



## B.E. IN COMPUTER SCIENCE & ENGINEERING (AI&ML)

Scheme of Teaching and Evaluation 2022  
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)  
(2022 Scheme: Effective from the Academic Year 2023 - 24)

### III SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
						L	T	P	S					
1	BSC	MA322T1A	Linear Algebra and Statistics for Machine Learning	BSC	BSC	03	00	00	00	3	50	50	100	3
2	IPCC	AM322I2A	Digital Logic Design and Computer Organization	AIML	CSE	03	00	02	00	3	50	50	100	4
3	IPCC	CS322I3C	Object Oriented Programming Concepts	CSE and Allied	CSE	03	00	02	00	3	50	50	100	4
4	PCC	CS322T4C	Data Structures and Applications	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
5	PCCL	CS322L5C	Data Structures Laboratory with C	CSE and Allied	CSE	00	00	02	00	3	50	50	100	1
6	ESC/ETC/PLC	AM322T6Ax/ CS322T6Cx	(See table below)	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
7	UHV	HU32287X	UHV -1:Social Connect and Responsibilities	BSC	BSC	01	00	00	00	1	50	50	100	1
8	AEC / SEC	CS32298Cx	Ability Enhancement Course III / Skill Enhancement Course III	CSE and Allied	CSE	01	00	00	00	1	50	50	100	1
9	MC	N322N10X	National Service Scheme (NSS)	NSS / PED / Yoga		00	00	02	00	Registrations to any one of the courses be completed (as per the choice of the student) and activities to be carried out.				0
		P322N10X	Physical Education (PE) (Sports and Athletics)											
		Y322N10X	Yoga											
											<b>400</b>	<b>400</b>	<b>800</b>	<b>20</b>

**ESC/ETC/PLC**

AM322T6AA	Web Technology and its application	CS322T6CC	Unix Shell Programming
CS322T6CB	Mobile Application Development	CS322T6CD	Ethical Hacking
<b>ABILITY ENHANCEMENT COURSE III / SKILL ENHANCEMENT COURSE III</b>			
CS32298CA	Data Analytics using Excel	CS32298CC	MERN
CS32298CB	UI/UX Design	CS32298CD	Competitive Programming using C++

**COURSE PRESCRIBED TO LATERAL ENTRY DIPLOMA HOLDERS ADMITTED TO III SEMESTER B.E. PROGRAMS**

1		Additional Mathematics I	BSC	BSC	02	00	00	01	3	50	50	100	0
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**Note:** **BSC:** Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course Laboratory, **AEC:** Ability Enhancement Courses. **UHV:** Universal Human Value Course, **SEC:** Skill Enhancement Course, **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **MC:** Mandatory Course  
**L** – Lecture, **T** – Tutorial, **P-** Practical/ Drawing, **S** – Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB:** Paper Setting Board.

**Integrated Professional Core Course (IPCC):** Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIA and SEE. The practical part shall be evaluated by only CIA (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

**National Service Scheme (NSS)/ Physical Education (PE)/ Yoga:** All the students have to register for any one of the courses namely NSS/ PE/ Yoga with the concerned coordinator of the course during the first week of the III semester. Activities shall be carried out between the III semester and VI semester (for Four Semesters). The events shall be appropriately scheduled and the same shall be reflected in the Institute Academic and Activity Calendar. The course will be evaluated only for the CIA marks and will not have SEE component. The students who successfully complete the registered course will be awarded with “PP” grade and the students not completing the same will be awarded with “NP” grade. The marks and the grade obtained by the student will be included in the SIXTH semester grade card. The course will not be considered for the SGPA and CGPA calculations and Vertical Progression, however, completion of the course is mandatory for the award of the Degree.

**Non–Credit Mandatory Courses (NCMC):**

**(A) Additional Mathematics I:**

- 1) This course is prescribed in the III semester to the to the lateral entry Diploma holders admitted to the second year of the B.E., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Assessment (CIA). These courses are slated for both CIA and SEE.
- 2) Additional Mathematics I shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
- 3) Successful completion of the courses Additional Mathematics I shall be indicated with Pass (PP) grade in the grade card. Non-completion of the courses will lead to the award of Not Pass (NP) Grade.
- 4) In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIA marks and 40% of the prescribed SEE marks, shall be deemed to have secured an NP grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s.

**(B) National Service Scheme (NSS)/Physical Education (Sport and Athletics) (PED)/ Yoga:**

- 1) Securing 40% or more in CIA, 40% or more marks in SEE and 40% or more in the sum total of CIA + SEE leads to successful completion of the registered course.
- 2) In case, students fail to secure 40 % marks in SEE, they have to appear for SEE during the subsequent examinations and obtain the minimum requirement.
- 3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum requirements as mentioned in (B).1, they shall be awarded with NP Grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s.
- 4) Successful completion of the course shall be indicated with a PP Grade in the grade card.
- 5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

**BoS SPECIFIED NPTEL COURSES**

**(APPLICABLE ONLY TO THE STUDENTS WHO FAIL IN A COURSE MORE THAN FOUR TIMES)**

<b>Course Code</b>	<b>Course Name</b>	<b>Alternative NPTEL Courses*</b>
<b>A</b>		

**\*subjected to change depending on the courses offered by the NPTEL.**

**Note:**

- The student has to provide the evidences for registering to the course, assignment submission, attending the examination and the certificate provided by NPTEL indicating the clearance of the Course by the candidate.
- Only on submitting the valid documents, the student will be awarded with the credits mentioned against the course(s)



## B.E. IN COMPUTER SCIENCE & ENGINEERING (AI&ML)

Scheme of Teaching and Evaluation 2022  
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)  
(2022 Scheme: Effective from the Academic Year 2023 - 24)

### IV SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						L Theory Lecture	T Tutorial	P Practical / Drawing	S Self -Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
1	IPCC	AM422I1A	Principles of Artificial Intelligence	AIML/CSE (DS)	CSE	03	00	02	00	3	50	50	100	4
2	IPCC	AM422I2A	Computer Network and Its Applications	AIML	CSE	03	00	02	00	3	50	50	100	4
3	PCC	AM422T3A	Principles of Operating Systems	AIML	CSE	03	00	00	00	3	50	50	100	3
4	PCC	CS422T4C	Design and Analysis of Algorithms	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
5	PCCL	CS422L5C	Design and Analysis of Algorithms Laboratory	CSE and Allied	CSE	00	00	02	00	3	50	50	100	1
6	ESC/ETC/PLC	MA422T6Ax/ MA422T6Cx	<b>Mathematics Course specific to the program</b>	BSC	BSC	03	00	00	00	3	50	50	100	3
7	AEC / SEC	CS42297Cx/ AM42297Ax	Ability Enhancement Course IV / Skill Enhancement Course IV	CSE and Allied	CSE	01	00	00	00	1	50	50	100	1
8	BSC	HI422T8X	Biology for Engineers	BSC	BSC	02	00	00	00	2	50	50	100	2
9	UHV	HU42289X	UHV -2: Understanding Harmony and Ethical Human Conduct	BSC	BSC	01	00	00	00	1	50	50	100	1
10	MC	N322N10X	National Service Scheme (NSS)	NSS / PED / Yoga		00	00	02	00	Activities to be carried out by the student in the registered course				0
		P322N10X	Physical Education (PE) (Sports and Athletics)											
		Y322N10X	Yoga											
											<b>450</b>	<b>450</b>	<b>900</b>	<b>22</b>

**ESC/ETC/PLC**

MA422T6AA	Mathematics for AIML	MA422T6CC	Optimization Techniques
MA422T6CB	Regression Statistical Computing	MA422T6CD	Metric Spaces
<b>ABILITY ENHANCEMENT COURSE IV / SKILL ENHANCEMENT COURSE IV</b>			
CS42297CA	GitHub : AI-Powered Developer Platform	CS42297CC	Data Visualization using R
CS42297CB	Dev Ops	AM42297AD	Python Data Structures and Algorithms

**COURSE PRESCRIBED TO LATERAL ENTRY DIPLOMA HOLDERS ADMITTED TO III SEMESTER B.E. PROGRAMS**

1		Additional Mathematics II	BSC	BSC	02	00	00	01	3	50	50	100	0
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**Note:** **BSC:** Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course Laboratory, **AEC:** Ability Enhancement Courses. **UHV:** Universal Human Value Course, **SEC:** Skill Enhancement Course, **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **MC:** Mandatory Course

**L** – Lecture, **T** – Tutorial, **P**- Practical/ Drawing, **S** – Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB:** Paper Setting Board.

**Integrated Professional Core Course (IPCC):** Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIA and SEE. The practical part shall be evaluated by only CIA (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

**National Service Scheme (NSS)/ Physical Education (PE)/ Yoga:** All the students have to register for any one of the courses namely NSS/ PE/ Yoga with the concerned coordinator of the course during the first week of the III semester. Activities shall be carried out between the III semester and VI semester (for Four Semesters). The events shall be appropriately scheduled and the same shall be reflected in the Institute Academic and Activity Calendar. The course will be evaluated only for the CIA marks and will not have SEE component. The students who successfully complete the registered course will be awarded with “PP” grade and the students not completing the same will be awarded with “NP” grade. The marks and the grade obtained by the student will be included in the SIXTH semester grade card. The course will not be considered for the SGPA and CGPA calculations and Vertical Progression, however, completion of the course is mandatory for the award of the Degree.

**Non–Credit Mandatory Courses (NCMC):**

**(A) Additional Mathematics I:**

- 1) This course is prescribed in the III semester to the lateral entry Diploma holders admitted to the second year of the B.E., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Assessment (CIA). These courses are slated for both CIA and SEE.
- 2) Additional Mathematics I shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
- 3) Successful completion of the courses Additional Mathematics I shall be indicated with Pass (PP) grade in the grade card. Non-completion of the courses will lead to the award of Not Pass (NP) Grade.
- 4) In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIA marks and 40% of the prescribed SEE marks, shall be deemed to have secured an NP grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s.

**National Service Scheme (NSS)/Physical Education (Sport and Athletics) (PED)/ Yoga:**

- 1) Securing 40% or more in CIA, 40% or more marks in SEE and 40% or more in the sum total of CIA + SEE leads to successful completion of the registered course.
- 2) In case, students fail to secure 40 % marks in SEE, they have to appear for SEE during the subsequent examinations and obtain the minimum requirement.
- 3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum requirements as mentioned in (B).1, they shall be awarded with NP Grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s.
- 4) Successful completion of the course shall be indicated with a PP Grade in the grade card.
- 5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

**BoS SPECIFIED NPTEL COURSES****(APPLICABLE ONLY TO THE STUDENTS WHO FAIL IN A COURSE MORE THAN FOUR TIMES)**

<b>Course Code</b>	<b>Course Name</b>	<b>Alternative NPTEL Courses*</b>
<b>A</b>		

**\*subjected to change depending on the courses offered by the NPTEL.****Note:**

- The student has to provide the evidences for registering to the course, assignment submission, attending the examination and the certificate provided by NPTEL indicating the clearance of the Course by the candidate.
- Only on submitting the valid documents, the student will be awarded with the credits mentioned against the course(s)



## B.E. IN COMPUTER SCIENCE & ENGINEERING (AI&ML)

SCHEME OF TEACHING AND EVALUATION 2022  
OUTCOME BASED EDUCATION (OBE) AND CHOICE BASED CREDIT SYSTEM (CBCS)  
(2022 SCHEME: EFFECTIVE FROM THE ACADEMIC YEAR 2024 - 25)

### V SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
1	IPCC	AM522I1A	Machine Learning	AIML	CSE	03	00	02	00	3	50	50	100	4
2	IPCC	AM522I2A	Advanced RISC Machines	AIML	CSE	03	00	02	00	3	50	50	100	4
3	PCC	CS522T3C	Automata Theory and Computability	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
4	PCC	CS522T4C	Database Management Systems	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
5	PCCL	CS522L5C	Database Management Systems Laboratory	CSE and Allied	CSE	00	00	02	00	3	50	50	100	1
6	PEC	AM522I6Ax	Professional Elective I	AIML	CSE	03	00	00	00	3	50	50	100	3
7	PROJ	AM522P7A	Mini-Project Work	AIML	CSE	00	00	04	00	3	50	---	50	2
8	AEC	AM52298A	Research Methodology and IPR	AIML	CSE	01	00	00	00	1	50	50	100	1
9	MC	AM522T9A	Environmental Studies	BSC	BSC	01	00	00	00	1	50	50	100	1
10	MC	N322N10X	National Service Scheme (NSS)	NSS / PED / Yoga		00	00	02	00	Activities to be carried out by the student in the registered course				0
		P322N10X	Physical Education (PE) (Sports and Athletics)											
		Y322N10X	Yoga											
											<b>450</b>	<b>400</b>	<b>850</b>	<b>22</b>

### PROFESSIONAL ELECTIVE COURSES

AM52216AA	Distributed Computing	AM52216AC	Industrial Internet of Things
AM52216AB	Data Mining and Data Warehousing	AM52216AD	Social Network Analysis
<p><b>Note:</b> <b>HSMC:</b> Humanities Science &amp; Management Course, <b>IPCC:</b> Integrated Professional Core Course, <b>PCC:</b> Professional Core Course, <b>PCCL:</b> Professional Core Course Laboratory, <b>AEC:</b> Ability Enhancement Courses, <b>PEC:</b> Professional Elective Course, <b>MC:</b> Mandatory Course, <b>PROJ:</b> Project Work  <b>L</b> – Lecture, <b>T</b> – Tutorial, <b>P-</b> Practical/ Drawing, <b>S</b> – Self -Study Component, <b>CIA:</b> Continuous Internal Assessment, <b>SEE:</b> Semester End Examination, <b>TD-</b> Teaching Department, <b>PSB:</b> Paper Setting Board.</p>			
<p><b>Integrated Professional Core Course (IPCC):</b> Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIA and SEE. The practical part shall be evaluated by only CIA (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.</p>			
<p><b>National Service Scheme (NSS)/ Physical Education (PE)/ Yoga:</b> All the students have to register for any one of the courses namely NSS/ PE/ Yoga with the concerned coordinator of the course during the first week of the III semester. Activities shall be carried out between the III semester and VI semester (for Four Semesters). The events shall be appropriately scheduled and the same shall be reflected in the Institute Academic and Activity Calendar. The course will be evaluated only for the CIA marks and will not have SEE component. The students who successfully complete the registered course will be awarded with “PP” grade and the students not completing the same will be awarded with “NP” grade. The marks and the grade obtained by the student will be included in the SIXTH semester grade card. The course will not be considered for the SGPA and CGPA calculations and Vertical Progression, however, completion of the course is mandatory for the award of the Degree.</p>			
<p><b>Non–Credit Mandatory Courses (NCMC):</b>  <b>National Service Scheme (NSS)/Physical Education (Sport and Athletics) (PED)/ Yoga:</b></p> <ol style="list-style-type: none"> <li>1) Securing 40% or more in CIA, 40% or more marks in SEE and 40% or more in the sum total of CIA + SEE leads to successful completion of the registered course.</li> <li>2) In case, students fail to secure 40 % marks in SEE, they have to appear for SEE during the subsequent examinations and obtain the minimum requirement.</li> <li>3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum requirements as mentioned in (B).1, they shall be awarded with NP Grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s.</li> <li>4) Successful completion of the course shall be indicated with a PP Grade in the grade card.</li> <li>5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.</li> </ol>			





## B.E. IN COMPUTER SCIENCE & ENGINEERING (AI&ML)

Scheme of Teaching and Evaluation 2022  
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)  
(2022 Scheme: Effective from the Academic Year 2024 - 25)

### VI SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
						T	T	P	S					
1	HSMC	CS622T1C	Software Engineering and Project Management	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
2	IPCC	AM622I2A	Computer Vision and Applications	AIML	CSE	03	00	02	00	3	50	50	100	4
3	PCC	AM622T3A	Advanced AI and ML	AIML	CSE	03	00	00	00	3	50	50	100	3
4	PEC	AM62214Ax	Professional Elective Course	AIML	CSE	03	00	00	00	3	50	50	100	3
5	OEC	AM62225Xx	Open Elective Course	AIML	CSE	03	00	00	00	3	50	50	100	3
6	PROJ	AM622P6A	Project Work Phase I	AIML	CSE	00	00	08	00	3	100	---	100	4
7	PCCL	AM622L7A	Advanced AI and ML Laboratory	AIML	CSE	00	00	02	00	3	50	50	100	1
8	AEC / SEC	AM62299Ax	Ability Enhancement Course V / Skill Enhancement Course V	AIML	CSE	01	00	00	00	1	50	50	100	1
9	MC	N322N10X	National Service Scheme (NSS)	Completed during the intervening period of III and VI Semester							50	---	50	0
		P322N10X	Physical Education (PE) (Sports and Athletics)											
		Y322N10X	Yoga											
														<b>22</b>

