Curriculum Structure
and
Evaluation Scheme
for
B. Tech.
in
Computer Science & Engineering
with
Honors & Multidisciplinary Minor

(To be implemented for 2025-2029 Batch)

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SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S
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SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of CSE

ABBREVIATIONS

- **L:** Lecture
- **T:** Tutorial
- **P:** Practical
- **ISE 1:** In Semester Evaluation 1
- **ISE 2:** In Semester Evaluation 2
- **MSE:** Mid Semester Examination
- **ESE:** End Semester Examination
- **PCC**: Program Core Course
- **PEC**: Program Elective Course
- **OEC**: Open Elective Course
- **AEC:** Ability Enhancement Courses
- **IKS:** Indian Knowledge System
- **HMC:** Humanities & Management Course
- **ELC:** Experiential Learning Course
- **MDM:** Multidisciplinary Minor Course

Group A

(Computer Science &Engineering/Electronics &Computer Engineering/Electronics &Telecommunication Engineering)

Department: Applied Science & Humanities **Semester: I**

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH101	Engineering Mathematics- I	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH102	Engineering Physics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH104	Basic Electrical Engineering	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH105	Engineering Mechanics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25ASH108	Programming in C	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
AEC	25ASH110	Communication Skills	1	-	-	1	ISE-I	5		20
							MSE	15		
							ISE-II	5		
							ESE	25	10	
BSC	25ASH112	Engineering Physics Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH114	Basic Electrical Engineering Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH115	Engineering Mechanics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSEC	25ASH118	Programming in C Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
CC	25ASH120	Yoga & Meditation	-		2	1	ISE	50	20	
AEC	25ASH122	Communication Skills Laboratory	-	-	2	1	ISE	50	20	
	Total		**15**	**1**	**12**	**22**		**950**		

Total Contact Hours- 28 **Total Credits- 22**

Group A

(Computer Science &Engineering/Electronics &Computer Engineering/Electronics &Telecommunication Engineering)

Department: Applied Science & Humanities **Semester: II**

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH201	Engineering Mathematics- II	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH203	Engineering Chemistry	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH206	Fundamentals of Electronics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH207	Engineering Graphics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
IKS	25ASH209	Architecture and Town Planning	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ASH211	Program Core Course	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH213	Engineering Chemistry Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH216	Fundamentals of Electronics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
ESC	25ASH217	Computer Aided Engineering Graphics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSEC	25ASH219	Workshop Practices	-	-	2	1	ISE	50	20	
CC	25ASH221	Social Life Skills	1	-	-	1	ISE	50	20	
	Total		**17**	**01**	**08**	**22**		**950**		

Total Contact Hours- 26 **Total Credits- 22**

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Group B
(Artificial Intelligence & Data Science/ Artificial Intelligence & Machine Learning/Electrical Engineering/ Mechanical Engineering/Civil Engineering)

Department: Applied Science & Humanities **Semester: I**

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH101	Engineering Mathematics- I	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH103	Engineering Chemistry	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH106	Fundamentals of Electronics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH107	Engineering Graphics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
IKS	25ASH109	Architecture and Town Planning	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25ASH111	Program Core Course	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH113	Engineering Chemistry Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH116	Fundamentals of Electronics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
ESC	25ASH117	Computer Aided Engineering Graphics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSEC	25ASH119	Workshop Practices	-	-	2	1	ISE	50	20	
CC	25ASH121	Social Life Skills	1	-	-	1	ISE	50	20	
	Total		**17**	**01**	**08**	**22**		**950**		
Total Contact Hours- 26							**Total Credits- 22**			

Group B
(Artificial Intelligence & Data Science/ Artificial Intelligence & Machine Learning/Electrical Engineering/ Mechanical Engineering/Civil Engineering)

Department: Applied Science & Humanities **Semester: II**

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
BSC	25ASH201	Engineering Mathematics- II	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
BSC	25ASH202	Engineering Physics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH204	Basic Electrical Engineering	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ESC	25ASH205	Engineering Mechanics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25ASH208	Programming in C	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
AEC	25ASH210	Communication Skills	1	-	-	1	ISE-I	5		20
							MSE	15		
							ISE-II	5		
							ESE	25	10	
BSC	25ASH212	Engineering Physics Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH214	Basic Electrical Engineering Laboratory	-	-	2	1	ISE	50	20	
ESC	25ASH215	Engineering Mechanics Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
VSCE	25ASH218	Programming in C Laboratory	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
CC	25ASH220	Yoga & Meditation	-	-	2	1	ISE	50	20	
AEC	25ASH222	Communication Skills Laboratory	-	-	2	1	ISE	50	20	
	Total		**15**	**01**	**12**	**22**		**950**		
Total Contact Hours- 28							**Total Credits- 22**			

Program Core Course offered by the Departments

Sr. No	Department	Course Title	Course Code
1	Computer Science& Engineering	Data Communication	25ASH211A
2	Electronics & Tele-Communication Engineering	Sensors & Transducers	25ASH211B
3	Electronics & Computer Engineering	Measurement & Instrumentation	25ASH211C
4	Artificial Intelligence & Data Science Engineering	Fundamentals of Artificial Intelligence	25ASH111A
5	Artificial Intelligence & Machine Learning Engineering	Fundamentals of Artificial Intelligence	25ASH111B
6	Electrical Engineering	Power Plant Engineering	25ASH111C
7	Mechanical Engineering	Fundamentals of Mechanical Engineering	25ASH111D
8	Civil Engineering	Fundamentals of Civil Engineering	25ASH111E

