-	-	40	60	100	3
AGCoE - 21504X	**Professional Elective Course-1 (PEC-1)***	3	1	-	40	60	100	4
AGCS - 21505	Artificial Intelligence	3	-	-	40	60	100	3
AGCS - 21506	Design and Analysis of Algorithms Lab	-	-	2	30	20	50	1
AGCS - 21507	Software Engineering Lab	-	-	2	30	20	50	1
AGCS - 21508	Programming in Java Lab	-	-	2	30	20	50	1
AGCS - 21509	Artificial Intelligence Lab	-	-	2	30	20	50	1
AGAP - 21502	Engineering Aptitude - II	-	1	-	50		50	1
AGCS - 21510	Summer Training	-	-	-	60	40	100	1
		15	**4**	**8**	**430**	**420**	**850**	**24**
		Contact Hours = 27 hrs						

* AGCS-21502 (Software Engineering) and AGCoE-21504A (Professional Elective Course-1) shall be offered in online mode through Swayam – NPTEL platform during the session Jul-Dec,2026

The details of the courses opted for under AGCS-21502 (Software Engineering) and AGCS-21504A (Professional Elective Course-1) are as follows:

X	**PEC-1**
A	**Theory of Computations***
B	Compiler Design
C	Soft Computing
D	Distributed Systems

	AGCS-21502 Software Engineering	**AGCS-21504A Theory of Computations**
Title	Software Engineering	Theory of Computation
SME	Prof. Rajib Mall	Prof. Raghunath Tewari
Institute	IIT Kharagpur	IIT Kanpur

Semester: 7th								
Course code	**Course Name**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Credit**
		L	**T**	**P**	**Internal**	**External**		
AGCS - 21701	Data Science	3	1	-	40	60	100	4
AGCoE - 21702X	**Professional Elective Course-3 (PEC-3)***	**3**	**-**	**-**	**40**	**60**	**100**	**3**
AGCoE - 21702Y	**Professional Elective Course-4 (PEC-4)***	**3**	**-**	**-**	**40**	**60**	**100**	**3**
AGOE	Open Elective	3	-	-	40	60	100	3
AGCS - 21703	Data Science Lab	-	-	2	30	20	50	1
AGCoE - 21704	Major Project Lab	-	-	4	60	40	100	2
		12	**1**	**6**	**250**	**300**	**550**	**16**
		Contact Hours = 19 hrs						

X	PEC-3	Y	PEC-4
#A	**Software Testing**	**#F**	**Introduction to Internet of Things**
#B	**Deep Learning**	**#G**	**Social Network Analysis**
#C	**Computer Vision**	**#H**	**Reinforcement Learning**
D	Advanced Computer Networks	**I**	Object Oriented Analysis and Design using UML
E	Business Intelligence and Analytics	**J**	Foundations of Cryptography
		K	Natural Language Processing

* AGCoE-21702X (Professional Elective Course-3) and AGCoE-21702Y (Professional Elective Course-4) shall be offered in online mode through Swayam – NPTEL platform during the session Jan,2025-Jun,2025.

#The details of the course opted for under AGCS-21702X (Professional Elective Course-3) and AGCS-21702Y (Professional Elective Course-4) are as follows:

	AGCS-21702A Software Testing	**AGCS-21702B Deep Learning**	**AGCS-21702C Computer Vision**
Title	Software Testing	Deep Learning - IIT Ropar	Computer Vision
SME	Prof. Meenakshi D'souza	Prof. Sudarshan Iyengar	Prof. Jayanta Mukhopadhyay
Institute	IIIT Bangalore	IIT Ropar	IIT Kharagpur

	AGCS-21702F Introduction to Internet of Things	**AGCS-21702G Social Network Analysis**	**AGCS-21702H Reinforcement Learning**
Title	Introduction to Internet of Things	Social Network Analysis	Reinforcement Learning
SME	Prof. Sudip Misra	Prof. Tanmoy Chakraborty	Prof. Balaraman Ravindran
Institute	IIT Kharagpur	IIT Delhi	IIT Madras