ABILITY ENHANCEMENT COURSE V/ SKILL ENHANCEMENT COURSE V			
AM62299AA	3-D Animation using Blender	AM62299AC	Algorithmic Game Theory
AM62299AB	Docker	AM62299AD	Network Security
PROFESSIONAL ELECTIVE COURSE			
AM62214AA	Augmented Reality and Virtual Reality	AM62214AC	Cloud Computing and Applications
AM62214AB	NO SQL Database	AM62214AD	Data Science and Big Data Analytics
OPEN ELECTIVE COURSE			
AM62225XA	Introduction to Data Structures	AM62225XC	Mobile Application Development
AM62225XB	Introduction of AI	AM62225XD	Fundamentals of Operating Systems
<p><b>Note:</b> <b>BSC:</b> Basic Science Course, <b>IPCC:</b> Integrated Professional Core Course, <b>PCC:</b> Professional Core Course, <b>PCCL:</b> Professional Core Course Laboratory, <b>AEC:</b> Ability Enhancement Courses. <b>UHV:</b> Universal Human Value Course, <b>SEC:</b> Skill Enhancement Course, <b>ESC:</b> Engineering Science Course, <b>ETC:</b> Emerging Technology Course, <b>PLC:</b> Programming Language Course  <b>L</b> – Lecture, <b>T</b> – Tutorial, <b>P-</b> Practical/ Drawing, <b>S</b> – Self -Study Component, <b>CIA:</b> Continuous Internal Assessment, <b>SEE:</b> Semester End Examination, <b>TD-</b> Teaching Department, <b>PSB:</b> Paper Setting Board.</p>			
<p><b>Integrated Professional Core Course (IPCC):</b> Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIA and SEE. The practical part shall be evaluated by only CIA (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.</p>			
<p><b>Professional Elective Course (PEC):</b> A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students’ strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.</p>			
<p><b>Open Elective Courses (OEC):</b> Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.</p> <p>Selection of an Open Elective shall not be allowed if,</p> <ol style="list-style-type: none"> <li>i. The candidate has studied the same course during the previous semesters of the program.</li> <li>ii. The syllabus content of open electives is similar to that of the Departmental core courses or Professional Elective courses.</li> <li>iii. A similar course, under any category, is prescribed in the higher semesters of the program.</li> <li>iv. In case, if any department is interested in offering courses from streams such as Law, Business (MBA), Medicine, Arts, Commerce etc. need to get the necessary approval from the respective Board of Studies and the Academic Council.</li> <li>v. The minimum numbers of students’ strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.</li> </ol>			

**Non-Credit Mandatory Courses (NCCM):**

**National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:**

- 1) Securing 40% or more in CIA, 40% or more marks in SEE and 40% or more in the sum total of CIA + SEE leads to successful completion of the registered course.
- 2) In case, students fail to secure 40 % marks in SEE, they have to appear for SEE during the subsequent examinations and obtain the minimum requirement.
- 3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum requirements as mentioned in (B).1, they shall be awarded with NP Grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s.
- 4) Successful completion of the course shall be indicated with a PP Grade in the grade card.
- 5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

**Project Work Phase I:** Students have to discuss with their mentors/guides and with their help has to complete the Literature Review, define the problem statement for the Project Work, and submit appropriate report. The guidelines and the evaluation process will be defined by the Board of Studies in line with the requirements of VTU and approved by the Academic Council of SCEM.



## B.E. IN COMPUTER SCIENCE & ENGINEERING (AI&ML)

SCHEME OF TEACHING AND EVALUATION 2022  
OUTCOME BASED EDUCATION (OBE) AND CHOICE BASED CREDIT SYSTEM (CBCS)  
(2022 SCHEME: EFFECTIVE FROM THE ACADEMIC YEAR 2025 - 26)

### VII SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination			Credits	
						Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIA Marks	SEE Marks		Total Marks
						L	T	P	S					
1	IPCC	AM722I1A	Natural Language Processing	AIML	CSE	03	00	02	00	3	50	50	100	4
2	PCC	AM722T2A	Neural Networks and Deep Learning	AIML	CSE	03	00	00	00	3	50	50	100	3
3	PEC	AM72213Ax	Professional Elective Course	AIML	CSE	03	00	00	00	3	50	50	100	3
4	OEC	AM72224Ax	Open Elective Course	AIML	CSE	03	00	00	00	3	50	50	100	3
5	PCCL	AM722L5A	Neural Networks and Deep Learning Laboratory	AIML	CSE	00	00	02	00	3	50	50	100	1
6	PROJ	AM722P6A	Project Work Phase II	AIML	CSE	00	00	16	00	03	100	100	200	8
														<b>22</b>
<b>PROFESSIONAL ELECTIVE COURSE</b>														
AM72213A		Block Chain Technology			AM72213C		Robotic Process Automation							
AM72213B		Business Intelligence			AM72213D		Pattern Recognition							
<b>OPEN ELECTIVE COURSE</b>														
AM72224AA		Introduction to Machine Learning			AM72224AC		Introduction to Data Science							
AM72224AB		Introduction to Bigdata			AM72224AD		Python Data Structures							

**Note: PCC:** Professional Core Course, **PEC**–Professional Elective Course. **OEC:** Open Elective Course, **PROJ:** Project Work

**L** – Lecture, **T** – Tutorial, **P**- Practical/ Drawing, **S** – Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB:** Paper Setting department.

**Professional Elective Course (PEC):** A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

**Open Elective Courses (OEC):** Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an Open Elective shall not be allowed if,

- i. The candidate has studied the same course during the previous semesters of the program.
- ii. The syllabus content of open electives is similar to that of the Departmental core courses or Professional Elective courses.
- iii. A similar course, under any category, is prescribed in the higher semesters of the program.
- iv. In case, if any department is interested in offering courses from streams such as Law, Business (MBA), Medicine, Arts, Commerce etc. need to get the necessary approval from the respective Board of Studies and the Academic Council.
- v. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

#### **Project Work:**

The objective of the Project Work is to

- i. Encourage independent learning and the innovative attitude of the students
- ii. Develop interactive attitude, communication skills, Organization, Time Management and Presentation Skills.
- iii. Impart Flexibility and Adaptability
- iv. Inspire Team working
- v. Expand Intellectual capacity, credibility, judgement and intuition
- vi. Adhere to Punctuality, setting and meeting deadlines
- vii. Install responsibilities to oneself and others
- viii. Train students to present the topic of Project work without any fear, face the audience confidently, enhance communication skills, involve in group discussions to present and exchange ideas.

The CIA and SEE evaluation procedure for the Project work will be as provided by the Board of Studies in line with VTU Regulations and approved by the Academic Council of



**SAHYADRI**  
COLLEGE OF ENGINEERING & MANAGEMENT  
An Autonomous Institution  
MANGALURU

## B.E. IN COMPUTER SCIENCE & ENGINEERING (AI&ML)

SCHEME OF TEACHING AND EVALUATION 2022  
OUTCOME BASED EDUCATION (OBE) AND CHOICE BASED CREDIT SYSTEM (CBCS)  
(2022 SCHEME: EFFECTIVE FROM THE ACADEMIC YEAR 2025 – 26)

### VIII SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination			Credits	
					Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIA Marks	SEE Marks		Total Marks
					L	T	P	S					
1	INT	AM82231A	Internship (14-20 Weeks) [Research Internship/ Rural Internship/ Industry Internship]	AIML	00	00	20	00	3	100	100	200	10
2	SEM	AM822S2A	Research oriented Technical Seminar	AIML	00	00	04	00	3	100	---	100	2
													<b>12</b>

**Note: INT:** Internship

**L** – Lecture, **T** – Tutorial, **P**- Practical/ Drawing, **S** – Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB:** Paper Setting department.

### **Research Internship/Industry Internship/Rural Internship**

- **Research Internship:** This is intended to offer the flavor of current research happening in the Research fields. It helps students to get familiarize with the field and imparts the skill required for carrying out research.
- **Industry Internship:** An extended period of work experience undertaken by the students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate the organizations, perspectives and cultures. Dealing with contingencies helps the students recognize, appreciate and adapt to the organizational realities by tempering their knowledge with practical constraints.
- **Rural Internship:** A long term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
- The student may take up Interdisciplinary Research Internship or Industry Internship.
- The Faculty Mentor need to monitor the student's internship progress and interact with them to guide them for the successful completion of the internship requirements
- The students are permitted to carry out internship anywhere in India or Abroad. However, the institute will not bear any expenses incurred with respect to the internship.

**Research Oriented Technical Seminar:** In order to make the student aware of the technological and research application in various domains of the society, a comprehensive presentation need to be provided with all the supporting evidences for the claims in the presentation.

- The objective of the Technical Seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas.
- Each student, under the guidance of a Faculty, shall choose a topic, preferably a recent topic in their interested specializations.
- The student has to
  - i. Carry out a detailed Literature survey, systematically organize the content
  - ii. Prepare the report as per their own intuition, without cut-paste activities.
  - iii. Use tools for writing equations, drawings etc. and gain proficiency of the tools used.
  - iv. Present the topics effectively through appropriate digital media.
  - v. Answer the queries posed and involve in healthy debates/discussions
  - vi. Submit a report in an error-free and professional way
  - vii. Present the findings of the seminar in the reputed Conferences/Journals for possible publications (desirable).

The evaluation procedure for the Research oriented Technical Seminar will be as provided by the Board of Studies and approved by the Academic Council of SCEM.



## LINEAR ALGEBRA AND STATISTICS FOR MACHINE LEARNING

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	MA322T1A	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40 L	Exam Hours	3 Hours

### CREDITS – 3

#### COURSE PREREQUISITES:

Basics of Linear algebra and Statistics.

#### COURSE OBJECTIVES:

- Enable the students to understand the advance concepts of linear algebra
- Understand the concept of probability and enable the students to predict the outcome of simple experiments
- Enable the students to use various tests of significance in engineering problems

#### TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

### COURSE CONTENTS

#### MODULE - I

<b>Linear Algebra:</b> Vector spaces, Linear independence and dependence of vectors, Basis and dimension, Singular Values, Singular vector, Singular value decomposition. LU decomposition Introduction, Cholesky decomposition. Applications of Linear Algebra	<b>8 Hours</b>
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#### MODULE - II

<b>Probability Distribution Functions:</b> Random variables (discrete and continuous), Probability mass/density functions, Binomial, Poisson distributions-problems. Exponential and Normal distributions-problems.	<b>8 Hours</b>
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#### MODULE - III

<b>Curve Fitting:</b> Curve fitting by the method of least squares- fitting the curves of the form $y = ax + b$ , $y = ax^2 + bx + c$ . Correlation-Karl Pearson's coefficient of correlation regression analysis-lines of regression.	<b>8 Hours</b>
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#### MODULE - IV

<b>Sampling and Testing Hypothesis:</b> Null hypothesis, Alternate hypothesis, Type-1 & II error, -Only Definitions. <b>Test of significance for small samples:</b> student's t-distribution, Chi-square distribution as a test of goodness of fit. <b>Test of significance for large samples</b> – Test of hypothesis for proportions and means.	<b>8 Hours</b>
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#### MODULE – V





<b>Stochastic Process and Estimation:</b> Regular stochastic matrices. Transition Probability matrices. Markov Process. Estimation of Parameters, Interval Estimation, Central Limit Theorem. Maximum Likelihood functions.	<b>8 Hours</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply concepts of Linear algebra to solve related problems of Machine learning	CL3
CO2	Utilize Discrete and Continuous random variables and Probability distribution functions to analyze the probability models in engineering field	CL3
CO3	Compute correlation coefficient and Lines of regression to fit a Mathematical model for statistical data.	CL3
CO4	Validate hypothesis testing and apply the Principles of Sampling to infer the nature of population.	CL3
CO5	Apply advanced estimation techniques to model and analyze stochastic processes, demonstrating expertise in probabilistic systems.	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3								1			1			
CO2	2	3	1	1		1				1		1			
CO3	2	3	1		1							1			
CO4	2	3	1	1					1						
CO5	2	3							1	1		1			

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT DETAILS**

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)		
I	II	III			
<b>Syllabus Coverage</b>			<b>Syllabus Coverage</b>		<b>Syllabus Coverage</b>
<b>40%</b>	<b>30%</b>	<b>30%</b>	<b>100%</b>		<b>100%</b>
MI			MI		MI



MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. V.K Kapoor and S.C Gupta "Mathematical Statistics" 11<sup>th</sup> edition, S. Chand Publications
2. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
3. C Ray Wylie, Louis C Barrett: "Advanced Engineering Mathematics", 6th Edition,
4. B.V Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill,
5. Dr. K. Chandrashekar: " Complex analysis, Probability and Statistical Methods" Sudha Publications,2021

#### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. <https://www.youtube.com/watch?v=8Kg21jBCm-k>
2. <https://www.youtube.com/watch?v=Wa6kaCwyYRk>
3. <http://nptel.ac.in/courses.php?disciplineID=111>
4. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
5. <http://academicearth.org/>
6. <http://www.bookstreet.in>
7. VTU e-Shikshana Program



## DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	<b>AM322I2A</b>	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

### CREDITS – 4

#### COURSE PREREQUISITES:

- Basic logic design principles and various function of digital computer.

#### COURSE OBJECTIVES:

This course will enable students to:

- Illustrate combinational digital circuits.
- Demonstrate the use of flipflops and apply for registers and counters.
- Explain the basic sub systems of a computer, their organization, structure and operation.
- Describe memory hierarchy and concept of cache memory.
- Describe arithmetic and logical operations with integer operands.
- Demonstrate different ways of communicating with I/O devices and standard I/O interfaces.
- Illustrate organization of a simple processor and other computing systems using instruction level parallelism.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

**Combinational Logic design:** Karnaugh Map, Minimization of complete and incomplete Boolean expressions using K-Map, Multiplexers, Three state buffers, Decoders and Encoders, Programmable Logic devices.

**8 Hours**

#### MODULE - II

**Sequential Logic Design:** Flip-Flops and its Applications: Master Slave Flip-Flops, Edge-Triggered Flip-Flops, Registers, Counters, Design of Synchronous Counters.

**8 Hours**

#### MODULE - III

**Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

**8 Hours**

**Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations.

#### MODULE - IV





<b>CO1</b>	3	3	3	2	2					1		1	
<b>CO2</b>	3	3	3	2	2					1		1	
<b>CO3</b>	3	3	2	1	2					1		1	
<b>CO4</b>	3	3	2	1	2					1		1	
<b>CO5</b>	3	3	2	1	2					1		1	

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### CO - ASSESSMENT MAPPING

Course Outcomes	Continuous Internal Assessment (CIA) (50%)					Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)		
	I	II	III			
	Syllabus Coverage			Syllabus Coverage		Syllabus Coverage
	40%	30%	30%	100%		100%
CO1	x			x	x	
CO2	x	x		x	x	
CO3		x		x	x	
CO4			x	x	x	
CO5			x	x	x	

#### NOTE

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. Charles H Roth and Larry L Kinney, Analog and Digital Electronics, Cengage Learning, 2019. (**Chapters: 5, 9, 11, 12**)
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (**Chapters: 1, 2, 4, 5, 6, 7**)
3. Digital Principles and Design, Donald D. Givone, 1st Edition, 2002, Tata McGraw-Hill Publishers.
4. Computer Organization And Architecture Designing For Performance, William Stallings 11th Edition, 2019, Pearson.
5. Logic and Computer Design Fundamentals, M. Morris Mano Charles Kime, 4th Edition 2014, Pearson.



6. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008
7. Digital Design and Computer Architecture, David M Harris, Sarah L Harris, 2nd Edition, 2013, Elsevier Morgan Kaufmann Publishers.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):**

1. <https://nptel.ac.in/courses/108/105/108105132/>
2. <https://nptel.ac.in/courses/106/103/106103068/>
3. <https://nptel.ac.in/content/storage2/courses/106103068/pdf/coa.pdf>
4. <https://nptel.ac.in/courses/106/105/106105163/>
5. <https://nptel.ac.in/courses/106/106/106106092/>
6. <https://nptel.ac.in/courses/106/106/106106166/>
7. <http://www.nptelvideos.in/2012/11/computer-organization.html>
8. <http://vlabs.iitkgp.ac.in/coa/index.html>
9. <http://vlabs.iitkgp.ac.in/dec>



## OBJECT ORIENTED PROGRAMMING CONCEPTS

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	CS322I3C	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

### CREDITS – 4

#### COURSE PREREQUISITES:

- Fundamental knowledge of Programming.

#### COURSE OBJECTIVES:

- Learn fundamental Object-Oriented features of Java, classes, objects and its methods.
- Set up Java JDK environment to create, debug and run simple Java programs.
- Explore the concepts of Inheritance, Packages and Interfaces.
- Create Multi-threaded programs, Event handling mechanisms

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

<b>Introduction to Object Oriented Concepts:</b> A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. <b>Class and Objects:</b> Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors.	<b>8 Hours</b>
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#### MODULE - II

<b>Introduction to Java:</b> Java’s magic: the Byte code, Java Development Kit (JDK), The Java Buzzwords, Object-oriented programming, Simple Java programs. Data types, variables and arrays, Operators, Control Statements.	<b>8 Hours</b>
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#### MODULE - III

<b>Classes, Inheritance, Exceptions, Packages and Interfaces:</b> Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. <b>Inheritance:</b> Inheritance basics, using super, creating multi-level hierarchy, method overriding. <b>Exception handling:</b> Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces.	<b>8 Hours</b>
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#### MODULE - IV

<b>Multi-Threaded Programming:</b> Multi-Threaded Programming: What are threads? How to make the	<b>8 Hours</b>
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classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read write problem, producer consumer problems.