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of CSE

Program: Computer Science & Engineering
Semester: III

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25CS301	Computational Mathematics for CSE	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS302	Data Structures	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS303	Discrete Mathematical Structures	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM304	Multidisciplinary Minor – I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Entre./ Econo./ Manag	25CS305	Professional Skill Development	2	-	-	2	ISE	50	20	
VEC	25CS306	Universal Human Values	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
CEP/ FP	25CS307	Mini Project – I	-	-	2	1	ISE	50	20	
PCC	25CS308	Object Oriented Programming using C++	1	-	2	2	ISE	50	20	
							ESE(POE)	50	20	
PCC	25CS309	Data Structures Lab	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
		Total	**17**	-	**6**	**20**		**800**		
Total Contact Hours- 23				**Total Credits- 20**						

Program: Computer Science & Engineering
Semester: IV

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25CS401	Design & Analysis of Algorithms	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS402	Database Management System	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS403	Computer Network	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM 404	Multidisciplinary Minor – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25OE405	Open Elective – I	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Entre./ Econo./ Manag	25CS406	Entrepreneurship Development	1	-	-	1	ISE	50	20	
AEC	25CS407	Quantitative Aptitude & Logical Reasoning – I	1	-	-	1	ISE	50	20	
VEC	25CS408	Constitution of India	2	-	-	2	ISE	50	20	
VSEC	25CS409	Skill Enhancement	-	-	2	1	ISE	50	20	
PCC	25CS410	Python Programming	1	-	2	2	ISE	50	20	
							ESE(POE)	50	20	
PCC	25CS411	Database Management System – Lab	-	-	2	1	ISE	50	20	
							ESE(OE)	50	20	
		Total	**19**	**0**	**6**	**22**		**900**		
Total Contact Hours- 25			**Total Credits- 22**							

Program: Computer Science & Engineering
Semester: V

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25CS501	Theory Of Computation	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS502	Operating System	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS503	Cloud Computing	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25CS504	Program Elective – I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM505	Multidisciplinary Minor – III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25OE506	Open Elective – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
AEC	25CS507	Quantitative Aptitude & Logical Reasoning – II	1	-	-	1	ISE	50	20	
CFP/IP	25CS508	Mini Project-II	-	-	2	1	ISE	50	20	
PCC	25CS509	Operating System Lab	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
PCC	25CS510	Cloud Computing Lab	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
		Total	**19**	**0**	**6**	**22**		**900**		
Total Contact Hours- 25			**Total Credits- 22**							

Program: Computer Science & Engineering
Semester: VI

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25CS601	Artificial Intelligence	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS602	Compiler Design	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25CS603	Program Elective – II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25CS604	Program Elective – III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM605	Multidisciplinary Minor – IV	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	25OE606	Open Elective – III	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VSEC	25CS607	Project Phase– I	-	-	4	2	ISE	50	20	
PCC	25CS608	Artificial Intelligence Lab	-	-	2	1	ISE	50	20	
							ESE(POE)	50	20	
PEC	25CS609	Program Elective – II Lab	-	-	2	1	ISE	50	20	
							ESE(OE)	50	20	
		Total	**18**	**0**	**8**	**22**		**850**		
Total Contact Hours- 26			**Total Credits- 22**							

Program: Computer Science & Engineering
Semester: VII

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25CS701	Machine Learning	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS702	Mobile Application Development	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25CS703	Program Elective – IV	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25CS704	Program Elective – V	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	25MDM705	Multidisciplinary Minor – V	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	25CS706	Machine Learning Lab	-	-	2	1	ISE	50	20	
							ESE(OE)	50	20	
PCC	25CS707	Mobile Application Development Lab	-	-	2	1	ISE	50	40	
							ESE(POE)	50		
Project	25CS708	Project Phase– II	-	-	8	4	ISE	50	60	
							ESE(POE)	100		
		Total	14	0	12	20		850		
Total Contact Hours- 26			**Total Credits- 20**							

SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S ASHOKRAO MANE GROUP OF INSTITUTIONS Dept. of CSE

Program: Computer Science & Engineering
Semester: VIII

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	25CS801	Cyber Security	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	25CS802	Program Elective – VI	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
RM	25CS803	Research Methodology	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
Intern. / OJT	25CS804	Internship/On Job Training	-	-	-	12	ISE	100	40	
							ESE	100	40	
		Total	**9**	**1**	**-**	**22**		**500**		
Total Contact Hours- 10							**Total Credits- 22**			

MULTIDISCIPLINARY MINOR (MDM) BASKET

Important Note:

1. Students should select **any one basket** for the award of Minor Degree of their interest from the table below.
2. The student must complete **all five courses under the selected MDM Basket** to qualify for the Minor.
3. The credits earned under the Multidisciplinary Minor shall form part of the total **172 Credits** required for award of the degree.