Annexure-5

Allocation of M.Tech CSE Supervisor

S. No.	Univ. Roll No.	Student Name	Name of the Supervisor
1.	2412535	Anmolpreet Kaur	Er. Sanjeev Kumar
2.	2333986	Ramandeep Kaur	Er. Bhuvnesh Kumar
3.	2459400	Harpreet Kaur	Er. Pavitar Singh
4.	2412537	Harpal Singh	Dr. Sandeep Kad
5.	2412540	Khushi Sood	Dr. Sandeep Kad
6.	2412544	Sonampreet Kaur	Er. Neha
7.	2412534	Ameendeep Kaur Sandhu	Er. Ajay Sharma
8.	2412541	Nisha	Er. Neha
9.	2412542	Ranjodhbir Singh	Er. Tejinder Sharma

Annexure-6

Nov 2025 ESEs Result Analysis

B.Tech CSE-3rd Sem					
Subject	Mathematics and Statistics	Data Structures	Object Oriented Programming using C++	Computer Networks	Computer Architecture (NPTEL)
Pass %age	70	62	45	68	83

B.Tech CoE-3rd Sem					
Subject	Mathematics and Statistics	Data Structures	Object Oriented Programming using C++	Computer Networks	Computer Architecture (NPTEL)
Pass %age	45	46	23	61	71

B.Tech CSE-5th Sem					
Subject	Design and Analysis of Algorithms	Software Engineering (NPTEL)	Programming in Java	Theory of Computations (NPTEL)	Artificial Intelligence
Pass %age	89	90	33	85	45

B.Tech CoE-5th Sem					
Subject	Design and Analysis of Algorithms	Software Engineering (NPTEL)	Programming in Java	Theory of Computations (NPTEL)	Artificial Intelligence
Pass %age	51	70	30	60	23

B.Tech CSE-7th Sem				
Subject	Data Science	Management of Human Resource	Software Testing/ Deep Learning / Adv Computer Networks (NPTEL)	Internet of Things/ Social Network Analysis / Reinforcement Learning (NPTEL)
Pass %age	76	88	97	96

B.Tech AIML-7th Sem				
Subject	Data Science	Management of Human Resource	Software Testing/ Deep Learning / Adv Computer Networks (NPTEL)	Internet of Things/ Social Network Analysis / Reinforcement Learning (NPTEL)
Pass %age	67	80	100	100

M.Tech CSE		
Class/Sem	M.Tech CSE-1st Sem	M.Tech CSE-3rd Sem
Overall Pass %age	60	61

Other Agenda

1.

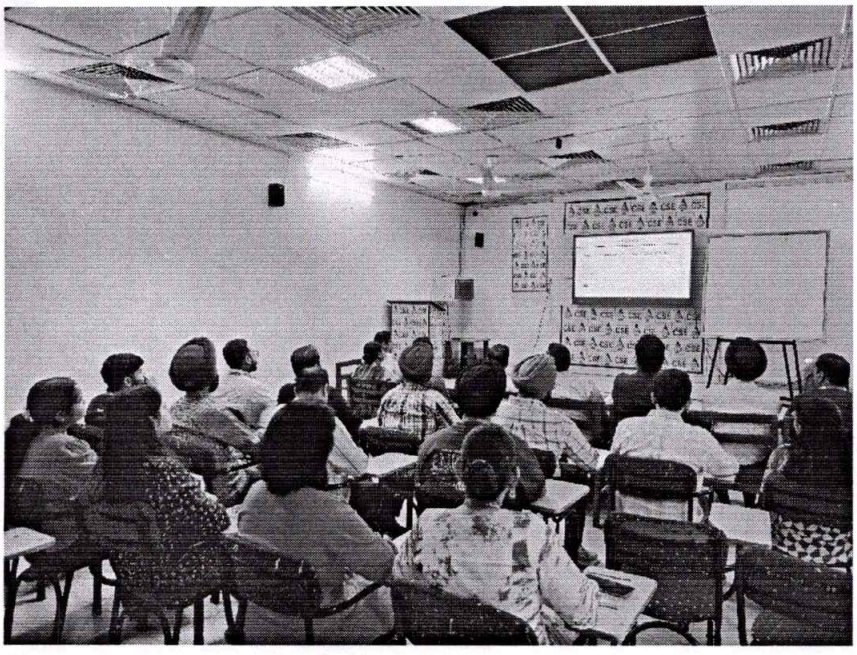
Synopsis presentation of M.Tech student Khushi Sood (Roll No. 2412540) was held on 05.05.2026 under the guidance of Dr. Sandeep Kad, Professor, DCSE. The title of the research work is **"An Improved U-Net-Based Deep Learning Model for Brain Tumor Segmentation Using MRI Images."**