**MODULE - V**

**Event Handling:** Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

**8 Hours**

**Swings:** The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Develop C++ programs by using different Object Oriented concepts like inheritance, polymorphism, nested classes, Constructors, Destructors.	CL3
CO2	Analyze and understand the basic Object Oriented concepts using Java with the help of Data types, variables and arrays, Operators, Control Statements.	CL3
CO3	Inspect inheritances, exceptions, packages concepts and exception handling using JAVA.	CL3
CO4	Utilize the concept of Threading and multi-thread programming in real time applications.	CL3
CO5	Illustrate JAVA Event handling mechanism and simple applications using swings.	CL3

**LABORATORY COMPONENTS**

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Implement a C++ Program to demonstrate the concepts of Class, Object and Constructors by creating a class that holds the basic information of students belonging to an Engineering College.	CO1	CL3
2.	Develop a C++ Program to simulate a calculator that performs basic arithmetic operations on integer and floating point numbers using the concepts of function overloading.	CO1	CL3
3.	Write a Java Program for demonstrating creation of Java classes, objects, constructors, declaration and initialization of variables.	CO2	CL3
4.	Demonstrate the for, for-each, while and do-while loops using a Java Program	CO2	CL3
5.	Implement a Java Program to illustrate the concept of Inheritance, polymorphism	CO3	CL3
6.	Develop a Java Program to create Java package and illustrate the process of importing a user defined Java Package .	CO3	CL3
7.	Implement a Java Program to demonstrate of Bounded buffer problems using Java Multi-Threading concepts	CO4	CL3
8.	Implement a Java Program to demonstration of producer-consumer problems	CO4	CL3
9.	Develop a Java program to simulate Key Event and Mouse Event	CO5	CL3
10.	Develop a Java program to demonstrate the java swings	CO5	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	2							3		





<b>CO2</b>	3	2	3	2	2						3		
<b>CO3</b>	3	3	3	2	2						3		
<b>CO4</b>	3	3	3	2	2						3		
<b>CO5</b>	3	3	3	2	2						3		

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)		
I	II	III			
Syllabus Coverage			Syllabus Coverage		Syllabus Coverage
40%	30%	30%	100%		100%
MI			MI		MI
MII	MII		MII		MII
	MIII		MIII		MIII
		MIV	MIV		MIV
		MV	MV		MV

**NOTE:**

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

**SEE QUESTION PAPER PATTERN:**

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer **FIVE** full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006.
2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
3. Sourav Sahay, Object Oriented Programming with C++, 2nd Ed, Oxford University Press,2006
4. E Balagurusamy, Programming with Java, McGraw Hill, 6th Edition, 2019.
5. Mahesh Bhavne and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):**

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs102/](https://onlinecourses.nptel.ac.in/noc22_cs102/)
2. <https://www.geeksforgeeks.org>



## DATA STRUCTURES AND ITS APPLICATIONS

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	CS322T4C	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

### CREDITS – 3

#### COURSE PREREQUISITES:

- Knowledge of Mathematics and C Programming

#### COURSE OBJECTIVES:

This course will enable students to:

- Explain the fundamental knowledge of various types of data structures and their applications essential for implementing solutions to problems.
- Illustrate representations and implementations of various linear and non linear data structures such as Stack, Queues, Linked list, Trees, Graphs and Hashing.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

**Introduction to Data Structures** : Classifications, Data structure Operations, Demonstration of Sparse Matrices with arrays, Strings : Operations and Pattern Matching Algorithms.

**8 Hours**

**Stack** : Concepts and Operations, Array Representation of Stacks, Stacks using Dynamic Arrays.

**Applications of Stack** : Infix to Postfix Conversion, Evaluation of Postfix expression, Recursion : Ackermann function.

#### MODULE - II

**Queues** : Introduction to Queues, Array and Linked Representation of Queues, Operations on queues, Circular queues Operations, Circular queues using Dynamic arrays, Dequeues, Priority Queues.

**8 Hours**

**Applications of Queues** : Job Scheduling.

#### MODULE - III

**Linked List** : Introduction to Linked Lists, Representation of linked lists in Memory, Dynamic Memory allocation functions, Singly Linked list Operations : Traversing, Searching, Insertion and Deletion, Header linked lists, Doubly Linked lists Operations, Circular linked lists, Linked Stacks and Queues.

**8 Hours**

**Applications of Linked Lists** : Polynomials, Sparse matrix representation.

#### MODULE - IV

**Trees** : Terminologies, Binary Trees, Properties of Binary trees, Array and linked representation of Binary

**8 Hours**



Trees, Binary Tree Traversals, Threaded binary trees, Binary Search Trees : Definition, Insertion, Deletion, Traversal, Searching, AVL tree, B-Tree. <b>Application of Trees</b> : Evaluation of Arithmetic Expression.	
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**MODULE - V**

<b>Graphs</b> : Terminologies, Graph representations, Traversal methods : Breadth First Search and Depth First Search. <b>Hashing</b> : Introduction, Hash Table organizations, Hashing Functions, Static and Dynamic Hashing	<b>8 Hours</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the fundamental knowledge of various types of data structures and apply stack data structure for problem solving.	CL3
CO2	Apply the concept of queues, circular queue for solving various problems.	CL3
CO3	Illustrate the operations such as insertion, deletion and searching on singly linked lists, circular linked lists and doubly linked list.	CL3
CO4	Make use of tree data structure with different traversal methods to evaluate arithmetic expression.	CL3
CO5	Illustrate the concept of graphs with applications and the usage of hashing techniques.	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3		1			2	2			3	3	3
CO2	3	3	3		1			2	2			3	3	3
CO3	3	3	3		1			2	2			3	3	3
CO4	3	3	3		1			2	2			3	3	3
CO5	3	3	3		1			2	2			3	3	3
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT DETAILS**

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)		
I	II	III			
<b>Syllabus Coverage</b>			<b>Syllabus Coverage</b>	<b>Syllabus Coverage</b>	
<b>40%</b>	<b>30%</b>	<b>30%</b>	<b>100%</b>	<b>100%</b>	
MI			MI	MI	



MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3. Gilberg and Forouzan, Data Structures : A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.
4. Jean Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013.
5. A M Tenenbaum, Data Structures using C, PHI, 1989.
6. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.

#### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. [https://www.youtube.com/watch?v=3Xo6P\\_V-qns&t=201s](https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s)
2. <https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html>
3. <https://nptel.ac.in/courses/106/102/106102064>
4. <https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html>
5. <https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html>
6. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>
7. <https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html>



## DATA STRUCTURES LABORATORY WITH C

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	CS322L5C	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Maths and Fundamentals of C Programming.
- Usage of IDEs like NetBeans.

#### COURSE OBJECTIVES:

This course will enable students :

- To get practical experience in design, develop, implement, analyze and testing of various algorithms.
- To visualize and understand linear/nonlinear data structures with their applications such as Stack, Queues, Linked List, Trees, Graphs and Hashing.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### LIST OF EXPERIMENTS

Exp. No.	Description
1	Design and Implement a program in C on Frequency Histogram, which builds a frequency array for data values in the range 1 to n and then prints their histogram. The program should, a. Read, Store and Print the data in an array. b. Analyse the data in the array, one element at a time. Add 1 to the corresponding element in a frequency array based on the data value. c. Print a histogram using asterisks for each occurrence of an element.



2	<p>Design and Implement a program in C for the following Stack Applications,</p> <ol style="list-style-type: none"><li>Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^</li><li>Conversion of Arithmetic Expressions</li></ol>
3	<p>Design and Implement a program in C for the following operations on QUEUES,</p> <ol style="list-style-type: none"><li>Categorize the numbers (Range 1 to 100) without losing the original ordering as mentioned below: Group 1: Less than 10 Group 2: Between 10 and 19 Group 3: Between 20 and 29 Group 4: Between 30 and 99</li><li>Sort the categorized data using any sorting algorithm</li></ol>
4	<p>Design and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters,</p> <ol style="list-style-type: none"><li>Insert an Element on to Circular QUEUE</li><li>Delete an Element from Circular QUEUE</li><li>Demonstrate Overflow and Underflow situations on Circular QUEUE</li><li>Display the status of Circular QUEUE</li></ol>
5	<p>Design and Implement a menu driven program in C for the following operations on Doubly Linked List (DLL) of Student Data with the fields: USN, Name, Department, Marks, Ph.No,</p> <ol style="list-style-type: none"><li>Create a DLL of N Students Data by using end insertion.</li><li>Display the status of DLL and count the number of nodes in it</li><li>Perform Insertion and Deletion at End of DLL</li><li>Perform Insertion and Deletion at Front of DLL</li><li>Display the total and average marks for each student</li></ol>
6	<p>Design and Implement a program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes,</p> <ol style="list-style-type: none"><li>Represent and Evaluate a Polynomial <math>P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3</math>.</li><li>Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z).</li></ol>
7	<p>Design and Implement a program in C that reads a list of names and telephone numbers to inserts them into a Binary Search Tree for the following operations,</p> <ol style="list-style-type: none"><li>Search the list for a specified name.</li><li>Insert a new name.</li></ol>



	<p>c. Delete an existing name.</p> <p>d. Traverse using Inorder, Preorder and Postorder.</p>																																								
8	<p>A company has seven top officers working for it. They are each fluent in atleast one language according to the following sample table,</p> <table border="1"><thead><tr><th>Officer</th><th>Hindi</th><th>Malayalam</th><th>Kannada</th><th>Telugu</th></tr></thead><tbody><tr><td>01</td><td>-</td><td>-</td><td>Y</td><td>-</td></tr><tr><td>02</td><td>-</td><td>-</td><td>Y</td><td>Y</td></tr><tr><td>03</td><td>-</td><td>-</td><td>-</td><td>Y</td></tr><tr><td>04</td><td>-</td><td>Y</td><td>-</td><td>Y</td></tr><tr><td>05</td><td>Y</td><td>Y</td><td>-</td><td>-</td></tr><tr><td>06</td><td>Y</td><td>-</td><td>Y</td><td>-</td></tr><tr><td>07</td><td>-</td><td>Y</td><td>-</td><td>-</td></tr></tbody></table> <p>Design and Implement a program in C for the following operations on Graphs (G),</p> <p>a. Create a graph using adjacency matrix indicating people who can communicate directly with each other.</p> <p>b. Print all the officers which are reachable from a given officer as a starting node in a digraph.</p> <p>Example: An officer wants to send a message to each other officer: A message comes to an officer, he reads it and transmits it to another officer possibly after translation to someone who has not read it.</p>	Officer	Hindi	Malayalam	Kannada	Telugu	01	-	-	Y	-	02	-	-	Y	Y	03	-	-	-	Y	04	-	Y	-	Y	05	Y	Y	-	-	06	Y	-	Y	-	07	-	Y	-	-
Officer	Hindi	Malayalam	Kannada	Telugu																																					
01	-	-	Y	-																																					
02	-	-	Y	Y																																					
03	-	-	-	Y																																					
04	-	Y	-	Y																																					
05	Y	Y	-	-																																					
06	Y	-	Y	-																																					
07	-	Y	-	-																																					
9	<p>Design and Implement a program in C that uses Hash Function <math>H:K \rightarrow L</math> as <math>H(K)=K \bmod m</math>(reminder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.</p>																																								



### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Design and implement array and stack data structures for a given application.	CL2
CO2	Design and implement queue data structures for a given application.	CL2
CO3	Design and implement the concepts of DLL and SCLL.	CL2
CO4	Utilize the concepts of trees and graphs to solve the real world problems.	CL2
CO5	Illustrate the application of hashing techniques to analyze the collision problems and develop suitable functions to resolve collision.	CL3

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		2			1	1			3	3	3
CO2	3	2	2		2			1	1			3	3	3
CO3	3	2	2		2			1	1			3	3	3
CO4	3	2	2		2			1	1			3	3	3
CO5	3	2	2		2			1	1			3	3	3
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>						

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly





Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

#### **SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

#### **LEARNING RESOURCES:**

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2<sup>nd</sup> Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1<sup>st</sup> Ed, McGraw.
3. Gilberg & Forouzan, Data Structures: A Pseudo - Code Approach with C, 2<sup>nd</sup> Ed, Cengage Learning, 2014.
4. Michael J. Folk, Bill Zoellick and Greg Riccardi, "File Structures - An Object Oriented Approach with C++", Pearson Education, 2004.

#### **REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. [https://www.youtube.com/watch?v=3Xo6P\\_V-qns&t=201s](https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s)
2. <https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html>
3. <https://nptel.ac.in/courses/106/102/106102064>
4. <https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html>
5. <https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html>
6. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>
7. <https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html>



## WEB TECHNOLOGY AND ITS APPLICATION

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	AM322T6AA	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

### CREDITS – 3

#### COURSE PREREQUISITES:

Basic computer skills, HTML and CSS fundamentals, JavaScript fundamentals.

#### COURSE OBJECTIVES:

- Comprehend the basics of the internet and web terminologies.
- Introduce scripting language concepts for developing client-side applications.
- Practice server-side programming features.
- Familiarize the database applications.
- Know the future generation of web services.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- PowerPoint Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE – I

**Internet and World Wide Web:** Overview of Internet and the sub network “the Web”, History, Web System Architecture, Web Clients and Web Servers, Application Servers. HTTP – Basics of HTTP Request and Response, HTTP Methods, headers, content transport (PUSH and PULL), Drawbacks of HTTP1.0, Introduction to HTTP1.1, HTTPS, SSL, Generation of Dynamic Web pages, Extension Mechanisms.

**8 Hours**

#### MODULE – II

**Client side programming:** Web application Design Life cycle, Web page design and production, Web Markup Languages –markup basics, markup purposes, Introductions to HTML and Deficiencies of HTML, Using XHTML – Basic syntax, fundamental elements, URLs –Interpage and Intrapage Linking, Lists, Tables, Frames and Forms., Document Object Model (DOM), Styling with CSS, Introduction to HTML5 and CSS3, Client side dynamic programming with JavaScript – Basics, Primitives, Loops, Decision Statements, Screen Output and Keyboard Input, Arrays and Functions, Event Handling, Pattern Matching and Form Validation with Regular Expressions.

**8 Hours**

#### MODULE – III

**Server side programming:** Three Tier Model, PHP –Basics, Form Validation, Emailing Form Data, Addressing the Stateless Nature of HTTP-Sessions and Session Tracking techniques, jQuery and AJAX.