MDM Basket Name	Sr. No.	Course Code	Course Name	Semester	Offered by the Department
Data Analyst	1	25MDM304A	Data Structure	III	**Artificial Intelligence & Machine Learning** (To all UG Programs except UG AIML, AIDS, CSE, E&C Engg.)
	2	25MDM404A	R-programming	IV	
	3	25MDM505A	DBMS	V	
	4	25MDM605A	Big Data Technologies	VI	
	5	25MDM705A	Introduction to Machine Learning	VII	
Prompt Engineering	1	25MDM304B	R-programming	III	**Artificial Intelligence & Machine Learning** (To all UG Programs except UG AIML, AIDS, CSE, E&C Engg.)
	2	25MDM404B	Introduction to AI and ML	IV	
	3	25MDM505B	IOT	V	
	4	25MDM605B	Introduction to Blockchain Technology	VI	
	5	25MDM705B	Prompt Engineering	VII	
Intelligent Data Systems	1	25MDM304C	Computer Organization Architecture	III	**Artificial Intelligence & Data Science** (To all UG Programs except UG AIDS, AIML CSE, E&C Engg.)
	2	25MDM404C	R-programming	IV	
	3	25MDM505C	Data Manipulation, Analysis and Visualization	V	
	4	25MDM605C	DBMS	VI	
	5	25MDM705C	Big Data Technologies	VII	
Cognitive Computing	1	25MDM304D	Computer Organization Architecture	III	**Artificial Intelligence & Data Science** (To all UG Programs except UG AIDS, AIML CSE, E&C Engg.)
	2	25MDM404D	Introduction to Data Science	IV	
	3	25MDM505D	Introduction to Machine Learning	V	
	4	25MDM605D	Social Network Analysis	VI	
	5	25MDM705D	Natural Language Processing	VII	

Essentials of Software Development	1	25MDM304E	Data Structures	III	**Computer Science & Engineering** (To all UG Programs except UG CSE, AIML, AIDS, E&C Engg.)
	2	25MDM404E	Python Programming	IV	
	3	25MDM505E	Computer Algorithms	V	
	4	25MDM605E	Database Management System	VI	
	5	25MDM705E	Software Engineering	VII	
Modern Computing Systems	1	25MDM304F	Data Structures	III	**Computer Science & Engineering** (To all UG Programs except UG CSE, AIML, AIDS, E&C Engg.)
	2	25MDM404F	Python Programming	IV	
	3	25MDM505F	Java Programming	V	
	4	25MDM605F	Artificial Intelligence & Machine Learning	VI	
	5	25MDM705F	Cloud Computing	VII	
Smart Energy Systems and Sustainability	1	25MDM304G	Fundamentals of Energy Systems	III	**Electrical Engineering** (To all UG Programs except UG Electrical Engg.)
	2	25MDM404G	Solar and Wind Energy Technologies	IV	
	3	25MDM505G	Fundamentals of Energy Management Systems	V	
	4	25MDM605G	Energy Storage Systems	VI	
	5	25MDM705G	Renewable Energy Integration in Smart Grids	VII	
Intelligent Electrical Systems	1	25MDM304H	Introduction to Intelligent Electrical Systems	III	**Electrical Engineering** (To all UG Programs except UG Electrical Engg.)
	2	25MDM404H	IoT and IOV for Electrical Systems	IV	
	3	25MDM505H	AI Applications in Electrical Systems	V	
	4	25MDM605H	Automation and Control in Energy Systems	VI	
	5	25MDM705H	Smart Grid and Intelligent Monitoring Systems	VII	
Communication System	1	25 MDM304I	Principles of Communication	III	**Electronics & Computer Engineering** (To all UG Programs except UG E&C & E&TC Engg.)
	2	25 MDM404I	Wireless and Mobile Communication	IV	
	3	25 MDM505I	Wireless Sensor Networks	V	
	4	25 MDM605I	Information theory and Coding	VI	
	5	25MDM705I	Satellite and Radar Communication	VII	

Computing Solutions for Industry	1	25MDM304J	Python programming	III	**Electronics & Computer Engineering** (To all UG Programs except UG E&C, AIML, AIDS, CSE Engg.)
	2	25MDM404J	Industry Analytics	IV	
	3	25MDM505J	Cloud Computing	V	
	4	25MDM605J	Industrial Internet of Things (IIoT)	VI	
	5	25MDM705J	Power BI	VII	
Internet of Things (IoT)	1	25MDM304K	Fundamentals of IoT	III	**Electronics & Telecommunication Engineering** (To all UG Programs except UG E&TC Engg.)
	2	25MDM404K	Technologies Enabling IoT	IV	
	3	25MDM505K	IoT System Design	V	
	4	25MDM605K	Industrial IoT	VI	
	5	25MDM705K	IoT Security and Privacy	VII	
Embedded Systems	1	25MDM304L	Digital Design	III	**Electronics & Telecommunication Engineering** (To all UG Programs except UG E&TC Engg.)
	2	25MDM 404L	Microcontroller & Interfacing Techniques	IV	
	3	25MDM 505L	Embedded Systems Design	V	
	4	25MDM 605L	Real-Time Operating Systems	VI	
	5	25MDM 705L	Advanced Embedded Systems & Product Development	VII	
Product Development	1	25MDM 304M	Design Thinking Approach	III	**Mechanical Engineering** (To all UG Programs except UG Mech Engg.)
	2	25MDM 404M	Engineering Design Process	IV	
	3	25MDM 505M	Rapid Prototyping and Testing	V	
	4	25MDM 605M	Product Development	VI	
	5	25MDM 705M	Commercialization and Sustainability	VII	
Refrigeration and Air Conditioning	1	25MDM 304N	Fundamentals of Refrigeration	III	**Mechanical Engineering** (To all UG Programs except UG Mech Engg.)
	2	25MDM 404N	Refrigeration Components and Low Temperature Cycles	IV	
	3	25MDM 505N	Psychrometry and Air Conditioning Process	V	
	4	25MDM 605N	HVAC Systems and Emerging Technologies	VI	
	5	25MDM705N	Application Based System Design	VII	