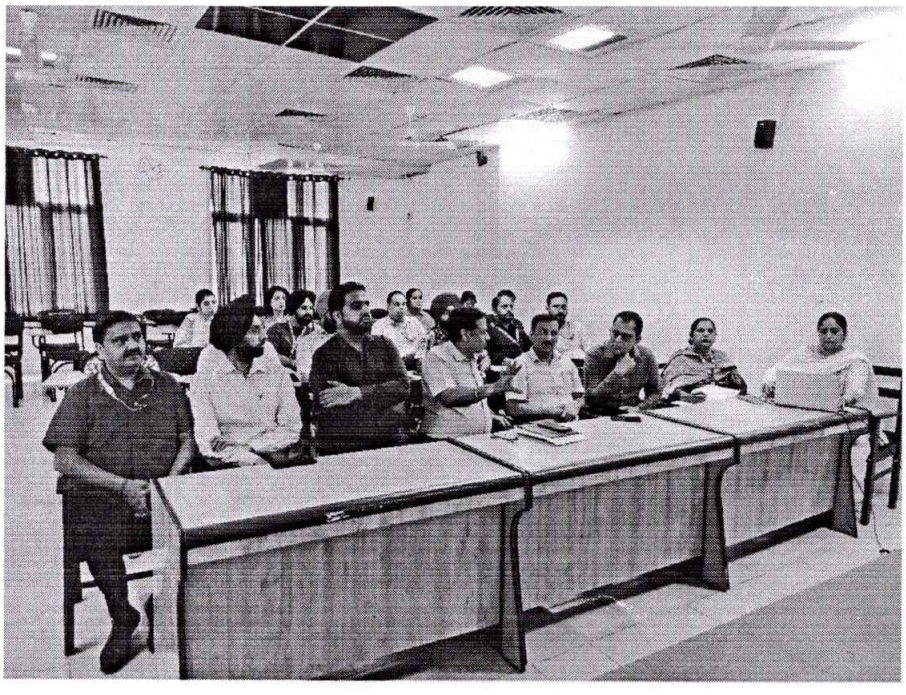
2.