**8 Hours**



**MODULE – IV**

<b>Advanced technologies:</b> XML – Syntax and Semantics, Document Structure, DTDs, Need for Namespaces, XML Schemas, Navigating XML documents with XPath, Displaying XML documents with CSS and XSLT.	<b>8 Hours</b>
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**MODULE – V**

<b>Advanced topics:</b> E-Commerce Basics, Models and Architecture; mcommerce - WAP; Search Engines and Search Engine Optimization.  <b>The Next Generation Web:</b> The Social Web, The Semantic Web, The Internet of Things, Applications and Research Trends.	<b>8 Hours</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Describe the components of the Internet and Web; basics of Web clients and servers, and serving content to users over the application layer.	CL2
CO2	Explain web page design cycle and identify the various client-side programming languages and interfaces.	CL2
CO3	Summarize the server-side interfaces for serving Web based applications.	CL2
CO4	Use the XML Web standard for promoting automated machine processing.	CL3
CO5	Discuss the advanced, interactive web-based computing applications and systems.	CL2

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2				2					3		
CO2	3	2	2				2					3		
CO3	3	2	2				2					3		
CO4	3	2	2				2					3		
CO5	3	2	2				2					3		
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>						

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT DETAILS**

<b>Continuous Internal Assessment (CIA) (50%)</b>			<b>Semester End Exam (SEE) (50%)</b>	
<b>Continuous Internal Evaluation (CIE) (60%)</b>			<b>Assignment/ Activities (40%)</b>	
<b>I</b>	<b>II</b>	<b>III</b>		



Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. Web Technologies – A Computer Science Perspective – Jeffrey C Jackson [Pearson -2009]
2. E-commerce, Fundamentals and Applications - Henry Chan et al [John Wiley- 2002]
3. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
4. Designing systems for Internet commerce - G. Winfield Treese [Pearson - 2002]
5. The Web Warrior Guide to Web Programming –Bai,Farell et.el

#### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES:)

1. <https://www.azdocuments.in/2021/05/web-technology-and-its-applications.html>



## MOBILE APPLICATION DEVELOPMENT

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	CS322T6CB	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

### CREDITS – 3

#### COURSE PREREQUISITES:

- Fundamentals of Java Programming

#### COURSE OBJECTIVES:

- Learn to setup Android application development environment
- Illustrate user interfaces for interacting with apps and triggering actions
- Interpret tasks used in handling multiple activities
- Identify options to save persistent application data
- Appraise the role of security and performance in Android applications

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE – I

<b>Getting Started with Android Programming:</b> What is Android? Features of Android, Android Architecture, obtaining the required tools, launching your first android application <b>Activities, Fragments and Intents:</b> Understanding activities, linking activities using intents, fragments.	<b>8 Hours</b>
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#### MODULE – II

<b>Getting to know the Android User Interface: Understanding the Components of a Screen:</b> Views and View Groups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView. <b>Adapting to Display Orientation:</b> Anchoring Views. <b>Utilizing the Action Bar:</b> Adding Action Items to the Action Bar.	<b>8 Hours</b>
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#### MODULE – III

<b>Designing User Interface with Views: Using Basic Views:</b> TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews, ProgressBar View. <b>Using Picker Views:</b> TimePicker View, DatePicker View. <b>Using List Views to Display Long Lists:</b> ListView View, Using the Spinner View.	<b>8 Hours</b>
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#### MODULE – IV

<b>Displaying Pictures and Menus with Views: Using Image Views to Display Pictures:</b> ImageView View, ImageSwitcher, GridView. <b>Using Menus with Views:</b> Creating the Helper Methods, Options Menu, Context Menu. <b>Using WebView:</b> WebView.	<b>8 Hours</b>
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**MODULE – V**

<b>Data Persistence: Saving and Loading User Preferences:</b> Accessing Preferences Using an Activity, Programmatically Retrieving and Modifying the Preference Values. <b>Creating and Using Databases:</b> Creating the DBAdapter Helper Class, Using the Database Programmatically.	8 Hours
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Discuss the features, architecture and activities of Android Application Development.	CL2
CO2	Explain the role of various components and action bar in Android Application.	CL2
CO3	Discuss the basic views used in Android application development.	CL2
CO4	Explain the methods involved in handling images and menus in Android platform.	CL2
CO5	Discuss various features available for user data management in Android Application .	CL2

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1		2							1		
CO2	3	2	1		2							1		
CO3	3	2	1		2							1		
CO4	3	2	1		2							1		
CO5	3	2	1		2							1		
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT DETAILS**

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)		
I	II	III			
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage	
40%	30%	30%	100%	100%	
MI			MI	MI	
MII	MII		MII	MII	
	MIII		MIII	MIII	
		MIV	MIV	MIV	
		MV	MV	MV	

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*



### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. J. F. DiMarzio, Beginning Android Programming with Android Studio, 4thEdition, 2017.
2. John Horton, Android Programming for Beginners, 1stEdition, 2015
3. Dawn Griffiths & David Griffiths, Head First Android Development, O'Reilly, 1stEdition, 2015



**UNIX SHELL PROGRAMMING**  
(Effective from the Academic Year 2023 - 2024)  
**III SEMESTER**

Course Code	CS322T6CC	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	12	Exam Hours	01

**CREDITS – 1**

**COURSE PREREQUISITES:**

- Basic Knowledge of C Programming.

**COURSE OBJECTIVES:**

- To help the students to understand effective use of Unix concepts, commands and terminology.
- Identify, access, and evaluate UNIX file system.
- Understand UNIX command syntax and semantics.
- Ability to read and understand specifications, scripts and programs.
- Analyse Facility with UNIX Process.

**TEACHING - LEARNING STRATEGY:**

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Practical Based Learning
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

**Module - I**

**Introduction of UNIX** - Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, and bc.

**Module - II**

**UNIX File System**- The file, what's in a filename? The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system.

**Module - III**

**Basic File Attributes** - Is - l, the -d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find.





**Module - IV**

**Introduction to the Shell Scripting** - Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators && and ||, exit, if, and case conditions, expr, sleep and wait, while, until, for, \$, @, redirection. The here document, set, trap, Sample Validation and Data Entry Scripts.

**Module - V**

**Introduction to UNIX System Process:** Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Know the basics of Unix concepts and commands.	CL3
CO2	Evaluate the UNIX file system.	CL3
CO3	Apply Changes in file system.	CL3
CO4	Understand scripts and programs.	CL3
CO5	Analyze Facility with UNIX system process	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3		3							1		
CO2	3	2	3		3							1		
CO3	3	2	3		3							1		
CO4	3	2	3		3							1		
CO5	3	2	3		3							1		
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>						

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT STRATEGY:**

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).



**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

#### **SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

#### **Text Books:**

1. Unix Concepts & Applications 4th Edition, Sumitabha Das, Tata McGraw Hill
2. Unix Shell Programming, Yashwant Kanetkar
3. Introduction to UNIX by M G Venkatesh Murthy

#### **REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://www.youtube.com/watch?v=ffYUfAqEamY>
2. <https://www.youtube.com/watch?v=Q05NZiYFcD0>
3. <https://www.youtube.com/watch?v=8GdT53KDIyY>
4. <https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo>

#### **Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Real world problem solving using group discussion.
- Real world examples of Linux operating system Utilizations.



## ETHICAL HACKING

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	<b>CS322T6CD</b>	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	<b>40L</b>	Exam Hours	03

### CREDITS – 3

#### COURSE PREREQUISITES:

- Fundamental knowledge of Ethical Hacking.

#### COURSE OBJECTIVES:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

**Introduction to Ethical Hacking:** Ethical Hacking Overview, Role of Security and Penetration Testers, Penetration, Testing Methodologies, Laws of the Land , Overview of TCP/IP, The Application Layer, The Transport Layer, The Internet Layer, IP Addressing, Network and Computer Attacks, Malware, Protecting Against Malware Attacks, Intruder Attacks, Addressing Physical Security.

**8 Hours**

#### MODULE - II

**Foot Printing, Reconnaissance and scanning Networks:** Footprinting Concepts, Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email, Competitive Intelligence, Footprinting through Social Engineering, Footprinting Tools, Network Scanning Concepts, Port-Scanning Tools, Scanning Techniques, Scanning Beyond IDS and Firewall.

**8 Hours**

#### MODULE - III

**Enumeration and Vulnerability Analysis:** Enumeration Concepts, NetBIOS Enumeration, SNMP, LDAP, NTP, SMTP and DNS Enumeration, Vulnerability Assessment Concepts, Desktop and Server OS Vulnerabilities, Windows OS Vulnerabilities, Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities, Vulnerabilities of Embedded Oss.

**8 Hours**

#### MODULE - IV

**System Hacking:** Hacking Web Servers, Web Application Components, Vulnerabilities, Tools for Web Attackers and Security Testers Hacking Wireless Networks, Components of a Wireless Network,

**8 Hours**



Wardriving, Wireless Hacking, Tools of the Trade.														
<b>MODULE - V</b>														
<b>Network Protection Systems:</b> Access Control Lists, Cisco Adaptive Security Appliance Firewall, Configuration and Risk Analysis Tools for Firewalls and Routers, Intrusion Detection and Prevention Systems, Network Based and Host Based IDSs and IPSs, Web Filtering, Security Incident Response Teams, Honey pots.														<b>8 Hours</b>
<b>COURSE OUTCOMES</b>														
Upon completion of this course, the students will be able to:														
<b>CO No.</b>	<b>Course Outcome Description</b>													<b>Bloom's Taxonomy Level</b>
CO1	To express knowledge on basics of computer based vulnerabilities													CL2
CO2	To gain understanding on different foot printing, reconnaissance and scanning methods.													CL2
CO3	To demonstrate the enumeration and vulnerability analysis methods.													CL3
CO4	To gain knowledge on hacking options available in Web and wireless applications.													CL2
CO5	To acquire knowledge on the options for network protection.													CL2
<b>CO-PO-PSO MAPPING</b>														
<b>CO No.</b>	<b>Programme Outcomes (PO)</b>												<b>Programme Specific Outcome (PSO)</b>	
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>1</b>	<b>2</b>
CO1	2	1											1	2
CO2	2	1	3										1	2
CO3	2	1	3										1	1
CO4	2	1	3										1	1
CO5	2	1											1	1
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>						<b>1: Poor (Low)</b>				
<b>ASSESSMENT STRATEGY</b>														
Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:														
<b>Sl. No.</b>	<b>Assessment Description</b>						<b>Weightage (%)</b>				<b>Max. Marks</b>			
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>						<b>100 %</b>				<b>50</b>			
	Continuous Internal Evaluation (CIE)						60 %				30			
	Assignments						40 %				20			
<b>2</b>	<b>Semester End Examination (SEE)</b>						<b>100 %</b>				<b>50</b>			
<b>ASSESSMENT DETAILS</b>														
<b>Continuous Internal Assessment (CIA) (50%)</b>										<b>Semester End Exam (SEE) (50%)</b>				
<b>Continuous Internal Evaluation (CIE) (60%)</b>						<b>Assignment/ Activities (40%)</b>								
<b>I</b>		<b>II</b>		<b>III</b>										
<b>Syllabus Coverage</b>						<b>Syllabus Coverage</b>				<b>Syllabus Coverage</b>				
<b>40%</b>		<b>30%</b>		<b>30%</b>		<b>100%</b>				<b>100%</b>				
MI						MI				MI				
MII		MII				MII				MII				
		MIII				MIII				MIII				
				MIV		MIV				MIV				
				MV		MV				MV				
<i>Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.</i>														



### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

### TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.
4. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. <https://www.hackthebox.com/>
2. <https://www.hackthissite.org/>



## UHV -1: SOCIAL CONNECT AND RESPONSIBILITIES

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	HU32287X	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Have/Develop the critical analysis of the day today happenings.

#### COURSE OBJECTIVES:

This course will enable students to:

- Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
- Provide a formal platform for students to communicate and connect to their surroundings.
- Enable to create a responsible connection with society

#### TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies

### COURSE CONTENTS

#### MODULE - I

**Connectivity with Nature:** Importance of plants, Plantation process, **Plant Development:** Sequence of Plant Development, Factors affecting Plant Development, Practice Problems.

Activity: Self-study on selected plant's origin, its usage in daily life and its appearance in folklore and literature.

**3 Hours**

#### MODULE - II

**Heritage walk and Regional Crafts:** An overview of Heritage, Awareness on Indian Cultural Heritages, Crafts & Heritage, Protective measures for the survival of handicrafts.

Activity: Self-study on selected Heritage and its Inheritance.

**3 Hours**

#### MODULE - III

**Organic farming and waste management:** Introduction of organic farming, study on wet waste management, Effects of organic farming on crop productivity.

**3 Hours**

#### MODULE - IV

**Water Conservation:** Necessity of water conservation, study on water reuse, an overview on rainwater harvesting.

Activity: Documentary or photo blog presenting the current practices.

**3 Hours**

#### MODULE - V



<b>Food Practices:</b> Fast foods - nutritional value, food lore and indigenous materials of the region used in cooking.	<b>3 Hours</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	To understand the social responsibility of individual-Adaptation and Plantation of Tree	CL3
CO2	To know the heritage and holistic places - Heritage walk and crafts corner	CL3
CO3	To understand the importance of Organic farming and waste management	CL3
CO4	To know the importance and necessity of Water Conservation	CL3
CO5	To understand diverse food practices of the region.	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1			1	2	1	2			1		
CO2			1			1	1	1	1			1		
CO3			1			1	2	1				1		
CO4			1			1	2	1				1		
CO5						1	1	1				1		

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

**ASSESSMENT STRATEGY**

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**CO - ASSESSMENT MAPPING**

Course Outcomes	Continuous Internal Assessment (CIA) (50%)					Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Assignment/Activities (40%)		
	I	II	III			
	Syllabus Coverage			Syllabus Coverage		Syllabus Coverage
	40%	30%	30%	100%		100%
CO1	MI			MI	MI	
CO2	MII	MII		MII	MII	
CO3		MIII		MIII	MIII	
CO4			MIV	MIV	MIV	
CO5			MV	MV	MV	

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*



### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Case Studies	25 %	05
3	Seminar/Presentation	25 %	05
4	Peer - to - Peer Learning	25 %	05

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

### SEE Question Paper Pattern:

- The question paper will have **seventy MCQ** questions and **six** main questions.
- Each MCQ questions consisting of 1mark; and main questions of 5 marks.
- Main questions will be asked from all FIVE modules.

### TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.

### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. <https://www.aicteindia.org/sites/default/files/Vol.%20II%20%20AICTE%20UG%20%20Curriculum.>





## DATA ANALYTICS USING EXCEL

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	CS32298CA	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge of Computers.

#### COURSE OBJECTIVES:

- To Apply analysis techniques to datasets in Excel
- Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
- Understand and identify the principles of data analysis
- Become adept at using Excel functions and techniques for analysis
- Build presentation ready dashboards in Excel

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- Any other innovative initiatives with respect to the Course contents

#### LIST OF EXPERIMENTS

Sl. No.	Description
1	Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2	Working with Data: Importing data, Data Entry & Manipulation, Sorting & Filtering.
3	Working with Data: Data Validation, Pivot Tables & Pivot Charts.
4	Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
5	Cleaning Data with Reference Functions: use of UPPER and LOWER, TRIM function, Concatenate.
6	Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7	Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8	Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9	Create worksheet with following fields: Empno, Ename, Basic Pay (BP), Travelling Allowance (TA), Dearness Allowance (DA), House Rent Allowance (HRA), Income Tax (IT), Provident Fund (PF), Net Pay (NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
11	Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details.



	Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
12	Generation of report & presentation using Autofilter & macro.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use advanced functions and productivity tools to assist in developing worksheets	CL2
CO2	Manipulate data lists using Outline and PivotTables	CL3
CO3	Use Consolidation to summarize and report results from multiple worksheets	CL3
CO4	Apply Macros and Auto filter to solve the given real-world scenario	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1																
CO2																
CO3																
CO4																
CO5																

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Problems solved in Competitive Programming websites (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT STRATEGY:**

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)



The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
  2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
  3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. Berk & Carey - Data Analysis with Microsoft® Excel: Updated for Office 2007®, Third Edition, © 2010 Brooks/Cole, Cengage Learning, ISBN-13: 978-0-495-39178-4
2. Wayne L. Winston - Microsoft Excel 2019: Data Analysis And Business Modeling, PHI, ISBN: 9789389347180
3. Aryan Gupta - Data Analysis in Excel: The Best Guide. (<https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel>)



## UI/UX Design

(Effective from the Academic Year 2022 - 2023)

### III SEMESTER

Course Code	CS32298CB	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge of creating Graphical User Interface

#### COURSE OBJECTIVES:

- To provide students with the knowledge of user- centered design, user -centered methods in design, graphic design on screens.
- Learn about the importance of user experience design in the digital world.
- To enable the students to design the user centered design in corporate perspective.
- To give exposure to wire framing and Prototyping software in the various UI/UX Design tools.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### LIST OF EXPERIMENTS

Sl. No	Description	CO
1	Demonstrate the Interface connectivity between two different program modules.	CO1
2	Designing a small calculator app using Figma.	CO2/CO3
3	Create a photo gallery prototype using Figma.	CO2/CO3
4	Create a custom profile card using Figma.	CO2/CO3
5	Build the user interface for calendar application using Adobe XD	CO2/CO3
6	Build the Travel application design using Adobe XD and include animation between contents between different screens.	CO2/CO3

### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate effective and compelling screen based experiences in UI/UX development.	CL4
CO2	Experiment and analyze the various visual design aspects in UI/UX development.	CL4
CO3	Analyze all stages of the UI/UX development process in different tools.	CL4



**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	3				2		3	3	3	3
CO2	3	2	3	2	3				2		3	3	3	3
CO3	3	2	3	2	3				2		3	3	3	3
CO4	3	2	3	2	3				2		3	3	3	3
CO5	3	2	3	2	3				2		3	3	3	3
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT STRATEGY:**

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)  
The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.



3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://help.figma.com/hc/en-us/sections/4405269443991-Figma-for-Beginners-tutorial-4-parts->
2. [https://www.youtube.com/watch?v=HZuk6Wkx\\_Eg](https://www.youtube.com/watch?v=HZuk6Wkx_Eg)
3. <https://www.youtube.com/watch?v=dXQ7IHkTiMM>



**MERN**

(Effective from the Academic Year 2023 - 2024)

**III SEMESTER**

Course Code	CS32298CC	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

**CREDITS – 1**

**COURSE PREREQUISITES:**

- Fundamental Knowledge of HTML, CSS.

**COURSE OBJECTIVES:**

- To design as web page using front end technologies.
- To develop application with server side scripting tools.
- To develop web application with REST APIs and use of framework to communicate client-server applications.
- To build as responsive web application with managing SQL databases.

**TEACHING - LEARNING STRATEGY:**

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

**LIST OF EXPERIMENTS**

Sl. No.	Description
1	Demonstrate React Component Life cycle.
2	Develop React components for a basic frontend application.
3	Simulate the process of establishing communication between the React frontend and Express backend.
4	Demonstrate process of connecting Express application to a MongoDB database and perform database operations.
5	Implement MERN application for user authentication and authorization
6	Demonstrate the Redux integration method for state management in your React application.
7	Build a web application using the Express.js framework.
8	Develop a Node.js application demonstrating handling data I/O (Buffer, Stream, Zlib modules).