Planning and Execution of Projects	1	25MDM304P	Building Construction Materials	III	**Civil Engineering** (To all UG Programs except UG Civil Engg.)
	2	25MDM404P	Engineering Management	IV	
	3	25MDM505P	Resource Management	V	
	4	25MDM605P	Optimization Technique	VI	
	5	25MDM705P	Engineering Economics	VII	
Building Interior Design and Home Automation	1	25MDM304R	Introduction to Buildings and Spaces	III	**Civil Engineering** (To all UG Programs except UG Civil Engg.)
	2	25MDM404R	Basics of Interior Building Design	IV	
	3	25MDM505R	Building Interior Materials and Finishes	V	
	4	25MDM605R	Smart Devices and Sensors for Home Automation	VI	
	5	25MDM705R	Recent Techniques for Home Automation	VII	

OPEN ELECTIVE COURSES

(Students have to select any one Open Elective course, for each applicable semester, of their interest (other than open electives offered by his/her department) from the table below)

Open Elective – I

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE405A	E Commerce	Artificial Intelligence & Machine Learning & Artificial Intelligence & Data Science
2	25OE405B	Environmental Science	Civil Engineering
3	25OE405C	Human Computer Interaction (HCI)	Computer Science & Engineering
4	25OE405D	Electrical Safety & Standards	Electrical Engineering
5	25OE405E	Sensor Technology	Electronics & Computer Engineering & Electronics & Telecommunication Engineering
6	25OE405F	Project Management	Mechanical Engineering

Open Elective – II

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE506A	Design Thinking	Artificial Intelligence & Machine Learning & Artificial Intelligence & Data Science
2	25OE506B	Disaster Management	Civil Engineering
3	25OE506C	Cyber Security	Computer Science & Engineering
4	25OE506D	Energy Audit	Electrical Engineering
5	25OE506E	Drone Technology	Electronics & Computer Engineering & Electronics & Telecommunication Engineering
6	25OE506F	Startup and Business Strategy	Mechanical Engineering

Open Elective – III

Sr. No.	Course Code	Course Name	Offered by Department
1	25OE606A	Recommender System	Artificial Intelligence & Machine Learning & Artificial Intelligence & Data Science
2	25OE606B	Environmental Impact Assessment	Civil Engineering
3	25OE606C	Cyber Laws	Computer Science & Engineering
4	25OE606D	E-Mobility	Electrical Engineering
5	25OE606E	Engineering Economics	Electronics & Computer Engineering & Electronics & Telecommunication Engineering
6	25OE606F	Industrial Automation	Mechanical Engineering

PROGRAM ELECTIVE CORE

(Students have to select any one Program Elective Core course out of 03, for each applicable semester, of their interest, offered by the Department from the table below)

Program Elective Core - I

Sr. No	Course Code	Domain	Course Name	Semester
1	25CS504 A	Networks & Cybersecurity	Advanced Computer Networks	V
2	25CS504 B	Management & Business	Business Communication	
3	25CS504 C	Data Science & Analytics	Data Mining	

Program Elective Core - II

Sr. No	Course Code	Domain	Course Name	Semester
1	25CS603 A	Networks & Cybersecurity	Internet of Things (IoT) Security	VI
2	25CS603 B	Management & Business	Economics and Management	
3	25CS603 C	Data Science & Analytics	Deep Learning	

Program Elective Core - III

Sr. No	Course Code	Domain	Course Name	Semester
1	25CS604 A	Networks & Cybersecurity	Cryptography and Network Security	VI
2	25CS604 B	Management & Business	Consumer Behavior	
3	25CS604 C	Data Science & Analytics	Natural Language Processing	

Program Elective Core - IV

Sr. No	Course Code	Domain	Course Name	Semester
1	25CS703 A	Networks & Cybersecurity	Information Retrieval	VII
2	25CS703 B	Management & Business	Leadership and Organizational Behavior	
3	25CS703 C	Data Science & Analytics	Big Data Engineering	

Program Elective Core - V

Sr. No	Course Code	Domain	Course Name	Semester
1	25CS704 A	Networks & Cybersecurity	Ethical Hacking and Cyber Forensics	VII
2	25CS704 B	Management & Business	Employability and Skill Development	
3	25CS704 C	Data Science & Analytics	Business Intelligence	

Program Elective Core - VI

Sr. No	Course Code	Domain	Course Name	Semester
1	25CS802 A	Networks & Cybersecurity	Digital Forensics	VIII
2	25CS802 B	Management & Business	Project Management	
3	25CS802 C	Data Science & Analytics	Social Network & Image Analytics	

Exit Courses
(After First Year)

The Candidate should pass following skill-based courses to qualify for Diploma.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25CS225	Object oriented programming	2	-	4	4	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25CS226	Python Programming	2	-	4	4	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
Total		**4**	**0**	**8**	**8**		**200**		
Total Contact Hours- 10				**Total Credits- 8**					

Exit Courses
(After Second Year)

The Candidate should pass following skill-based courses to qualify for Diploma.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25CS412	Network Administration	2	-	4	4	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
25CS413	Data Center Essentials	2	-	4	4	ISE-I	10		40
						MSE	30		
						ISE-II	10		
						ESE	50	20	
Total		**4**	**0**	**8**	**8**		**200**		
Total Contact Hours- 10				**Total Credits- 8**					

Exit Courses
(After Third Year)

The Candidate should pass following skill-based courses to qualify for Diploma.

Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
		L	T	P	Cr	Components	Max	Min for Passing	
25CS610	Android App Development	2	-	4	4	ISE-I	10		
						MSE	30		
						ISE-II	10		40
						ESE	50	20	
25CS611	IOS App Development	2	-	4	4	ISE-I	10		
						MSE	30		
						ISE-II	10		40
						ESE	50	20	
Total		4	0	8	8		200		
Total Contact Hours- 10		Total Credits- 8							

B. Tech (Hons.) Computer Science & Engineering with Specialization of Cloud Computing & Emerging Technologies

Name of the Basket- Cloud Computing & Emerging Technologies				
1		Internet of Things (IoT)	III	Computer Science & Engineering
2		Cloud Computing	IV	
3		Embedded Systems	V	
4		Block Chain Technology	VI	
5		Edge Computing	VII	
6		Digital Twin Technology	VIII	

B.Tech. (Hons) in Cloud Computing & Emerging Technologies

Department: Computer Science & Engineering

Course Code	Name of the Course	Credit
25CS3H	Internet of Things (IoT)	3
25CS4H	Cloud Computing	3
25CS5H	Embedded Systems	3
25CS6H	Block Chain Technology	3
25CS7H	Edge Computing	3
25CS8H	Wireless and Cellular Communications	3
	Total	**18**

Guidelines for Honor Certification Courses

1. Students are required to complete six courses (each carrying 3 credits) through an online platform to earn a total of 18 credits under the Honor Certification scheme.
2. All six courses must be completed starting from the Second Year First Semester (Semester III) to the Final Year Second Semester (Semester VIII).
3. The student has to obtain all 18 credits by the last semester of the program.
4. While selecting the course platform, first preference must be given to SWAYAM/NPTEL.
5. Registration on platforms such as Coursera or Udemy is permitted only under the following conditions:
   a. The SWAYAM/NPTEL course schedule does not align with the academic calendar.
   b. The subsequent course in the learning sequence is not available on SWAYAM/NPTEL.
   c. Any other unavoidable circumstances arise.
   d. About 80% of the contents of the course should match with the SWAYAM/NPTEL courses.
6. Course selection must strictly adhere to the recommendations of the Chairman of Board of Studies (BOS).
7. Credits for the respective Honor courses will be awarded under the following conditions:
   a. For NPTEL courses, students must complete all assignments on time, pass the examination, and obtain the certificate.
   b. For Coursera or Udemy courses, students must obtain the course certificate and appear for the Online examination which will be conducted under the supervision of the Institute by Examination Cell

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8. While selecting an online course, the following criteria must be ensured:
   a. The course should be of an advanced level, not basic or introductory.
   b. The course content must not overlap with subjects already included in the regular curriculum or listed under elective courses.
   c. The duration of each course must be:
      - Minimum 8/12 weeks for SWAYAM/NPTEL courses
      - At least 30+ hours for Coursera/Udemy courses

Course Code	Name of the Course and SWAYAM/NPTEL Links	Credit
25CS3H	Internet of Things (IoT) 1. Introduction to Internet of Things by Prof. Sudip Misra | IIT Kharagpur 2. Introduction to Industry 4.0 and Industrial Internet of Things by Prof. Sudip Misra | IIT Kharagpur 3. Foundation of Cloud IoT Edge ML By Prof. Rajiv Misra | IIT Patna	3
25CS4H	Cloud Computing 1. Cloud Computing and Distributed Systems, IIT Patna Prof. Rajiv Misra 2. Cloud Computing, IIT Kharagpur Prof. Soumya Kanti Ghosh 3. Google Cloud Computing	3
25CS5H	Embedded System 1. Embedded Systems-Design Verification and Test, IIT Guwahati Prof. Santosh Biswas, Prof. Jatindra Kumar Deka and Prof. Arnab Sarkar 2. Embedded Systems Design, IIT Kharagpur Prof. Anupam Basu 3. Embedded System Design with ARM, IIT Kharagpur Prof. Indranil Sengupta Prof. Kamalika Datta	3
25CS6H	Block Chain Technology 1. Introduction to Blockchain Technology and Applications, IIT Kanpur Prof. Sandeep Shukla 2. Cryptography and Network Security, IIT Kharagpur Dr. Debdeep Mukhopadhyay 3. Blockchain and its Applications, IIT Kharagpur Prof. Sandip Chakraborty	3

	Prof. Shamik Sural	
25CS7H	Edge Computing 1. Edge Computing By Prof. Rajiv Misra 2. Foundation of Cloud IoT Edge ML By Prof. Rajiv Misra | IIT Patna 3. Artificial Intelligence: Knowledge Representation apnd Reasoning, IIT Madras Prof. Deepak Khemani	3

Computational Mathematics for CSE

Course Name: **Computational Mathematics for CSE** Course Code: **25CS301**	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Students should have a foundational understanding of engineering mathematics, including calculus, linear algebra, probability, statistics, and basic set theory.

Course Objective: The course aims to:	
1	Understand and apply numerical techniques to solve algebraic and transcendental equations.
2	Apply numerical differentiation and integration methods for engineering computations.
3	Understand the fundamentals of fuzzy sets and fuzzy arithmetic for handling uncertainty.
4	Analyze relationships between variables using correlation techniques.
5	Develop and interpret linear regression models for engineering data analysis.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Apply numerical methods such as Bisection, Regula–Falsi, Newton–Raphson, and Secant methods to solve algebraic and transcendental equations.
CO2	Use numerical differentiation and integration techniques for solving engineering problems.
CO3	Apply fuzzy set concepts, fuzzy arithmetic, and solve simple fuzzy equations.
CO4	Analyze engineering data using correlation and regression techniques for interpretation and prediction.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	1	-	-	-	-	-	1	-	-	-