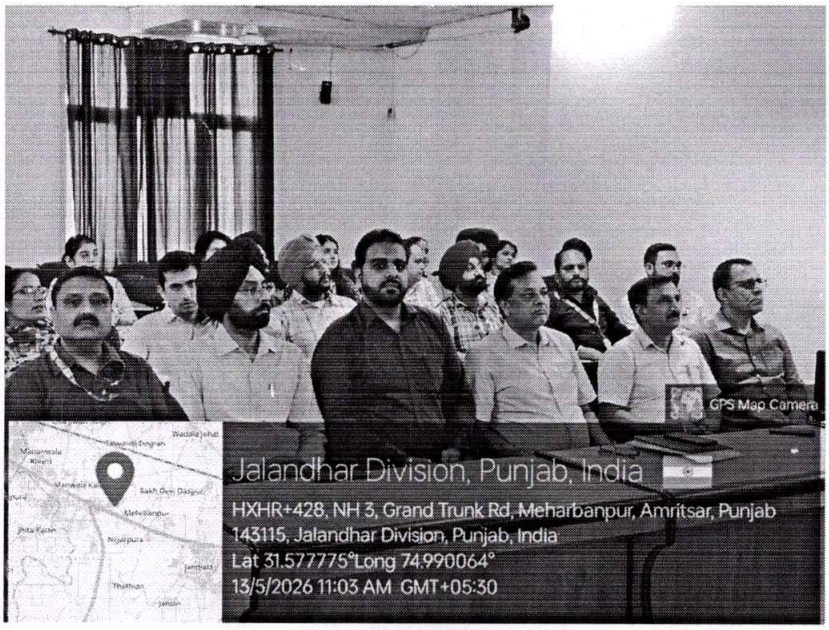
Allocation of M.Tech Supervisor

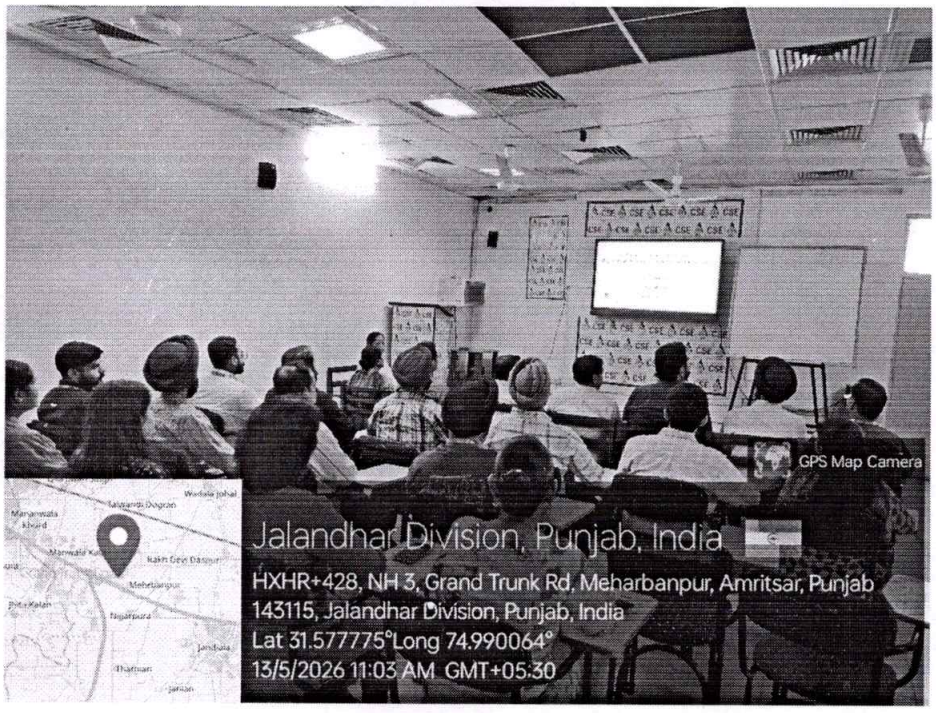
S. No.	Univ. Roll No.	Student Name	Name of the Supervisor
1.	2342036	Vishvas	Er. Bhuvnesh Kumar

AMRITSAR GROUP OF COLLEGES NAAC Grade "A" 3rd Cycle | Autonomous College under Autonomous Category | (Since 2014) Conferred by UGC	**14th BoS Meeting Glimpses**	**Department of Computer Science and Engineering**






GPS Map Camera
Jalandhar Division, Punjab, India
HXHR+428, NH 3, Grand Trunk Rd, Meharbanpur, Amritsar, Punjab
143115, Jalandhar Division, Punjab, India
Lat 31.577775°Long 74.990064°
13/5/2026 11:03 AM GMT+05:30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Jalandhar Division, Punjab, India
HXHR+428, NH 3, Grand Trunk Rd, Meharbanpur, Amritsar, Punjab
143115, Jalandhar Division, Punjab, India
Lat 31.577775°Long 74.990064°
13/5/2026 11:03 AM GMT+05:30