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate React Component Life cycle and implement React components for a basic frontend application.	CL3
CO2	Illustrate the process of establishing communication between the React frontend and Express backend.	CL3
CO3	Demonstrate various database operations by connecting Express application to a MongoDB Database.	CL3



CO4	Illustrate MERN application for user authentication and implement Redux integration method for state management.	CL3
CO5	Demonstrate Node.js application and handling I/O data.	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		2				1			2			
CO2	3	2	1		2				1			2			
CO3	3	2	1		2				1			2			
CO4	3	2	1		2				1			2			
CO5	3	2	1		2				1			2			

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT STRATEGY:**

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.





- |  |  |
|--|--|
|  | 4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks. |
|--|--|

	<b>REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):</b>
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- |  |   |
|--|---|
|  | <ol style="list-style-type: none"><li>1. <a href="https://nptel.ac.in/courses/106106156">https://nptel.ac.in/courses/106106156</a></li><li>2. <a href="https://www.coursera.org/learn/introduction-to-front-end-development">https://www.coursera.org/learn/introduction-to-front-end-development</a></li></ol> |
|--|---|



## COMPETITIVE PROGRAMMING USING C++

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	CS32298CD	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge of C.

#### COURSE OBJECTIVES:

- 

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- Any other innovative initiatives with respect to the Course contents

### LIST OF EXPERIMENTS

Sl. No.	Description
1	Introduction to programming in C++: input/output, variables, datatypes, operators (Arithmetic, Assignment Logical, comparison, Bitwise, operator precedence)
2	Conditions, Loop, Functions, Introduction to competitive programming- sample programs
3	Simple programs in C++
4	Standard Template Library: Sequential – Pairs, Programs
5	Standard Template Library: Sequential – Vectors , Programs
6	Standard Template Library: Sequential- Stacks , Programs
7	Standard Template Library: Sequential- Queue, Programs
8	Standard Template Library: Ordered and Unordered Maps, Programs
9	Standard Template Library: Ordered and Unordered – Sets, Programs
10	Recursion, backtracking, Upper Bound, Lower Bound
11	Recursion, backtracking, Upper Bound, Lower Bound
12	Introduction to Classes and objects in C++, Programs



### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Write simple programs in C++ and work with various competitive programming websites	CL2
CO2	Understand and apply Pair, and vectors as a part of the Standard Template Library (STL) in C++ to different problem statements	CL3
CO3	Understand and apply Stacks, and queue as a part of the STL in C++ to different problem statements	CL3
CO4	Understand and apply Maps, and Sets as STL in C++ to different problem statements	CL3
CO5	Understand and apply Object Oriented Concepts in C++, recursion and backtracking	CL2

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	3							2	2	1	3
CO2	3	3	3	1	3							2	2	1	3
CO3	3	3	3	1	3							2	2	1	3
CO4	3	3	3	1	3							2	2	1	3
CO5	3	3	3	1	3							2	2	1	3
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>					

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Problems solved in Competitive Programming websites (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

#### ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).

- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by



considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/>
2. <https://www.youtube.com/playlist?list=PLauivoElc3ggagradg8MfOZreCMmXMmJ->



## UI/UX DESIGN

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	<b>CS32298CB</b>	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge of creating Graphical User Interface

#### COURSE OBJECTIVES:

- To provide students with the knowledge of user-centered design, user-centered methods in design, graphic design on screens.
- Learn about the importance of user experience design in the digital world.
- To enable the students to design the user centered design in corporate perspective.
- To give exposure to wire framing and Prototyping software in the various UI/UX Design tools.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporated for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### LIST OF EXPERIMENTS

Sl. No	Description	CO
1	Demonstrate the Interface connectivity between two different program modules.	CO1
2	Designing a small calculator app using Figma.	CO2/CO3
3	Create a photo gallery prototype using Figma.	CO2/CO3
4	Create a custom profile card using Figma.	CO2/CO3
5	Build the user interface for calendar application using Adobe XD	CO2/CO3
6	Build the Travel application design using Adobe XD and include animation between contents between different screens.	CO2/CO3

### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate effective and compelling screen based experiences in UI/UX development.	CL4
CO2	Experiment and analyze the various visual design aspects in UI/UX development.	CL4
CO3	Analyze all stages of the UI/UX development process in different tools.	CL4



### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	3				2		3	3	3	3
CO2	3	2	3	2	3				2		3	3	3	3
CO3	3	2	3	2	3				2		3	3	3	3
CO4	3	2	3	2	3				2		3	3	3	3
CO5	3	2	3	2	3				2		3	3	3	3
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>						

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

### SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.



3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://help.figma.com/hc/en-us/sections/4405269443991-Figma-for-Beginners-tutorial-4-parts->
2. [https://www.youtube.com/watch?v=HZuk6Wkx\\_Eg](https://www.youtube.com/watch?v=HZuk6Wkx_Eg)
3. <https://www.youtube.com/watch?v=dXQ7IHkTiMM>



**MERN**

(Effective from the Academic Year 2023 - 2024)

**III SEMESTER**

Course Code	<b>CS32298CC</b>	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

**CREDITS – 1**

**COURSE PREREQUISITES:**

- Fundamental Knowledge of HTML, CSS.

**COURSE OBJECTIVES:**

- To design as web page using front end technologies.
- To develop application with server side scripting tools.
- To develop web application with REST APIs and use of framework to communicate client-server applications.
- To build as responsive web application with managing SQL databases.

**TEACHING - LEARNING STRATEGY:**

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

**LIST OF EXPERIMENTS**

<b>Sl. No.</b>	<b>Description</b>
1	Demonstrate React Component Life cycle.
2	Develop React components for a basic frontend application.
3	Simulate the process of establishing communication between the React frontend and Express backend.
4	Demonstrate process of connecting Express application to a MongoDB database and perform database operations.
5	Implement MERN application for user authentication and authorization
6	Demonstrate the Redux integration method for state management in your React application.
7	Build a web application using the Express.js framework.
8	Develop a Node.js application demonstrating handling data I/O (Buffer, Stream, Zlib modules).

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

<b>CO No.</b>	<b>Course Outcome Description</b>	<b>Bloom's Taxonomy Level</b>
CO1	Demonstrate React Component Life cycle and implement React components for a basic frontend application.	CL3
CO2	Illustrate the process of establishing communication between the React frontend and Express backend.	CL3





CO3	Demonstrate various database operations by connecting Express application to a MongoDB Database.	CL3
CO4	Illustrate MERN application for user authentication and implement Redux integration method for state management.	CL3
CO5	Demonstrate Node.js application and handling I/O data.	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1		2				1			2		
CO2	3	2	1		2				1			2		
CO3	3	2	1		2				1			2		
CO4	3	2	1		2				1			2		
CO5	3	2	1		2				1			2		
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT STRATEGY:**

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**



1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://nptel.ac.in/courses/106106156>
2. <https://www.coursera.org/learn/introduction-to-front-end-development>



## COMPETITIVE PROGRAMMING USING C++

(Effective from the Academic Year 2022 - 2023)

### III SEMESTER

Course Code	<b>CS32298CD</b>	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge of C.

#### COURSE OBJECTIVES:

- 

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- Any other innovative initiatives with respect to the Course contents

### LIST OF EXPERIMENTS

Sl. No.	Description
1	Introduction to programming in C++: input/output, variables, datatypes, operators (Arithmetic, Assignment, Logical, comparison, Bitwise, operator precedence)
2	Conditions, Loop, Functions, Introduction to competitive programming- sample programs
3	Simple programs in C++
4	Standard Template Library: Sequential – Pairs, Programs
5	Standard Template Library: Sequential – Vectors , Programs
6	Standard Template Library: Sequential- Stacks , Programs
7	Standard Template Library: Sequential- Queue, Programs
8	Standard Template Library: Ordered and Unordered Maps, Programs
9	Standard Template Library: Ordered and Unordered – Sets, Programs
10	Recursion, backtracking, Upper Bound, Lower Bound
11	Recursion, backtracking, Upper Bound, Lower Bound
12	Introduction to Classes and objects in C++, Programs

### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Write simple programs in C++ and work with various competitive programming websites	CL2



CO2	Understand and apply Pair, and vectors as a part of the Standard Template Library(STL) in C++ to different problem statements	CL3
CO3	Understand and apply Stacks, and queue as a part of the STL in C++ to different problem statements	CL3
CO4	Understand and apply Maps, and Sets as STL in C++ to different problem statements	CL3
CO5	Understand and apply Object Oriented Concepts in C++, recursion and backtracking	CL2

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	3							2	2	1	3
CO2	3	3	3	1	3							2	2	1	3
CO3	3	3	3	1	3							2	2	1	3
CO4	3	3	3	1	3							2	2	1	3
CO5	3	3	3	1	3							2	2	1	3
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>					

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Problems solved in Competitive Programming websites (C)	20 %	10
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT STRATEGY:**

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam, is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators



prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/>
2. <https://www.youtube.com/playlist?list=PLauivoElc3ggagradg8MfOZreCMmXMmJ->



## PRINCIPLES OF ARTIFICIAL INTELLIGENCE

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Course Code	AM422I1A	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

### CREDITS – 4

#### COURSE PREREQUISITES:

- Fundamental knowledge of mathematical concepts, analytical skills and programming.

#### COURSE OBJECTIVES:

- Gain a historical perspective of AI and its foundations.
- Learn the methods of solving problems using AI.
- Learn the knowledge representation techniques, logic concepts and planning.
- Investigate applications of AI techniques in expert systems.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

**Introduction to AI:** Intelligent systems, Foundations and Sub area of AI, Applications, Tic-Tac-Toe Game playing, Currents trend and developments of AI, General problem solving, Characteristics of problem, Constraint satisfaction.

**8  
Hours**

#### MODULE - II

**Search Techniques and Game playing:** Exhaustive searches, Heuristic search techniques, Game playing, Bounded look-ahead strategy, Alpha-beta pruning, Two-player perfect information games.

**8  
Hours**

#### MODULE - III

**Logic concepts and Prolog Programming concepts:** Propositional calculus, Propositional logic, Natural deduction system, Axiomatic system, Semantic tableau system in Propositional logic, Prolog program, Control strategy of prolog, Programming techniques in prolog, List manipulation in prolog, Structuring of data in prolog, Recursive data types in prolog.

**8  
Hours**

#### MODULE - IV

**Planning and Knowledge Representation:** Types of planning systems, Block world problem, Logic based planning, Linear planning using Goal stack, Means-Ends analysis, Approaches to knowledge representation, Knowledge representation using semantic network, Knowledge representation using frames.

**8  
Hours**

#### MODULE - V

**Expert system and Applications:** Phases in building expert systems, Architecture of expert system, Expert system versus traditional systems, Rule-based expert systems, Blackboard systems, Truth maintenance systems, Application of expert systems.

**8  
Hours**

### COURSE OUTCOMES

Upon completion of this course, the students will be able to:



CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the fundamental understanding of AI and its foundations.	CL3
CO2	Apply the knowledge of AI in search techniques and game playing.	CL3
CO3	Demonstrate the Logic concepts and Logic programming in AI.	CL3
CO4	Apply principles of AI in knowledge representation and planning.	CL3
CO5	Apply AI techniques to develop intelligent systems.	CL3

### LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1	Design and implement Tic-Tac-Toe game using Python programming.	CO1	CL3
2	Demonstrate Nim game using Python programming.	CO2	CL3
3	Write a program to implement A* Algorithm.	CO2	CL3
4	Write a python program to demonstrate the working of Alpha-Beta Pruning.	CO2	CL3
5	Demonstrate the Union and Intersection of two fuzzy Sets using python programming.	CO3	CL3
6	Write a program in Prolog to implement simple arithmetic.	CO3	CL3
7	Design and implement a Cross word puzzle using Python programming.	CO4	CL3
8	Demonstrate a simple Chatbot with minimum 10 conversations.	CO5	CL3

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2		2				1	1	1	1		
CO2	3	3	2	1	2					1		1		
CO3	3	3	2		2					1				
CO4	3	3	2		2					1				
CO5	3	3	2		2				1	1		1		
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>						

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)			Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
I	II	III		



Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

**NOTE:**

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

**SEE QUESTION PAPER PATTERN:**

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer **FIVE** full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning India Private Limited, 1<sup>st</sup> Edition, 2011, ISBN: 978-8131510995.
2. Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill Publications, 3rd Edition, 2019, ISBN: 9780070087705.
3. Stuart Jonathan Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Publications, 3<sup>rd</sup> Edition, 2016, ISBN: 9781292153964.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):**

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs56](https://onlinecourses.nptel.ac.in/noc22_cs56)
2. [https://onlinecourses.nptel.ac.in/noc23\\_ge40](https://onlinecourses.nptel.ac.in/noc23_ge40)





## COMPUTER NETWORK AND IT'S APPLICATIONS

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Course Code	AM422I2A	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

### CREDITS – 4

#### COURSE PREREQUISITES:

- Basic knowledge of computer.

#### COURSE OBJECTIVES:

- Demonstration of application layer protocols
- Discuss transport layer services and understand UDP and TCP protocols
- Explain routers, IP and Routing Algorithms in network layer
- Illustrate concepts of Data link Layer, Physical layer and Multimedia Networking
- Describe the concepts of networking over machine learning

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

**Introduction to networks:** Network hardware, Network software, Reference models  
**Principles of Network Applications:** Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. **The Web and HTTP:** Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, **File Transfer:** FTP Commands & Replies, **Electronic Mail in the Internet:** SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages.

**8 Hours**

#### MODULE - II

**Introduction and Transport-Layer Services:** Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, **Principles of Reliable Data Transfer:** Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, **Connection-Oriented Transport TCP:** The TCP Connection, TCP Segment Structure, Round Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management.

**8 Hours**

#### MODULE - III

**The Network layer:** Router Architecture, Input Processing, Switching, Output Processing, Occurrence of Queuing, IPv6, A Brief foray into IP Security, **Routing Algorithms:** The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, **Intra-AS Routing in the Internet:** RIP and OSPF. Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast.  
**Physical Layer:** Guided transmission media, Wireless transmission.

**8 Hours**





CO1	3			1	1						1		
CO2	3	2		1	1						1		
CO3	3	3		1	1						1		
CO4	3	2		1	1						1		
CO5	3	2	1	1	1						1		
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>					

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)		
I	II	III			
Syllabus Coverage			Syllabus Coverage		Syllabus Coverage
40%	30%	30%	100%		100%
MI			MI		MI
MII	MII		MII		MII
	MIII		MIII		MIII
		MIV	MIV		MIV
		MV	MV		MV

#### NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017.
2. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
3. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER
4. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson.
5. Mayank Dave, Computer Networks, Second edition, Cengage Learning

#### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs93/unit?unit=17&lesson=18](https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=17&lesson=18)
2. [https://onlinecourses.nptel.ac.in/noc22\\_cs93/unit?unit=26&lesson=27](https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=26&lesson=27)
3. [https://onlinecourses.nptel.ac.in/noc22\\_cs93/unit?unit=43&lesson=44](https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=43&lesson=44)
4. [https://onlinecourses.nptel.ac.in/noc22\\_cs93/unit?unit=52&lesson=53](https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=52&lesson=53)
5. [https://onlinecourses.nptel.ac.in/noc22\\_cs93/unit?unit=75&lesson=76](https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=75&lesson=76)



## PRINCIPLES OF OPERATING SYSTEMS

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Course Code	AM422T3A	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

### CREDITS – 3

#### COURSE PREREQUISITES(THEORY):

- C Programming, Data Structures, Object Oriented Programming, Computer Organization

#### COURSE OBJECTIVES: The course will enable the student to

- Obtain awareness on various types of operating systems and their structures.
- Understand and implement the concept of Process and threads
- Demonstrate the common synchronization problems arising in the Operating systems and provide solutions to them
- Demonstrate the issue of deadlock and handle them effectively.
- Understand the concept of Memory and demonstrate its management using various strategies.
- Know the various storage mechanisms available and discuss the management of storage space.

#### TEACHING - LEARNING STRATEGY: Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

**Operating Systems and Structures:** Introduction, user view, system view, Single processor systems, multiprocessors systems, clustered systems, multiprogramming and multitasking, dual mode and multimode operations, Distributed systems, Computing environments, Operating System services, System Calls, Linkers and Loader, Operating system design and implementation, Operating System Structures.

**8 Hours**

**Process Management:** Process concept, process state, process control block, context switch; operations on processes, inter process communication.

#### MODULE - II

**Multi-Threaded Programming:** Overview of threads, multithreading models, thread libraries, threading issues.

**8 Hours**

**CPU Scheduling:** Schedulers, Pre-emptive and non-pre-emptive scheduling, dispatcher; Scheduling Criteria.

**Scheduling Algorithms:** FCFS, SJF, SRTF, RR, Priority, HRRN, multi-level feedback Queue scheduling, Multiprocessor scheduling.