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Course Content		
Unit No.	**Unit Title and Content**	**Hrs**
1	**Numerical Methods :** Solution of algebraic and transcendental equations: Bisection method, Regula–Falsi Method, Newton–Raphson method, Secant Method, Application to problems in Engineering.	6
2	**Numerical differentiation & Integration :** Numerical differentiation - Newton's forward interpolation formula, Newton's backward interpolation formula, Lagrange's interpolation, Numerical Integration-Trapezoidal Rule, Simpson's 1/3rd Rule, Simpson's 3/8th Rule, Weddle's Rule (Only formula and examples), Applications in engineering	8
3	**Introduction to Fuzzy Sets :** Basic concepts of fuzzy sets, Crisp set & Fuzzy set, Membership functions, Basic operations on fuzzy sets, Properties of fuzzy sets	7
4	**Fuzzy Arithmetic:** Fuzzy numbers, Fuzzy cardinality, Operations on Fuzzy number, Fuzzy equations of type A+X = B and A.X = B	7
5	**Correlation** Introduction to types of correlation, correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient and its examples, Spearman's rank correlation, Probable errors and it's examples, Application to problems in Engineering.	7
6	**Linear Regression Analysis** Introduction, Linear and non-linear regression, Lines of regression, Properties of regression Coefficients, and Derivative of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression and its examples, Application to problems in Engineering.	7

Text books:

1. Numerical Methods for Engineers - Steven C. Chapra & Raymond P. Canale
2. Fuzzy Sets and Fuzzy Logic: Theory and Application - George J. Klir & Bo Yuan
3. Correlation and Regression: Principles and Applications – *Philip Bobko.*
4. Applied Linear Regression Models – *Kutner, Nachtsheim, Neter & Li*

Reference books:

1. Introductory Methods of Numerical Analysis – S.S. Sastry
2. Introduction to Fuzzy Sets and Fuzzy Logic – Witold Pedrycz & Fernando Gomide
3. Applied Statistics and Probability for Engineers- Douglas C. Montgomery & George C. Runger
4. *B.S. Grewal*,- Higher Engineering Mathematics, Khanna Publishers, New Delhi.

DATA STRUCTURES

Title of the Course Name: Data Structures **Course Code:** 25CS302	**L**	**T**	**P**	**Credits**
	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Knowledge of C Programming

Course Objectives: The course aims:

1. To understand fundamental data structures and their applications.
2. To analyze algorithms using time and space complexity.
3. To select appropriate data structures for efficient problem solving.
4. To implement linear and non-linear data structures.

Course Outcomes: At the end of the course, students will be able to:

	Course Outcomes
CO1	Understand data structures, ADTs, and basic searching and sorting algorithms.
CO2	Implement stacks, queues, and linked lists to solve practical problems.
CO3	Develop and traverse tree structures and perform heap operations.
CO4	Represent graphs and apply BFS and DFS traversal algorithms.

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	–	–	–	–	–	–	–	–	–	2	-
CO2	3	3	2	–	–	–	–	–	–	–	–	–	3	3
CO3	3	3	2	–	–	–	–	–	–	–	–	–	3	3
CO4	3	3	2	–	–	–	–	–	–	–	–	–	3	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Data Structures** Introduction to Data Structures: Definitions, Need, Types (Linear, Non-linear), Abstract Data Types (ADTs), Algorithms: Definition, Characteristics, Time and Space Complexity, Introduction to Asymptotic Notations, Types of Data Structures: Static vs Dynamic, Applications of Data Structures.	7
2	**Searching and Sorting Techniques** **Searching Algorithms:** Linear Search, Binary Search **Sorting Algorithms:** Bubble Sort, Selection Sort, Insertion Sort, Merge Sort , Quick Sort, Comparison of Sorting Techniques (Time Complexity)	6
3	**Stack and Queue** **Stacks:** Definition, Operations on Stack, Applications (Infix to Postfix, Expression Evaluation, Recursion – Tower of Hanoi), Implementation using Arrays and Linked Lists **Queues:** Definition, Operations on Queue, Types: Simple Queue, Circular Queue, Dequeue, Priority Queue, Implementation using Arrays and Linked List.	7
4	**Linked List** Introduction and Comparison with Arrays, **Types of Linked Lists:** Singly Linked List, Doubly Linked List, Circular Linked List (Singly and Doubly) Operations: Create, Traverse, Insert, Delete, Reverse	8
5	**Trees** Tree terminology, Representation, Binary Tree, Binary Tree Traversal methods, Types of Binary Tree, Binary Search Tree, Operations on BST (Insertion, Deletion and Search), Introduction to B Tree, B + Tree.	7
6	**Graphs** Graph Terminology, Vertex, Edge, Degree, Types of Graphs, Graph Representations: Adjacency Matrix, Adjacency List, Sparse Matrix Representation. Graph Traversal Algorithms: Breadth-First Search (BFS), Depth-First Search (DFS), Applications of Graph.	7

Text books:

1. Fundamentals of Data Structures in C,2nd Edition, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Universities Pres, 2008
2. Data Structures Using C, 3rd Edition, Reema Thareja, Oxford University Press (India)

Reference books:

1. Data Structures, 6th Edition, Seymour Lipschutz, McGraw-Hill Education, 2017
2. Data Structures Through C, 2nd Edition, Yashwant Kanetkar, BPB Publication, 2019

Online Resources:

1. Geeks for Geeks – Data Structures- https://www.geeksforgeeks.org/data-structures/
2. Coursera – Data Structures (University of California San Diego) - https://www.coursera.org/learn/data-structures

Discrete Mathematical Structures

Course Name: : Discrete Mathematical Structures	L	T	P	Credits
CourseCode:25CS303	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Concepts of Basic Mathematics

Course Objective:	
1	To expose the students to the mathematical logic related to computer science areas
2	To enhance the problem-solving skills in the areas of theoretical computer science
3	To use mathematical concepts in the development of computer applications.