2:15

Dear RAJESH KUMAR ,

Here's the summary of your successful FASTag transaction:

Transaction Amount:
INR 70.00
Vehicle No
9687
Date & Time:
13-05-2026 11:08:54 IST
Toll Location:
JATL Dhilwan Toll Plaza
Available Balance:
INR 849.38

Reply Forward

2:15

AXIS BANK

Dear RAJESH KUMAR ,

Here's the summary of your successful FASTag transaction:

Transaction Amount:
INR 65.00
Vehicle No.
9687
Date & Time:
13-05-2026 10:22:50 IST
Toll Location:
JATL Nijjerpura Toll Plaza
Available Balance:
INR 919.38

Reply Forward

2:16

AXIS BANK

Dear RAJESH KUMAR ,

Here's the summary of your successful FASTag transaction:

Transaction Amount:
INR 225.00
Vehicle No
9687
Date & Time:
13-05-2026 08:14:45 IST
Toll Location:
Ladowal Toll Plaza
Available Balance:
INR 984.38

Reply Forward

13/05/2026

Total Toll (To and fro)
540/- (five hundred forty Rs.)

Department of Computer Science and Engineering

Ref No.: —— **Date: 13.05.2026**

It is to inform you that department has conducted 14th BOS meeting on 13.05.2026 in **physical mode**. The bank details of BoS members are provided below to pay honorarium.

Name: Krishan Kumar Saluja	
Beneficiary Name	Krishan Kumar
Account Number	36133748710
Bank Name	State Bank of India
Branch Address	SBI, UIET, Blaock-2, South Campus, Sector-25, Panjab University Chandigarh
IFSC Code	SBIN0017022

O.K.
K. Saluja 13/05

Dr. Rajesh Kumar	
Beneficiary Name	RAJESH KUMAR
Account Number	65270241954
Bank Name	State Bank of India
Branch Address	TIET Br., Patiala
IFSC Code	SBIN0050244

Dr. Munish Bhatia	
Beneficiary Name	Munish Bhatia
Account Number	005190100016563
Bank Name	Yes Bank
Branch Address	Mall Road Amritsar
IFSC Code	YESB0000051

O.K. Munish

Dr. Sarbjeet Singh	
Beneficiary Name	Sarbjeet Singh
Account Number	1488010100009161
Bank Name	Punjab National Bank (PNB)
Branch Address	PEC Sec-12 Chandigarh
IFSC Code	PUNB0606000

ok Sarbjeet

13/5/26

13/5/26

HOD(CSE)

AMRITSAR GROUP OF COLLEGES

Autonomous Status Conferred by UGC | NAAC A-Grade

Department of Computer Science and Engineering

NBA Accredited
(2009-12, 2016-18)

Honorarium /TA/DA Bill

1 Name (In Block Letters):- MUNISH BHATIA 2. Father's Name: - NAVDEEP BHATIA

3. Address:- NIT KURUKSHETRA Contact No.:-

4. Designation:- ~~ASSISTANT~~ PRO (GRADE) 5. Organization: - NIT Kurukshetra.

6. Pay Scale/ Consolidated Salary:- 10150-16740 7. Grade Pay:- 8000 (Level-12)

8. Date of ~~Practical~~ BOS 13/05/2026 9. Last Pay Scale & GP (if Retired):-

10. E-mail ID:-

TA/DA/Local Journey/Toll Tax etc.