#### MODULE - III

**Process Synchronization:** Background, critical section problem, Peterson's solution; synchronization hardware- mutex, semaphores, monitors.

**8 Hours**

**Deadlocks:** System model, necessary conditions for deadlocks, methods for handling deadlocks, deadlock prevention, deadlock avoidance -resource allocation graph algorithm, banker's algorithm, deadlock detection, recovery from deadlock

#### MODULE - IV



<p><b>Memory Management:</b> Background, contiguous memory allocation, paging, swapping.</p> <p><b>Virtual Memory Management:</b> Background; demand paging: copy-on-write; page replacement algorithms - FIFO, Optimal, LRU; thrashing</p> <p><b>File System Interface and Operations:</b> Access methods, Directory structures, Protection, File system structure, Directory implementation, Allocation methods, Free space management.</p>	<b>8 Hours</b>
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**MODULE - V**

<p><b>Storage Management and Security:</b> Mass storage structures; Disk scheduling algorithms, Swap space management.</p> <p><b>Protection:</b> Goals, Principles and Domains of protection, Access matrix, Implementation of access matrix, Revocation of access rights, Access control.</p>	<b>8 Hours</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate the operating system and its components. Demonstrate the concept of process and inter-process communication.	CL3
CO2	Discuss the concepts of multi-threading and demonstrate various CPU scheduling algorithms by considering different scheduling criteria.	CL3
CO3	Illustrate the process synchronization, its classical issues and provide solutions to them. Discuss the concepts of deadlock and provide various strategies for handling them.	CL3
CO4	Discuss the concept of memory management and highlight the suitable memory management strategy. Demonstrate the working of various page replacement algorithms and file system operations.	CL3
CO5	Discuss the structure of mass storage devices and demonstrate various disk scheduling techniques. Summarize the concept of OS protection.	CL3

**CO-PO-P SO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	1	1			1	2	1		2		
CO2	3	3	3	2	1			1	2	1		2		
CO3	3	3	3	2	1			1	2	1		2		
CO4	3	3	3	2	1			1	2	1		2		
CO5	3	3	3	3	2			1	2	1		2		
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>						

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT DETAILS**



Continuous Internal Assessment (CIA) (50%)			Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

### TEXT BOOKS:

- Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", 10th edition, Wiley-India, 2021
- M. Morris Mano, "Computer System Architecture", PHI, 3rd Edition.
- Ann McHoes, Ida M Fylnn, "Understanding Operating System", Cengage Learning, 6th Edition
- D.M Dhamdhare, "Operating Systems: A Concept Based Approach", 3rd Edition, McGraw- Hill, 2013.
- P.C.P. Bhatt, "An Introduction to Operating Systems: Concepts and Practice", 4th Edition, PHI(EEE), 2014.
- William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson.

### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

- <https://www.geeksforgeeks.org/operating-systems/>
- [https://www.youtube.com/watch?v=RozoeWzT7IM&list=PLdo5W4Nhv31a5ucW\\_S1K3-x6ztBRD-PNa](https://www.youtube.com/watch?v=RozoeWzT7IM&list=PLdo5W4Nhv31a5ucW_S1K3-x6ztBRD-PNa)
- [https://en.wikipedia.org/wiki/Operating\\_system](https://en.wikipedia.org/wiki/Operating_system)
- <https://www.youtube.com/watch?v=By6lWjiPpVI&list=PLG9aCp4uE-s17rFjWM8KchGlfXgOzzVP>
- <https://www.youtube.com/watch?v=bkSWJJZNgf8&list=PLxCzCOWd7aiGz9donHRrE9I3Mwn6XdP8>



**DESIGN AND ANALYSIS OF ALGORITHMS**  
**(Effective from the Academic Year 2023 - 2024)**  
**SEMESTER - IV**

Course Code	CS422T4C	CIA Marks	<b>50</b>
Number of Contact Hours/Week (L:T:P:S)	<b>3:0:0:2</b>	SEE Marks	<b>50</b>
Total Hours of Pedagogy	<b>40 L + 20 S</b>	Exam Hours	<b>3 Hours</b>

**CREDITS – 3**

**Prerequisites:**

- Fundamental knowledge of Mathematics, Data Structures.

**Course Objectives:**

This course will enable students to:

- Describe the techniques for analyzing algorithms and how to evaluate their performance. Indicate the effectiveness of the method using asymptotic notations.
- Utilize algorithm design techniques including the brute force approach, greedy approach, divide-and-conquer strategy, decrease-and-conquer strategy, transform-and-conquer strategy, dynamic programming, backtracking, and branch-and-bound to solve issues.
- Decide on the best data structure and algorithm design technique for the given application.
- Recognize the fundamental ideas behind NP-complete and NP-hard class issues.

**Teaching - Learning Strategy:**

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

**COURSE CONTENTS**

**MODULE - 1**

<b>Module Contents</b>	<b>Lecture Hours</b>
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<p><b>Introduction to Algorithms-</b> Properties, Specification, Fundamentals of Algorithmic Problem solving, Analysis Framework.</p> <p><b>Performance Analysis:</b> Estimating Space complexity and Time complexity of algorithms. Asymptotic Notations with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.</p> <p><b>Brute force design techniques:</b> Selection sort, sequential search and String-matching algorithm with complexity Analysis.</p>	<b>8 Hours</b>
<b>MODULE - 2</b>	
<p><b>Divide and Conquer:</b> General method, Recurrence equation for divides and conquers, solving it using Master's theorem. , Divide and Conquer algorithms and complexity Analysis of Finding the maximum &amp; minimum, Binary search, Merge sort, Quick sort.</p> <p><b>Decrease and Conquer Approach:</b> Introduction, Insertion sort, Topological Sorting and efficiency analysis.</p>	<b>8 Hours</b>
<b>MODULE - 3</b>	
<p><b>Greedy Method:</b> General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines, Minimum cost spanning tree algorithms: Prim's Algorithm, Kruskal's Algorithm. <b>Single source shortest paths:</b> Dijkstra's Algorithm. <b>Optimal Tree problems:</b> Huffman Trees and Codes. <b>Transform and Conquer Approach:</b> Heaps and Heap Sort.</p>	<b>8 Hours</b>
<b>MODULE - 4</b>	
<p><b>Dynamic Programming:</b> General method with Examples, Multistage Graphs.</p> <p><b>Transitive Closure:</b> Warshall's Algorithm. All Pairs Shortest Paths: Floyd's Algorithm, Knapsack problem, Optimal Binary Search Trees, Travelling Sales Person problem.</p> <p><b>Space-Time Tradeoffs:</b> Sorting by Counting, Input Enhancement in String Matching Harspool's algorithm.</p>	<b>8 Hours</b>
<b>MODULE - 5</b>	
<p><b>Backtracking:</b> General method, N-Queens problem, Sum of subsets problem, Hamiltonian cycles Problems.</p> <p><b>Branch and Bound:</b> Basic concepts, Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem.</p> <p><b>NP-Complete and NP-Hard problems:</b> Basic concepts, non-deterministic algorithms, P, NP,</p>	<b>8 Hours</b>





NP-Complete, and NP-Hard classes.															
<b>COURSE OUTCOMES</b>															
Upon completion of this course, the students will be able to:															
<b>CO No.</b>	<b>Course Outcome Description</b>												<b>Bloom's Taxonomy Level</b>		
CO1	Solve the time complexity of recursive, non-recursive and brute force algorithms using asymptotic notations.												CL3		
CO2	Solve the recurrence relation to obtain the performance of divide-and-conquer, decrease-and conquer approach.												CL3		
CO3	Apply greedy technique, transform and conquer strategy to solve the problem for optimal solution.												CL3		
CO4	Determine the time complexity for Dynamic-Programming paradigm and String-matching techniques.												CL3		
CO5	Apply backtracking and branch-and-bound approach on combinatorial problems and categorize algorithms as P, NP, NP-complete and NP-hard classes.												CL3		
<b>CO-PO-PSO MAPPING</b>															
<b>CO No.</b>	<b>Programme Outcomes (PO)</b>												<b>Programme Specific Outcome (PSO)</b>		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3	3	2	1		1						3			
CO2	3	3	2	1		1						3			
CO3	3	3	3	1		1						3			
CO4	3	3	3	1		1						3			
CO5	3	3	3	1		1						3			
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>						
<b>CO - Assessment Mapping:</b>															
<b>Course Outcomes</b>			<b>Continuous Internal Assessment (CIA) (50%)</b>									<b>Semester End Exam (SEE)</b>			



	<b>Continuous Internal Evaluation (CIE)</b> <b>(60%)</b>			<b>Assignment/ Activities</b>  <b>(40%)</b>	<b>(50%)</b>
	<b>I</b>	<b>II</b>	<b>III</b>		
	<b>Syllabus Coverage</b>				
	<b>40%</b>	<b>30%</b>	<b>30%</b>	<b>100%</b>	<b>100%</b>
CO1	x			x	x
CO2	x			x	x
CO3		x		x	x
CO4		x	x	x	x
CO4			x	x	x

**Assessment Strategy:**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CI)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments*	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**Assignment Types:**

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Field Visits/Survey/Case Studies	50 %	10
4	Model / Prototype Development	100 %	20
5	Project Based Learning		
6	Seminar/Presentation	25 %	5
7	Peer - to -Peer Learning	25 %	5

**SEE Question Paper Pattern:**



- The question paper will have **TEN** full questions.
- Each full question consisting of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

#### **Reference Books:**

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 3rd Edition, Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, Universities Press.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
4. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).

#### **Reference Web Links and Video Lectures (e - Resources):**

1. [https://www.youtube.com/watch?v=gY0MwGLq9W8&list=PLyqSpQzTE6M9DKhN7z2fOpKTJWu-639\\_P](https://www.youtube.com/watch?v=gY0MwGLq9W8&list=PLyqSpQzTE6M9DKhN7z2fOpKTJWu-639_P)
2. <https://www.youtube.com/watch?v=5Y8Lfsreeck&list=PL7DC83C6B3312DF1E>
3. [https://www.youtube.com/watch?v=S47aSEqm\\_0I&list=PLgj\\_V-ZKxRKrxgFyOutPjpoLFBaQMOpK-](https://www.youtube.com/watch?v=S47aSEqm_0I&list=PLgj_V-ZKxRKrxgFyOutPjpoLFBaQMOpK-)



**DESIGN AND ANALYSIS OF ALGORITHMS LAB**  
**(Effective from the Academic Year 2023 -2024)**  
**SEMESTER - IV**

Course Code	CS422L5C	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	0:0:2:1	SEE Marks	50
Total Hours of Pedagogy	24 P+ 12 S	Exam Hours	3 Hours

**CREDITS –1**

**Prerequisites:**

- Knowledge of Mathematics, Data Structures and java Programming
- Usage of IDEs Eclipse, Netbeans and VS studio

**Course Objectives:**

This course will enable students to:

- Design, analyze, and implement various algorithms in Java
- Make use of different algorithmic design techniques to solve problems.
- Analyze and contrast the effectiveness of various algorithms.

**Descriptions:**

Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

**Algorithm Implementation using Python Programming (Max. Marks: 50)**

- Design, develop, and implement the specified algorithms using java Programming under LINUX/Windows environment.

**LIST OF EXPERIMENTS**

Exp. No.	Experiment Description
1	Design an application to create a list of TV channels (minimum 10) that includes the numbers of viewers and viewing time. Rate the channels based on the number of viewers (1 High - 6 low). Plot graphs to analyze the running times of different sorting algorithms.



2	Design and implement an application that considers the problem of scheduling $n$ jobs of known durations $t_1, t_2, \dots, t_n$ for execution by a single processor. The jobs can be executed in any order, one job at a time. Find and display the schedule that minimizes the total time spent by all the jobs in the system by maximizing the profit.
3	Develop an optimal route for a scenario where a person wants to buy a ticket to a baseball game. Along the way from the house to reaching the destination, some known person who lives on that street might give money. Visit towns for the collection of more money to buy a ticket.
4	Design an application for a thermal power station and electrical lines that are connected among various power stations. The costs of electrification involved appear as weights on the edges. Obtain the minimum possible connection among the thermal stations so that any two thermal stations can be linked with the minimum cost involved.
5	Develop a program for the following: a. To construct a Huffman code for a given English text and encode it. b. To decode an English text which has been encoded with a Huffman code?
6	The owner of a gourmet coffee shop wishes to mix a 10-pound bag of coffee using various types of coffee beans in such a way to produce the coffee blend at the maximum cost. The weights of the objects in the problem correspond to the quantity in pounds available of each type of coffee bean. The value of each quantity of coffee beans is the total cost of that quantity in rupees. Apply the Knapsack algorithm to maximize the profit.
7	Design an application for drilling an optimal printed circuit board. To drill two holes of different diameters consecutively, the head of the machine has to move to a toolbox and change the drilling equipment. This is quite time consuming. Thus, it is clear that one has to choose some diameter, drill all holes of the same diameter, change the drill, drill the holes of the next diameter, etc. Thus, this drilling problem has to minimize the travel time for the machine head. Find the optimal time to drill the circuit board.
8	Design and implement Java Program to find all Hamiltonian Cycles in a connected undirected Graph $G$ of $n$ vertices using backtracking principle.
9	Design and implement for a given chess board having $N \times N$ cells, place $N$ queens on the board in such a way that no queen attacks any other queen. If it is possible to place all the $N$ queens in such a way that no queen attacks another queen, then print $N$ lines having $N$ Queens. If there is more than one solution of placing the queens, print all of them. If it is not possible to place all $N$ queens in the desired way, then print "Not possible".



### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Implement Python data structures – lists, tuples & dictionaries to represent compound data.	CL3
CO2	Design, analyze and implement the brute force, divide and conquer algorithms and compare their time complexity.	CL4
CO3	Design and implement the greedy technique algorithms to solve the problem for optimal solution.	CL3
CO4	Apply dynamic programming techniques to solve Traveling Salesperson Problem and Knapsack problem.	CL3

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	1	3			2	2	1	2	2		
CO2	3	3	3	1	3			2	2	1	2	2		
CO3	3	3	3	1	3			2	2	1	2	2		
CO4	3	3	3	1	3			2	2	1	2	2		
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

**Assessment Strategy:**

- Assessment will be both CIA and SEE.
- All laboratory experiments should be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Lab test should be conducted for 25 Marks.
- Marks Distribution: Procedure + Conduction + Viva = 05 + 15 + 05 = 25 Marks.
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.



Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Weekly Assessment	50 %	25
	Lab Test	50 %	25
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**Learning Resources:**

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 3rd Edition, Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, Universities Press.

**Reference Web Links and Video Lectures (e - Resources):**

1. <https://nptel.ac.in/courses/106106182>.



## MATHEMATICS FOR MACHINE LEARNING

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

<b>Course Code</b>	<b>MA422T6AA</b>	<b>CIA Marks</b>	<b>50</b>
<b>Number of Contact Hours/Week (L:T:P:S)</b>	<b>3:0:0:1</b>	<b>SEE Marks</b>	<b>50</b>
<b>Total Hours of Pedagogy</b>	<b>40 L</b>	<b>Exam Hours</b>	<b>3 Hours</b>

**CREDITS – 3**

#### **COURSE PREREQUISITES:**

Fundamentals of Statistics, Linear algebra and Vector algebra.

#### **COURSE OBJECTIVES:**

- Enable the students to understand the advance concepts of Linear algebra
- Familiarize the importance of vector calculus associated with one variable and two variables for engineering.
- Understand the concept of probability and enable the students to predict the outcome of simple experiments
- Understand the concept of optimization techniques

#### **TEACHING - LEARNING STRATEGY:**

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

### **COURSE CONTENTS**

#### **Module – 1**

**Linear Algebra-Part1:** Linear Transformations. Matrix representation of Linear transformation. Change of Basis theorem related problems. Kernel and Image of Linear Transformation Rank-Nullity Theorem and Problems, Applications of Linear Algebra.

**8 Hours**

#### **Module – 2**

**Linear Algebra-Part2:** Inner product spaces. Norm of a vector, Orthogonality, Orthonormal Basis, Construction of orthonormal basis using Gram-Schmidt orthogonalization. Orthogonal Complement Rotations, Projections.

**8 Hours**

#### **Module – 3**

**Vector Calculus:** Introduction, Differentiation of Uni-variate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation.

**8 Hours**

#### **Module – 4**

**Probability and Distribution:** Probability concepts, Conditional probability, Bayes' Theorem, Discrete and Continuous Random Variables and Distributions, Expectation and its Interpretations, Standard discrete and continuous distribution functions, Central Limit theorem.