Course Outcomes:	
CO1	Apply principles of mathematical logic and set theory to formulate, analyze, and validate logical arguments
CO2	Analyze and model relations, functions, and combinatorial structures
CO3	Design and solve problems using trees and graph theory concepts for real-world and computational applications.
CO4	Demonstrate of algebraic systems and apply their properties to solve mathematical and computer science problems.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	2

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Mathematical Logic** Statements & Notations, Propositional logic, Logical connectives, Truth tables, Normal forms, Well-formed formulas & Tautologies, Equivalence of formulas & Duality law, Tautological Implications, Other Connectives, Predicate logic, Universal and existential quantification. Principles of Mathematical Induction.	8
2	**Set Theory** Basic concepts of set theory, Types of set, Operations on Sets, Venn Diagrams, Cardinality and Countability, Ordered pairs & n-tuples, Cartesian product,	6
3	**Relations & Functions** Relations, Properties of binary relations, Representation of relation, Equivalence Relations, Composition of Relation, POSET & Hasse Diagram, Functions, Types of Functions, Equivalence relations, Composition of function.	7
4	**Probability & Statistics** Basic Counting Principles, Permutations, Combinations, Binomial Theorem, Pigeonhole Principle, Recurrence Relations, Poission Distribution, Binomial Distribution, Mean & Variance of Random Variable.	7
5	**Trees & Graph** Basic terminology of tree, Spanning trees and cut set, Minimal spanning trees, Kruskal's and Prim's algorithms for minimal spanning tree. Basic concepts of graph theory, Types of graph, Matrix Representations of Graphs, Shortest path problems, Isomorphic graphs, Planar graphs.	7
6	**Algebraic Systems** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Subgroup & Homomorphism, Algebraic Structures with two Binary Operation, Rings, Fields, Boolean Algebra and Boolean Ring.	7

Textbooks:

1. Elements of Discrete Mathematics, C. L. Liu, McGraw-Hill Publication, 3rd Edition, 2008
2. Discrete Mathematical Structures, Bernard Kolman, Robert C. Busby, and Sharon Ross 1st Edition, Pearson Education

Reference books:

1. Lipschutz , Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2009.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Publication, 6th Edition, 2010

DATA STRUCTURES

Title of the Course Name: (MDM): Data Structures	**L**	**T**	**P**	**Credits**
Course Code: 25CS304 A	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Knowledge of C Programming

Course Objectives: The course aims:

1. To understand fundamental data structures and their applications.
2. To analyze algorithms using time and space complexity.
3. To select appropriate data structures for efficient problem solving.
4. To implement linear and non-linear data structures.

Course Outcomes: At the end of the course, students will be able to:

	Course Outcomes
CO1	Understand data structures, ADTs, and basic searching and sorting algorithms.
CO2	Implement stacks, queues, and linked lists to solve practical problems.
CO3	Develop and traverse tree structures and perform heap operations.
CO4	Represent graphs and apply BFS and DFS traversal algorithms.

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	–	–	–	–	–	–	–	–	–	2	-
CO2	3	3	2	–	–	–	–	–	–	–	–	–	3	3
CO3	3	3	2	–	–	–	–	–	–	–	–	–	3	3
CO4	3	3	2	–	–	–	–	–	–	–	–	–	3	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Data Structures** Introduction to Data Structures: Definitions, Need, Types (Linear, Non-linear), Abstract Data Types (ADTs), Algorithms: Definition, Characteristics, Time and Space Complexity, Introduction to Asymptotic Notations, Types of Data Structures: Static vs Dynamic, Applications of Data Structures.	7
2	**Searching and Sorting Techniques** **Searching Algorithms:** Linear Search, Binary Search **Sorting Algorithms:** Bubble Sort, Selection Sort, Insertion Sort, Merge Sort , Quick Sort, Comparison of Sorting Techniques (Time Complexity)	6
3	**Stack and Queue** **Stacks:** Definition, Operations on Stack, Applications (Infix to Postfix, Expression Evaluation, Recursion – Tower of Hanoi), Implementation using Arrays and Linked Lists **Queues:** Definition, Operations on Queue, Types: Simple Queue, Circular Queue, Dequeue, Priority Queue, Implementation using Arrays and Linked List.	7
4	**Linked List** Introduction and Comparison with Arrays, **Types of Linked Lists:** Singly Linked List, Doubly Linked List, Circular Linked List (Singly and Doubly) Operations: Create, Traverse, Insert, Delete, Reverse	8
5	**Trees** Tree terminology, Representation, Binary Tree, Binary Tree Traversal methods, Types of Binary Tree, Binary Search Tree, Operations on BST (Insertion, Deletion and Search), Introduction to B Tree, B + Tree.	7
6	**Graphs** Graph Terminology, Vertex, Edge, Degree, Types of Graphs, Graph Representations: Adjacency Matrix, Adjacency List, Sparse Matrix Representation. Graph Traversal Algorithms: Breadth-First Search (BFS), Depth-First Search (DFS), Applications of Graph.	7

Text books:

1. Fundamentals of Data Structures in C,2nd Edition, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Universities Pres, 2008
2. Data Structures Using C, 3rd Edition, Reema Thareja, Oxford University Press (India)

Reference books:

1. Data Structures, 6th Edition, Seymour Lipschutz, McGraw-Hill Education, 2017
2. Data Structures Through C, 2nd Edition, Yashwant Kanetkar, BPB Publication, 2019

Online Resources:

1. Geeks for Geeks – Data Structures- https://www.geeksforgeeks.org/data-structures/
2. Coursera – Data Structures (University of California San Diego) - https://www.coursera.org/learn/data-structures

DATA STRUCTURES

Title of the Course Name (MDM): Data Structures	**L**	**T**	**P**	**Credits**
Course Code: 25CS304 B	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Knowledge of C Programming

Course Objectives: The course aims:

1. To understand fundamental data structures and their applications.
2. To analyze algorithms using time and space complexity.
3. To select appropriate data structures for efficient problem solving.
4. To implement linear and non-linear data structures.