Departure			Arrival			Mode of Journey & Vehicle No.	Distance for Road Mileage		Amount of Toll tax etc.	Hotel/ Non Hotel D.A	Total Amount (Rs.)
Date	Station	Time	Date	Station	Time		K.M	Rate			
13/5/26	Kurukshetra (NIT)	05.30 am	13/5/26	~~Amritsar~~ (AGC)	10.00 am	PB02FD 9416	294	16			4704
13/5/26	AGC Amritsar	03.00 pm	13/5/26	NIT Kurukshetra			294	16			4704
Honorarium											4000
										Total	13408/-

~~C~~ified that:-

I. Particular provided herewith are correct & that I have not claimed TA/DA for this Journey from any other Public Source and bill is submitted first time.
II. I was not provided free lodging and/or boarding at the cost of Govt./ University or any autonomous body if provided please attach boarding/loading /both bills.
III. Certified that I shall perform the return. Journey From _____ to _____ in _____ class.
IV. Certified that the I have traveled by shortest route and I will perform return Journey by same route and _____ mode of conveyance/ as claimed.

The above practical examination conduct claim is verified to be true & correct.

Verified By: -

13/5/26

Head of Department (with Stamp)

Head
Deptt. of Computer Science & Engg.
Amritsar Group of Colleges
Amritsar.

Affix revenue stamp for receipt Above Rs.5000

13/05/2026

Signature of Claimant

For Use by Account Office Only

Amount claimed above is as per college rules/norms. Payment of Rs._____ may be allowed to be made please.

Dealing Clerk

Registrar

AMRITSAR GROUP OF COLLEGES

Autonomous Status Conferred by UGC | NAAC A-Grade

Department of Computer Science and Engineering

NBA Accredited
(2009-12, 2016-18)

Honorarium /TA/DA Bill

1 Name (In Block Letters):- Dr. RAJESH KUMAR 2. Father's Name: - SH. SUNDER DASS

3. Address:- _____ Contact No.:- _____

4. Designation:- Professor 5. Organization: - Thapar Inst. of Engg. & Tech., Patiala

6. Pay Scale/ Consolidated Salary:- Level 14; Gross: - 4.25 Lacs 7. Grade Pay:- 14 (Level)

8. Date of Practical:- — 9. Last Pay Scale & GP (if Retired):- — Level-14

10. E-mail ID:- rakumar@thapar.edu

TA/DA/Local Journey/Toll Tax etc.

Departure			Arrival			Mode of Journey & Vehicle No.	Distance for Road Mileage		Amount of Toll tax etc.	Hotel/ Non Hotel D.A	Total Amount (Rs.)
Date	Station	Time	Date	Station	Time		K.M	Rate			
13-05-26	TIET; Patiala	6:30 AM	13-05-26	AGC; Amritsar	10:30 AM	PB11 CC 9687	225	20	540		5040
13-05-26	AGC Amritsar	3:30 PM	13-05-26	TIET; Patiala	8:00 PM	"	225	20			4500
Honorarium											4000
										Total	13540/-

Certified that:-

I. Particular provided herewith are correct & that I have not claimed TA/DA for this Journey from any other Public Source and bill is submitted first time.
II. I was not provided free lodging and/or boarding at the cost of Govt./ University or any autonomous body if provided please attach boarding/loading /both bills.
III. Certified that I shall perform the return. Journey From _____ to _____ in _____ class.
IV. Certified that the I have traveled by shortest route and I will perform return Journey by same route and _____ mode of conveyance/ as claimed.

The above practical examination conduct claim is verified to be true & correct.

Verified By: -

13/5/26

Head of Department (with Stamp)

Head
Deptt. of Computer Science & Engg.
Amritsar Group of Colleges
Amritsar.

Affix revenue stamp for receipt Above Rs.5000

Signature of Claimant

For Use by Account Office Only

Amount claimed above is as per college rules/norms. Payment of Rs._____ may be allowed to be made please.