**8 Hours**



<b>Module – 5</b>															
<b>Optimization:</b> Introduction, Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization.														<b>8 Hours</b>	
<b>COURSE OUTCOMES</b>															
Upon completion of this course, the students will be able to:															
<b>CO No.</b>	<b>Course Outcome Description</b>												<b>Bloom's Taxonomy Level</b>		
CO1	Employ foundational concepts of linear transformation to data science tasks, in dimensional reduction.												CL3		
CO2	Apply advanced linear algebra concepts to analyze data, perform dimensional reduction, and optimize machine learning models.												CL3		
CO3	Illustrate advanced vector calculus techniques, including gradients and back propagation, to optimize machine learning algorithms in data science.												CL3		
CO4	Determine advanced probability model for machine learning algorithms and predictive analytics.												CL3		
CO5	Establish optimization techniques, including gradient descent, Lagrange multipliers, and convex optimization, in machine learning models												CL3		
<b>CO-PO-PSO MAPPING</b>															
<b>CO No.</b>	<b>Programme Outcomes (PO)</b>												<b>Programme Specific Outcome (PSO)</b>		
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>CO1</b>	3	2			1			1	1			1			
<b>CO2</b>	3	2		1					1	1		1			
<b>CO3</b>	3	1						1				1			
<b>CO4</b>	2	3		1		1				1		1			
<b>CO5</b>	3	3	2		1	1		1				1			
<b>3: Substantial (High)</b>				<b>2: Moderate (Medium)</b>				<b>1: Poor (Low)</b>							
<b>ASSESSMENT STRATEGY</b>															
Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:															
<b>Sl. No.</b>	<b>Assessment Description</b>				<b>Weightage (%)</b>				<b>Max. Marks</b>						
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>				<b>100 %</b>				<b>50</b>						
	Continuous Internal Evaluation (CIE)				60 %				30						
	Assignments				40 %				20						
<b>2</b>	<b>Semester End Examination (SEE)</b>				<b>100 %</b>				<b>50</b>						
<b>ASSESSMENT DETAILS</b>															
<b>Continuous Internal Assessment (CIA) (50%)</b>												<b>Semester End Exam (SEE) (50%)</b>			
<b>Continuous Internal Evaluation (CIE) (60%)</b>						<b>Assignment/ Activities (40%)</b>									
<b>I</b>		<b>II</b>		<b>III</b>											
<b>Syllabus Coverage</b>						<b>Syllabus Coverage</b>						<b>Syllabus Coverage</b>			
<b>40%</b>		<b>30%</b>		<b>30%</b>		<b>100%</b>		<b>100%</b>		<b>100%</b>		<b>100%</b>			
<b>MI</b>						<b>MI</b>				<b>MI</b>					

MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
2. David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
3. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
4. B.V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
5. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
6. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co., Newyork, 6th Ed., 2017.

#### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. <https://www.youtube.com/watch?v=8Kg21jBCm-k>
2. <https://www.youtube.com/watch?v=Wa6kaCwyYRk>
3. <http://nptel.ac.in/courses.php?disciplineID=111>
4. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
5. <http://academicearth.org/>
6. <http://www.bookstreet.in>
7. VTU e-Shikshana Program



## REGRESSION STATISTICAL COMPUTING

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Course Code	MA422T6CB	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40 L	Exam Hours	3 Hours

### CREDITS – 3

**COURSE PREREQUISITES:** Basic knowledge of statistics and programming.

#### COURSE OBJECTIVES:

- Understand the fundamentals of regression analysis and its application in statistical computing.
- Develop proficiency in implementing regression models, assessing model fit, and interpreting results.
- Apply regression techniques to real-world datasets, solving complex problems in data analysis and prediction.

#### TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

### COURSE CONTENTS

#### MODULE - I

<b>Introduction to Regression Analysis:</b> Basics of regression analysis. Simple linear regression model. Assumptions, Estimation of model parameters, least squares method, Difference between descriptive and inferential statistics. Regression, Dependent and independent variables.	<b>8 Hours</b>
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#### MODULE - II

<b>Simple Linear Regression:</b> least squares method, Interpretation of Regression coefficient properties Correlation-Karl Pearson's coefficient of correlation regression analysis-lines of regression. Fitting of first and second-degree curve, exponential curve by the method of least squares after logarithmic transformation.	<b>8 Hours</b>
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#### MODULE - III

<b>Multivariate data analysis 1:</b> Multiple linear regression (3 variables only), Assumption, Estimation of Regression by least squares method. Estimation of regression coefficients. Partial, multiple correlation coefficients. Coefficient of Determination ( $R^2$ )	<b>8 Hours</b>
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#### MODULE - IV

<b>Multivariate Data Analysis 2 -</b> (Description of various multivariate methods to be given) Logistic regression, Factor Analysis, Structural Equation Modelling, Cluster Analysis, Discriminant Analysis, conjoint analysis, Correspondence Analysis	<b>8 Hours</b>
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#### MODULE – V



<b>Statistical Computing:</b> Packages, GGplot2 package, Likert package, correlation and regression analysis (bivariate and multivariate data), polynomial regression	<b>8 Hours</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply regression analysis to solve complex computer science problems.	CL3
CO2	Use statistical software tools proficiently for data analysis and modeling.	CL2
CO3	Interpret and communicate results effectively.	CL3
CO4	Apply regression techniques to enhance decision-making and prediction in computer science.	CL3
CO5	Demonstrate critical thinking and problem-solving skills in practical applications	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	1		1		1								
CO2	3	3	2		1						1	1			
CO3	3	2			1					1		1			
CO4	3	2			2		1					1			
CO5	3	3	2		1		1				1				
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>					

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT DETAILS**

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)	
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)		
I	II	III			
<b>Syllabus Coverage</b>			<b>Syllabus Coverage</b>		<b>Syllabus Coverage</b>
<b>40%</b>	<b>30%</b>	<b>30%</b>	<b>100%</b>		<b>100%</b>
MI			MI		MI
MII	MII		MII		MII
	MIII		MIII		MIII
		MIV	MIV		MIV
		MV	MV		MV

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the*



*assignments.*

**ASSIGNMENT TYPES WITH WEIGHTAGES**

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

**SEE QUESTION PAPER PATTERN:**

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Gupta, S. C., & Kapoor, V. K. (2002). Fundamental of Mathematical Statistics. Sultan Chand & sons.
2. Joseph Hair, F., William Black, C., Barry Babin, J., & Rolph Anderson, E. (2010). Multivariate Data Analysis, Seventh edition. Pearson Prentice Hall.
3. Kothari, C. R. (2004). Research methodology. New Age International Publishers.
4. Levin, R. (2013). Statistics for Management. Prentice Hall India.
5. Medhi, J. (2006). Statistical Methods: An Introductory Text. New Age International(P) Limited, New delhi.
6. Montgomery, D. C. (2007). Introduction to Linear Regression analysis. John Wiley & sons.
7. Mukhopadhyay, P. (2000). Mathematical Statistics. Books & Allied Pvt. Ltd.
8. Robert Kabacoff, I. (2015). R in Action - Data Analysis and Graphics with R, second edition. dreamtech Press.
9. Sudha Purohit, G., Sharad Gore, D., & Shailaja Deshmukh, R. (2008). Statistics Using R. Narosa Publishing House.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):**

1. <https://www.youtube.com/watch?v=8Kg21jBCm-k>
2. <https://www.youtube.com/watch?v=Wa6kaCwyYRk>
3. <http://nptel.ac.in/courses.php?disciplineID=111>
4. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
5. <http://academicearth.org/>
6. <http://www.bookstreet.in>.
7. VTU e-Shikshana Program



## OPTIMIZATION TECHNIQUES

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Subject code	MA422T6CC	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40 L	Exam Hours	3 Hours

### CREDITS – 3

#### COURSE PREREQUISITES:

Basics of Statistics, Probability distributions. Multiple integration

#### COURSE OBJECTIVES:

- Study the techniques of complex variables and functions together with their derivatives, Contour integration and transformations
- Enable the students to apply basic concepts of graph theory on developing algorithms
- Understand the concept of probability and enable the students to predict the outcome of simple experiments
- Enable the students to use various tests of significance in engineering problems
- Understand the concept of optimization techniques

#### TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

### COURSE CONTENTS

#### MODULE - I

<b>Joint Probability Distribution Functions:</b> Discrete and Continuous Random variables, Probability mass function, Probability density functions. Cumulative distribution functions.  Lab Components: Finding joint Probability using R-software	<b>8 Hours</b>
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#### MODULE - II

<b>Stochastic Process and Estimation:</b> Regular stochastic matrices. Transition Probability matrices. Markov Process. Estimation of Parameters, Interval Estimation, Central Limit Theorem. Maximum Likelihood functions.	<b>8 Hours</b>
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#### MODULE - III

<b>Linear Programming Problem:</b> Components of LPP, Characteristics of LPP Advantages of LPP Simplex method, Big M method, Duality in LPP.  Lab Components: Solving LPP using R-software	<b>8 Hours</b>
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#### MODULE - IV

<b>Transportation and Assignment Problem:</b> Balanced TP. Components of TP, Northwest corner method. Least. cost cell method. Objectives of AP. Hungarian method of solving AP.	<b>8 Hours</b>
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#### MODULE – V



<b>Game Theory:</b> Introduction of game theory, Two-person zero sum game with two or more number of players. Payoff matrix. Optimal strategy. Minimax-Maxmin Principle .Games with and without Saddle point.	<b>8 Hours</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate random variables and Joint probability distribution functions to analyse the probability models in engineering field.	CL3
CO2	Construct Markov models to predict probability for a problem statement.	CL3
CO3	Solve Linear Programming Problem to get optimal solutions of a Mathematical model.	CL3
CO4	Ability to solve balanced Transportation and Assignment problems	CL3
CO5	Develop the technique of best strategic planning using Game theory.	CL3

**CO-PO-PSO MAPPING**

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		1	2					1		1			
CO2	2	3			1				1	1		1			
CO3	3	3	1	1				1							
CO4	3	3	1	1	1				1			1			
CO5	3	3		1				1	1						

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

**ASSESSMENT STRATEGY**

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

**ASSESSMENT DETAILS**

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)		
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)			
I	II	III				
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage		
<b>40%</b>	<b>30%</b>	<b>30%</b>	<b>100%</b>	<b>100%</b>		
MI			MI	MI		
MII	MII		MII	MII		
	MIII		MIII	MIII		
		MIV	MIV	MIV		
		MV	MV	MV		

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the*



*appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. V.K Kapoor and S.C Gupta "Mathematical Statistics" 11<sup>th</sup> edition, S. Chand Publications
2. 2.B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
3. C Ray Wylie, Louis C Barrett: "Advanced Engineering Mathematics", 6th Edition,
4. B.V Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill,
5. Dr. K. Chandrashekar: " Complex analysis, Probability and Statistical Methods" Sudha Publications,2021

#### REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. <https://www.youtube.com/watch?v=8Kg21jBCm-k>
2. <https://www.youtube.com/watch?v=Wa6kaCwyYRk>
3. <http://nptel.ac.in/courses.php?disciplineID=111>
4. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
5. <http://academicearth.org/>
6. <http://www.bookstreet.in>.
7. VTU e-Shikshana Program





## METRIC SPACES

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

<b>Course Code</b>	<b>MA422T6CD</b>	<b>CIA Marks</b>	<b>50</b>
<b>Number of Contact Hours/Week (L:T:P:S)</b>	<b>3:0:0:1</b>	<b>SEE Marks</b>	<b>50</b>
<b>Total Hours of Pedagogy</b>	<b>50 L</b>	<b>Exam Hours</b>	<b>3 Hours</b>

### CREDITS – 3

#### COURSE PREREQUISITES:

Basic knowledge of Set theory and Group theory

#### COURSE OBJECTIVES:

Introduce computer engineering students to metric theory, emphasizing its application in analyzing and optimizing data structures, algorithms, and network performance.

#### TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

### COURSE CONTENTS

#### MODULE - I

<b>Introduction to Metric Spaces:</b> Definition of metric space. Examples of metric spaces. Metrics and Distance Functions: Properties of metrics. Common distance functions. Open and Closed Sets, Definitions and properties.	<b>8 Hours</b>
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#### MODULE - II

<b>Topology of a Metric Space:</b> Topological concepts, Convergence and Limit Points, Convergence of sequences and series. Limit points, limit set. <b>Continuity in Metric Spaces:</b> Continuous functions in metric spaces. Properties of continuous functions.	<b>8Hours</b>
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#### MODULE - III

<b>Compactness and Completeness:</b> Connectedness, separated sets, Connected and disconnected sets, Components of metric spaces, Connectedness of product of connected metric spaces. Bounded sets and Compactness, Other Characterizations of Compactness, Continuous Functions on Compact Spaces, Locally Compact Spaces.	<b>8 Hours</b>
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#### MODULE - IV

<b>Cauchy Sequences and Completeness:</b> Cauchy sequences and completeness. Applications in analysis. <b>Compactness and Bolzano-Weierstrass Theorem:</b> Bolzano-Weierstrass theorem. Compactness and its applications.	<b>8 Hours</b>
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#### MODULE - 5



<b>Applications in Computer Networks:</b> Routing algorithms using metrics. Latency and distance metrics in network design. Metric Spaces in Geometry and Graphics: Geometric interpretations of metric spaces. Graphics algorithms and spatial metrics.	<b>8 Hours</b>
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### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Describe Metric space concepts in computer science engineering, enhancing problem-solving skills and algorithm optimization.	CL2
CO2	Apply topological concepts and continuous functions in metric spaces to enhance problem-solving skills in computer science.	CL3
CO3	Demonstrate compactness and apply concepts of Metric space to optimize network design and data compression.	CL3
CO4	Apply Cauchy sequences, completeness, and compactness to solve problems in mathematical analysis and optimization."	CL3
CO5	Interpret routing algorithms' effectiveness through metrics in computer network design, enhancing network performance and reliability."	CL3

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		1							1		1			
CO2	2	2	1				1			2		1			
CO3	2	2										1			
CO4	2	2					1					1			
CO5	3	2	2	1	2			1				1			
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>					

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)		
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)			
I	II	III				
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage		
<b>40%</b>	<b>30%</b>	<b>30%</b>	<b>100%</b>	<b>100%</b>		
MI			MI	MI		
MII	MII		MII	MII		
	MIII		MIII	MIII		
		MIV	MIV	MIV		
		MV	MV	MV		



*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

#### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

#### SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer **FIVE** full questions, selecting one full question from each module.

#### TEXT BOOKS:

1. Elements of Real Analysis, Shanti Narayan, Dr. M.D. Raisinghania, (2016)
2. Topology of Metric Spaces by S. Kumareshan, Alpha Science International Limited (2005)
3. Metric Spaces by Satish Shirali and Harikrishan L Vasudeva Springer, (2006)
4. Metric Spaces by P.K. Jain and Khalil Ahmad, Alpha Science International, (2004)
5. Elements of Metric spaces by M.N. Mukherjee, Academic Publishers (2005)



## GitHub : AI-Powered Developer Platform

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	CS42297CA	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge of Programming.

#### COURSE OBJECTIVES:

- To familiar with basic command of Git
- To create and manage branches
- To understand how to collaborate and work with Remote Repositories
- To familiar with version controlling commands

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Practical Based Learning
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### List of Experiments

Sl. No.	
1	<b>Setting Up and Basic Commands</b> Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
2	<b>Creating and Managing Branches</b> a) Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master." b) Write the commands to stash your changes, switch branches, and then apply the stashed changes.
3	<b>Collaboration and Remote Repositories</b>



	<p>a) Clone a remote Git repository to your local machine.</p> <p>b) Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.</p> <p>c) Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.</p>
4	<p><b>Git Tags and Releases</b></p> <p>Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.</p>
5	<p><b>Advanced Git Operations</b></p> <p>Write the command to cherry-pick a range of commits from "source-branch" to the current branch.</p>
6	<p><b>Analysing and Changing Git History</b></p> <p>a) Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?</p> <p>b) Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."</p> <p>c) Write the command to display the last five commits in the repository's history.</p> <p>d) Write the command to undo the changes introduced by the commit with the ID "abc123".</p>

### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use the basics commands related to git repository	CL3
CO2	Create and manage the branches	CL3
CO3	Apply commands related to Collaboration and Remote Repositories	CL3
CO4	Use the commands related to Git Tags, Releases and advanced git operations	CL3
CO5	Analyse and change the git history	CL3

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3		3							1		
CO2	3	2	3		3							1		
CO3	3	2	3		3							1		
CO4	3	2	3		3							1		
CO5	3	2	3		3							1		

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25



	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

#### **ASSESSMENT STRATEGY:**

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

#### **SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

#### **Suggested Learning Resources:**

- Version Control with Git, 3rd Edition, by Prem Kumar Ponuthurai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.



- Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, <https://gitcm.com/book/en/v2>
- [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_0130944433473699842782\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944433473699842782_shared/overview)
- [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01330134712177459211926\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330134712177459211926_shared/overview)



## DEVOPS

(Effective from the Academic Year 2023 - 2024)

### III SEMESTER

Course Code	<b>CS42297CB</b>	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Fundamental Knowledge of Unix Commands

#### COURSE OBJECTIVES:

- To design web pages Using Jenkins, Git, and Local HTTP Server
- To implement GitHub and GitLab Operations
- Demonstrate Infrastructure as Code (IaC) with Terraform.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### LIST OF EXPERIMENTS

Sl. No.	Description
1	Applying CI/CD Principles to Web Development Using Jenkins, Git, and Local HTTP Server
2	Exploring Git Commands through Collaborative Coding.
3	Implement GitHub Operations
4	Implement GitLab Operations
5	Exploring Containerization and Application Deployment with Docker
6	Applying CI/CD Principles to Web Development Using Jenkins, Git, using Docker Containers
7	Create the GitHub Account to demonstrate CI/CD pipeline using Cloud Platform.
8	Demonstrating Infrastructure as Code (IaC) with Terraform

### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy
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		Level
CO1	Demonstrate the application of CI/CD Principles to Web Development Using Jenkins	CL3
CO2	Illustrate various Git Commands and GitHub Operations through Collaborative Coding.	CL3
CO3	Examine different GitLab Operations and Containerization and Application Deployment with Docker.	CL3
CO4	Demonstrate CI/CD pipeline concepts using Cloud Platform by creating a GitHub Account	CL3
CO5	Use Terraform for demonstrating Infrastructure as Code (IaC).	CL3

#### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2		2			2	2	1		2		
CO2	3	3	2		2			2	2	1		2		
CO3	3	3	2		2			2	2	1		2		
CO4	3	3	2		2			2	2	1		2		
CO5	3	3	2		2			2	2	1		2		
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

#### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

#### ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)



- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://nptel.ac.in/courses/128106012>
2. <https://www.youtube.com/watch?v=iIkhMPAiW14>



## DATA VISUALIZATION USING R

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Course Code	CS42297CC	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge R programming and data manipulation concepts.

#### COURSE OBJECTIVES:

- Understand the basic plots and major packages available for plotting graphs in R.
- To develop small applications using R Programming

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

#### LIST OF EXPERIMENTS

Exp. No.	Description	CO No.	Bloom's Taxonomy Level
<b>PART-A</b>			
1	For a given set of training data examples stored in a .CSV file, compute the Mean, Median, Variance, Standard Deviation, Range and Quartiles of one of the attributes using R programming.	CO1	CL3
2	Write an R program to perform the following operations: Create a file, Writing into a file, Renaming a file, Reading a file, Listing all files, Copy a file.	CO1	CL3
3	Write an R program to perform the following operations on strings: Concatenate two strings, compare two strings, Reverse the string and Check if a given string is a palindrome or not.	CO2	CL3
4	Write an R program to demonstrate the use of the following String manipulation functions in R: nchar, toupper, tolower, substr, grep, paste, strsplit, sprintf, cat and sub functions.	CO2	CL3
<b>PART-B</b>			
1	Write an R program to create the following basic plots: Scatter plot, Line graph, Bar plot and Histogram.	CO3	CL3
2	Write an R program to create a 2D and 3D Pie chart with slice percentage & legend.	CO3	CL3
3	Using the in-build Iris dataset and ggplot2 package, write an R program to create	CO4	CL3



	Scatter plot, Line graph and Bar plot with chart titles and axis titles.		
4	Write an R program to create Histogram and Box plots using ggplot2 package in R.	CO4	CL3
5	Using the in-build mtcars dataset and lattice package, write an R program to create Bar plot, Scatter plot, Histogram and Density plot.	CO5	CL3
6	Write an R program to create 3D Wireframe Plot and Level Plot using lattice package in R.	CO5	CL3

### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply the concepts of R programming to read and write data files.	CL3
CO2	Implement the string manipulation and data handling concepts.	CL3
CO3	Illustrate the use of inbuilt functions in the creation and customization of graphs.	CL3
CO4	Apply ggplot2 Package for data visualization.	CL3
CO5	Demonstrate the lattice graphics and control styles using the lattice package.	CL3

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	2				1	1		2		
CO2	3	3	2	1	2				1	1		2		
CO3	3	3	2	1	2				1	1		2		
CO4	3	3	2	1	2				1			2		
CO5	3	3	2	1	2				1			2		
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

#### ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage



(25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.

Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. Essentials of R with Data Analytics, Saroj Dahiya Ratnoo, Himmat Singh Ratnoo, Wiley (India), Low price edition.
2. <https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/>



## PYTHON DATA STRUCTURES AND ALGORITHMS

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Course Code	AM42297AD	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Basic Knowledge of Python and concepts of Data Structures.

#### COURSE OBJECTIVES:

- To use different types of data structures, operations and algorithms
- Apply searching operations on files
- To use stack, Queue, Lists, Trees and Graphs in problem solving
- Apply sorting algorithms on files
- Implement all data structures in a high-level language for problem solving.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### LIST OF EXPERIMENTS

Sl. No.	Description
1	Develop a Python program to Implement the following searching techniques a. Linear Search b. Binary Search.
2	Develop a Python program to implement the following sorting algorithms using user defined functions: a. Bubble sort (Ascending order) b. Selection sort (Descending order).
3	Develop a Python Program implement STACK with the following operations a. Push an Element onto Stack b. Pop an Element from Stack
4	Implement a Program in Python for converting an Infix Expression to Postfix Expression
5	Implement a Program in Python for evaluating a Postfix Expression.
6	Develop a Python program to simulate the working of a singly linked list providing the following operations: a. Display & Insert b. Delete from the beginning/end c. Delete a given element
7	Obtain the Topological ordering of vertices in a given graph with the help of Python programming.
8	Check whether a given graph is connected or not using the DFS method using Python programming.
9	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm
10	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm



### COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Design a system by using different types of data structures, operations and algorithms	CL3
CO2	Apply different types of searching operations	CL3
CO3	Apply stack, Queue, Lists, Trees and Graphs in problem solving	CL3
CO4	Apply different types of sorting algorithms	CL3
CO5	Implement all data structures in a high-level language for problem solving	CL3

### CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3					2	2	1		
CO2	3	3	3	3	3					2	2	1		
CO3	3	3	3	3	3					2	2	1		
CO4	3	3	3	3	3					2	2	1		
CO5	3	3	3	3	3					2	2	1		
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
<b>2</b>	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

#### ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

**Assessment Mode:** Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

**Assessment Mode:** The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory



Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

**SEE QUESTION PAPER PATTERN:**

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

**REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):**

1. <https://jovian.com/learn/data-structures-and-algorithms-in-python>
2. [https://onlinecourses.nptel.ac.in/noc20\\_cs70/preview](https://onlinecourses.nptel.ac.in/noc20_cs70/preview)
3. <https://online.vtu.ac.in/course-details/Programming-Data-Structures-And-Algorithms-Using-Python>
4. <https://www.edureka.co/blog/data-structures-in-python/>





## BIOLOGY FOR ENGINEERS

(Effective from the Academic Year 2023 - 2024)

### IV SEMESTER

Course Code	HI422T8X	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	2:0:0:0	SEE Marks	50
Total Hours of Pedagogy	30L	Exam Hours	03

### CREDITS – 2

#### COURSE PREREQUISITES:

- Basic Concepts of Biology

#### COURSE OBJECTIVES:

- Implementation of new technology in medical Science.
- Use modern technical skills to bring out innovations in medical field.

#### TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

### COURSE CONTENTS

#### MODULE - I

<b>Basic Cell Biology</b> - Introduction to Biology, Cell-The unit of life, Cell Theory, Cell structure and Function- Plant cell and Animal cell. <b>Human Organ System</b> -Brain as a CPU system - architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Heart as the pump system- Double circulation of human heart, ECG.	<b>6 Hours</b>
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#### MODULE - II

<b>Common Diseases and Vaccination</b> - Allergies, Colds and Flu - causes and precautions. First vaccine in the world, Vaccine for Rabies and RNA vaccines for COVID. Heart disease and its types. Modern technologies to detect heart diseases. Engineering solutions for Parkinson's disease. DNA fingerprinting.	<b>6 Hours</b>
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#### MODULE - III

<b>Biosensors:</b> Various components of biosensors, Transducers in Biosensors: Various types of transducers; principles and applications, applications of biosensors. <b>Telemedicine:</b> Block diagram of telemedicine system, origin and development of Telemedicine, Benefits and limitations of Telemedicine.	<b>6 Hours</b>
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#### MODULE - IV

<b>Biomechanics of Joints:</b> Skeletal Joints, Skeletal Muscles, Joint Function, forces and stresses in human joints, Mechanics of the Elbow, Shoulder, Spinal Column, Hip, Knee and Ankle, Applications of prosthetics. <b>Bio-fluid Mechanics:</b> Circulatory System in the Human Body, Modeling of Flow in Blood Vessels, Blood Flow Theory. <b>Biomaterials:</b> Definition and classification of biomaterials, biocompatibility and biodegradability,	<b>6 Hours</b>
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Biomedical Implants.															
<b>MODULE - V</b>															
<b>Artificial intelligence for Medical Application:</b> Introduction to Artificial intelligence and machine learning in medical Science. Application of AI in Imaging and Computer-aided Diagnosis, Neuroscience and drug discovery, Genetic algorithms.														<b>6 Hours</b>	
<b>COURSE OUTCOMES</b>															
Upon completion of this course, the students will be able to:															
<b>CO No.</b>	<b>Course Outcome Description</b>													<b>Bloom's Taxonomy Level</b>	
CO1	Interpret the basics of cell biology and brain functions.													CL2	
CO2	Understand effect of common diseases, types of vaccination and general forensics.													CL2	
CO3	Summarize the application of biosensors and telemedicine in medical science.													CL2	
CO4	Visualize biomechanical joints, biofluid mechanics and bio materials in medical science.													CL2	
CO5	Contrast innovative methods of information technology in computer aided medical diagnosis.													CL2	
<b>CO-PO-PSO MAPPING</b>															
<b>CO No.</b>	<b>Programme Outcomes (PO)</b>												<b>Programme Specific Outcome (PSO)</b>		
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>1</b>	<b>2</b>	
CO1	1	1	1			1			1	1		1			
CO2	1	1	1			2			1	1		1			
CO3	1	2	2			1			1	1		1			
CO4	1	2	2			2			1	1		1			
CO5	1	2	2			1			1	1		1			
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>					
<b>ASSESSMENT STRATEGY</b>															
Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:															
<b>Sl. No.</b>	<b>Assessment Description</b>					<b>Weightage (%)</b>					<b>Max. Marks</b>				
<b>1</b>	<b>Continuous Internal Assessment (CIA)</b>					<b>100 %</b>					<b>50</b>				
	Continuous Internal Evaluation (CIE)					60 %					30				
	Assignments					40 %					20				
<b>2</b>	<b>Semester End Examination (SEE)</b>					<b>100 %</b>					<b>50</b>				
<b>ASSESSMENT DETAILS</b>															
<b>Continuous Internal Assessment (CIA) (50%)</b>										<b>Semester End Exam (SEE) (50%)</b>					
<b>Continuous Internal Evaluation (CIE) (60%)</b>					<b>Assignment/ Activities (40%)</b>										
<b>I</b>		<b>II</b>			<b>III</b>										
<b>Syllabus Coverage</b>					<b>Syllabus Coverage</b>					<b>Syllabus Coverage</b>					
<b>40%</b>		<b>30%</b>			<b>30%</b>			<b>100%</b>							
MI		MII			MIII			MI							
MII		MIII			MIV			MII							
		MIV			MV			MIII							
		MV						MIV							
								MV							
<p><i>Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the</i></p>															



*assignments.*

### **ASSIGNMENT TYPES WITH WEIGHTAGES**

<b>Sl. No.</b>	<b>Assignment Description</b>	<b>Max. Weightage (%)</b>	<b>Max. Marks</b>
1	Written Assignments	25 %	05
2	Case Studies	25 %	05
3	Seminar/Presentation	25 %	05
4	Peer - to - Peer Learning	25 %	05

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

### **SEE QUESTION PAPER PATTERN:**

1. The question paper will have TEN full questions.
2. Each full question consists of 20 marks.
3. There will be 2 full questions from all the FIVE modules.
4. Each full question will have a maximum of three sub-questions covering all the topics under a module.
5. The students will have to answer 5 full questions, selecting one full question from each module.

### **TEXT BOOKS:**

1. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012
2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022.
3. Brian R Eggins - Biosensors an Introduction, First edition, John Wiley & Sons Publishers, 1996.
4. R S Khandpur, "Telemedicine technology and applications", PHI Learning Pvt. Ltd, New Delhi, 2017.
5. N. Ozkaya and M. Nordin: Fundamentals of Biomechanics-Equilibrium, Motion and Deformation, Springer-Verlag, 2nd Edition, 1999.
6. Biomaterials Science and Tissue Engineering: Principles and Methods, by Bikramjit Basu, Cambridge IISc Series.

### **REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):**

1. <https://www.youtube.com/watch?v=96-u9s6D16k>
2. [https://www.youtube.com/watch?v=4\\_emccqgYMs](https://www.youtube.com/watch?v=4_emccqgYMs)
3. [https://onlinecourses.nptel.ac.in/noc22\\_cs56/preview](https://onlinecourses.nptel.ac.in/noc22_cs56/preview)
4. [https://onlinecourses.nptel.ac.in/noc22\\_cs29/preview](https://onlinecourses.nptel.ac.in/noc22_cs29/preview)



## UHV -2: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT

(Effective from the Academic Year 2023 - 2024)

### SEMESTER - IV

Course Code	HU42289X	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Exam Hours	03

### CREDITS – 1

#### COURSE PREREQUISITES:

- Have/Develop the critical analysis of the day today happenings.

#### COURSE OBJECTIVES:

This course will enable students to:

1. To make the students to understand, the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight possible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

#### TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies

### COURSE CONTENTS

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage students in interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed :

### MODULE - I

#### Introduction to Value Education :

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education).  
Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to fulfill the Basic Human Aspirations.

**3 Hours**

<b>MODULE - II</b>														
<b>Harmony in the Human Being :</b>													<b>3 Hours</b>	
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.														
<b>MODULE - III</b>														
<b>Harmony in the Family and Society :</b>													<b>3 Hours</b>	
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.														
<b>MODULE - IV</b>														
<b>Harmony in the Nature/Existence:</b>													<b>3 Hours</b>	
Understanding Harmony in the Nature, Inter-connectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence														
<b>MODULE - V</b>														
<b>Implications of the Holistic Understanding – a Look at Professional Ethics :</b>													<b>3 Hours</b>	
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.														
<b>COURSE OUTCOMES</b>														
Upon completion of this course, the students will be able to:														
<b>CO No.</b>	<b>Course Outcome Description</b>												<b>Bloom's Taxonomy Level</b>	
CO1	Understand value education to develop basic human aspirations through a holistic approach												CL2	
CO2	Relate to the needs of self and body to establish co-existence leading to harmony in the human being.												CL2	
CO3	Recognize the importance of trust and respect to promote harmony in the family and society.												CL2	
CO4	Realize the existence as coexistence to establish harmony through mutual fulfillment among four orders of nature.												CL2	
CO5	Recognize the needs for a holistic understanding of human values to develop ethical and professional conduct.												CL2	
<b>CO-PO-PSO MAPPING</b>														
<b>CO No.</b>	<b>Programme Outcomes (PO)</b>												<b>Programme Specific Outcome (PSO)</b>	
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>1</b>	<b>2</b>
<b>CO1</b>								1				2		
<b>CO2</b>						1		1	1			2		

CO3						2		1	1			2		
CO4							2	1	1			2		
CO5							1	1				2		
<b>3: Substantial (High)</b>					<b>2: Moderate (Medium)</b>					<b>1: Poor (Low)</b>				

### ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	<b>Continuous Internal Assessment (CIA)</b>	<b>100 %</b>	<b>50</b>
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	<b>Semester End Examination (SEE)</b>	<b>100 %</b>	<b>50</b>

### CO - ASSESSMENT MAPPING

Course Outcomes	Continuous Internal Assessment (CIA) (50%)			Assignment/ Activities (40%)	Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)		Syllabus Coverage		
	I	II		III	
	Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
	40%	30%	30%	100%	100%
CO1	MI			MI	MI
CO2	MII	MII		MII	MII
CO3		MIII		MIII	MIII
CO4			MIV	MIV	MIV
CO5			MV	MV	MV

*Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.*

### ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Case Studies	25 %	05
3	Seminar/Presentation	25 %	05
4	Peer - to - Peer Learning	25 %	05

*Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands*

### SEE QUESTION PAPER PATTERN:

Theory SEE will be conducted, with common question papers for the subject (**duration 01 hours**)

- The question paper will have 50 questions. Each question is set for 01 marks.
- The students have to answer all the questions, selecting one full question from each module

### TEXT BOOKS:

- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
- The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher.

8. Gandhi - Romain Rolland (English)

**REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):**

1. <https://www.aicteindia.org/sites/default/files/Vol.%20II%20%20AICTE%20UG%20%20Curriculum.>
2. [https://www.youtube.com/channel/UCQxWr5QB\\_eZUnwxSwxXEkQw](https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw)
3. [https://fdp-si.aicte-india.org/8dayUHV\\_download.php](https://fdp-si.aicte-india.org/8dayUHV_download.php)
4. <https://www.youtube.com/watch?v=8ovkLRYXIjE>