Dealing Clerk

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Department of Computer Science and Engineering

NBA Accredited
(2009-12, 2016-18)

Honorarium /TA/DA Bill

1 Name (In Block Letters):- SARBJEET SINGH 2. Father's Name: - JASWANT SINGH

3. Address:- PROFESSOR, CSE, UIET, P.U, Chandigarh Contact No.:- 9815951674

4. Designation:- PROFESSOR 5. Organization: - P.U. Chandigarh

6. Pay Scale/ Consolidated Salary:- Level-14 7. Grade Pay:- Level-14 7CPC (Eq AGP 10000)

8. Date of Practical:- 13-05-2026 9. Last Pay Scale & GP (if Retired):- —

10. E-mail ID:- sarbjeet@pu.ac.in

TA/DA/Local Journey/Toll Tax etc.

Departure			Arrival			Mode of Journey & Vehicle No.	Distance for Road Mileage		Amount of Toll tax etc.	Hotel/ Non Hotel D.A	Total Amount (Rs.)
Date	Station	Time	Date	Station	Time		K.M	Rate			
13/05/26	PU Chandigarh	7:00 am	13/05/26	AGC Amritsar	10:25	Own Car CH01AH 4709	225	20	565		5060
13/05/26	AGC ASR	43:15 pm		PU Chandigarh	47:00 pm	"	225	20			4500
Honorarium											4000
										Total	13560/-

Certified that:-

I. Particular provided herewith are correct & that I have not claimed TA/DA for this Journey from any other Public Source and bill is submitted first time.
II. I was not provided free lodging and/or boarding at the cost of Govt./ University or any autonomous body if provided please attach boarding/loading /both bills.
III. Certified that I shall perform the return. Journey From _____ to _____ in _____ class.
IV. Certified that the I have traveled by shortest route and I will perform return Journey by same route and _____ mode of conveyance/ as claimed.

The above practical examination conduct claim is verified to be true & correct.

Verified By:- 13/5/26

Head of Department (with Stamp)

Head
Deptt. of Computer Science & Engg.
Amritsar Group of Colleges
Amritsar.

Affix revenue stamp for receipt Above Rs.5000

Signature of Claimant

For Use by Account Office Only

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Dealing Clerk

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AMRITSAR GROUP OF COLLEGES

Autonomous Status Conferred by UGC | NAAC A-Grade

Department of Computer Science and Engineering

NBA Accredited
(2009-12, 2016-18)

Honorarium /TA/DA Bill

1 Name (In Block Letters):- Dr. KRISHAN KUMAR 2. Father's Name: - Late Sh. Om Parkash Saluja

3. Address:- Professor IT, UIET, Panjab University, Chandigarh Contact No.:- 8288012014

4. Designation:- Professor 5. Organization: - Panjab University Chandigarh.

6. Pay Scale/ Consolidated Salary:- Level-14 7. Grade Pay:- Level-14

8. Date of ~~Practical~~ BOS:- 13/05/2026 9. Last Pay Scale & GP (if Retired):- Level-14 (N.A).

10. E-mail ID:- K.salujauiet@gmail.com.

TA/DA/Local Journey/Toll Tax etc.

Departure			Arrival			Mode of Journey & Vehicle No.	Distance for Road Mileage		Amount of Toll tax etc.	Hotel/ Non Hotel D.A	Total Amount (Rs.)
Date	Station	Time	Date	Station	Time		K.M	Rate			
13/05	PU. CHD	6:30 AM	13/05	AGC Amritsar	10:30 AM	PB01F 5604	225	20	565		5060
13/05	AGC, Amritsar	3:30 PM	13/05	PU CHD			225	20			4500
Honorarium											4000
										Total	13560/-

Certified that:-

I. Particular provided herewith are correct & that I have not claimed TA/DA for this Journey from any other Public Source and bill is submitted first time.
II. I was not provided free lodging and/or boarding at the cost of Govt./ University or any autonomous body if provided please attach boarding/loading /both bills.
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IV. Certified that the I have traveled by shortest route and I will perform return Journey by same route and _____ mode of conveyance/ as claimed.

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Verified By: -

13/5/26

Head of Department (with Stamp)

Head
Deptt. of Computer Science & Engg.
Amritsar Group of Colleges
Amritsar.

Affix revenue stamp for receipt Above Rs.5000

K. Saluja

Signature of Claimant

For Use by Account Office Only

Amount claimed above is as per college rules/norms. Payment of Rs._____ may be allowed to be made please.

Dealing Clerk

Registrar

HDFC BANK

We understand your world

PROF. SARBJEET SINGH.

GURPREET KAUR

E-1/7 Sector 14 Panjab University NA Sector 15 Chandigarh , Chandigarh, Chandigarh
CHANDIGARH India 160015
9815951674

From: 13-May-2026 To: 13-May-2026

STATEMENT

Transaction Date Time	Settlement Date Time	Unique Transaction ID	Vehicle Registration No.	Narration	Divisions(Only Application for Corporate Customers)	Activity(Only Application for Corporate Customers)	Plaza Name	** Plaza Type (NH/SH)	Amount
05/13/2026 10:29:29 AM	05/13/2026 10:29:34 AM	001002260513102934 0568	CH01AH4709	ETC/2026051310293413/ 0010022605131029340568/CH01AH4709/041002/1 9000014791475	NA	NA	JATL Nijjerpura Toll Plaza	TOLL	65.00
05/13/2026 9:57:20 AM	05/13/2026 9:57:27 AM	260513095726613586 264	CH01AH4709	ETC/2026051309572765/ 2605130957266135862 64/CH01AH4709/041001/190 00014791475	NA	NA	JATL Dhilwan Toll Plaza	Toll	70.00
05/13/2026 8:56:35 AM	05/13/2026 8:57:55 AM	314027008130526085 636	CH01AH4709	ETC/2026051308575534/ 3140270081305260856 36/CH01AH4709/314027/190 00014791475	NA	NA	Behram	Toll	110.00
05/13/2026 8:03:47 AM	05/13/2026 8:05:07 AM	001003260513080507 7751	CH01AH4709	ETC/2026051308050786/ 0010032605130805077 751/CH01AH4709/314028/1 9000014791475	NA	NA	Bachhwan	Toll	70.00
05/13/2026 7:42:03 AM	05/13/2026 7:42:35 AM	006596059164	CH01AH4709	ETC/2026051307423514/ 006596059164/CH01AH4 709/157001/19000014791 475	NA	NA	BSC-C&C Kurali Toll Plaza	Toll	60.00

13/05/26

Total Toll (To and fro)
565/- (five hundred sixty five Rs.)

AMRITSAR GROUP OF COLLEGES

Autonomous status conferred by UGC under UGC act-1956, (2f), NAAC-A Grade,
(Formerly Known as Amritsar College of Engineering & Technology | Amritsar Pharmacy College)

Catering Request Form

Date: 8.5.26

Catering Date: 13.5.26	**Breakfast/Afternoon Tea/ Lunch/ Hi-Tea/ Dinner:**	
Start Time: 10:30 am	**End Time:** 2:00 pm	
Total No. of pax attending: 07	**No. of Internal pax:** 03	**No. of External Pax:** 04
Event: 14th BOS Meeting	**Venue:**	
Name of the Event Coordinator: Neha	**Department Organizing:** CSE	**Mob:** 8699322906
Email:	**Name & Contact No. (Supporting Staff):**	

Particulars	
1. One snacks	
2. Sandwiches	
3. Tea	
4. Cookies	
5. Dal	
6. Paneer	
7. Mix Veg	
8. Raita	
9. Rice, Chapatti, One dessert	Approx. cost - 2600 Rs/-

HOD 8/5/26 **Principal**

Request Instructions:

1. The request should be placed at least one day in advance and before 11 am.
2. All the above signatures are mandatory.
3. From the stated number of persons attending only an increase of 5% will be accommodated at the last hour.
4. Please send the above form duly signed to the Department of Hotel Management in either hard or soft format.

Cc: OSD

11/05/26