Course Outcomes: At the end of the course, students will be able to:

	Course Outcomes
CO1	Understand data structures, ADTs, and basic searching and sorting algorithms.
CO2	Implement stacks, queues, and linked lists to solve practical problems.
CO3	Develop and traverse tree structures and perform heap operations.
CO4	Represent graphs and apply BFS and DFS traversal algorithms.

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	–	–	–	–	–	–	–	–	–	2	-
CO2	3	3	2	–	–	–	–	–	–	–	–	–	3	3
CO3	3	3	2	–	–	–	–	–	–	–	–	–	3	3
CO4	3	3	2	–	–	–	–	–	–	–	–	–	3	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Data Structures** Introduction to Data Structures: Definitions, Need, Types (Linear, Non-linear), Abstract Data Types (ADTs), Algorithms: Definition, Characteristics, Time and Space Complexity, Introduction to Asymptotic Notations, Types of Data Structures: Static vs Dynamic, Applications of Data Structures.	7
2	**Searching and Sorting Techniques** **Searching Algorithms:** Linear Search, Binary Search **Sorting Algorithms:** Bubble Sort, Selection Sort, Insertion Sort, Merge Sort , Quick Sort, Comparison of Sorting Techniques (Time Complexity)	6
3	**Stack and Queue** **Stacks:** Definition, Operations on Stack, Applications (Infix to Postfix, Expression Evaluation, Recursion – Tower of Hanoi), Implementation using Arrays and Linked Lists **Queues:** Definition, Operations on Queue, Types: Simple Queue, Circular Queue, Dequeue, Priority Queue, Implementation using Arrays and Linked List.	7
4	**Linked List** Introduction and Comparison with Arrays, **Types of Linked Lists:** Singly Linked List, Doubly Linked List, Circular Linked List (Singly and Doubly) Operations: Create, Traverse, Insert, Delete, Reverse	8
5	**Trees** Tree terminology, Representation, Binary Tree, Binary Tree Traversal methods, Types of Binary Tree, Binary Search Tree, Operations on BST (Insertion, Deletion and Search), Introduction to B Tree, B + Tree.	7
6	**Graphs** Graph Terminology, Vertex, Edge, Degree, Types of Graphs, Graph Representations: Adjacency Matrix, Adjacency List, Sparse Matrix Representation. Graph Traversal Algorithms: Breadth-First Search (BFS), Depth-First Search (DFS), Applications of Graph.	7

Text books:

1. Fundamentals of Data Structures in C,2nd Edition, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Universities Pres, 2008
2. Data Structures Using C, 3rd Edition, Reema Thareja, Oxford University Press (India)

Reference books:

1. Data Structures, 6th Edition, Seymour Lipschutz, McGraw-Hill Education, 2017
2. Data Structures Through C, 2nd Edition, Yashwant Kanetkar, BPB Publication, 2019

Online Resources:

1. Geeks for Geeks – Data Structures- https://www.geeksforgeeks.org/data-structures/
2. Coursera – Data Structures (University of California San Diego) - https://www.coursera.org/learn/data-structures

Professional Skill Development

Course Name: **Professional Skill Development** Course Code: **25CS305**	L	T	P	Credits
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	25	--	25	--

Pre-Requisite: Basic literacy or education, Willingness to learn.

Course Objective: The course aims to:	
1	Students learn to acknowledge themselves, develop confidence, and take action without fear.
2	Students understand that dreams are realized through process, not talent or luck.
3	Acquiring Practical Task Management Skills
4	Students learn how to break goals into tasks, manage time, and sustain effort.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Explain the concepts of self-esteem, inner dialogue, and self-awareness using reflective writing techniques.
CO2	Apply value clarification, visualization, and self-awareness tools to design a clear long-term personal vision.
CO3	Formulate SMART goals and convert personal aspirations into structured action plans and weekly schedules.
CO4	Analyze progress through reflection, peer feedback, and outcome evaluation to improve decision-making and resilience.
CO5	Create and present a personal growth portfolio demonstrating continuous improvement using the PDCA cycle.

CO-PO & PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	–	–	–	–	–	2	–	3	–	2	–	–	–	–
CO2	–	2	3	–	–	2	–	2	–	–	2	–	–	–
CO3	–	3	3	–	–	–	–	–	–	–	3	–	–	–
CO4	–	3	2	2	–	–	–	–	3	2	–	–	–	–
CO5	–	2	3	–	2	–	–	2	2	3	2	–	–	–

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Self-Esteem and Inner Dialogue** • What is self-esteem, and why does it matter? • The power of writing and reflection (core philosophy of KAMI-MEMO) Self-awareness and value clarification exercises	5
2	**Visualizing the Future** • Designing a personal vision (5-year / 10-year future) Turning abstract dreams into concrete descriptions	5
3	**Goal Setting and Task Breakdown** • Translating dreams into goals • SMART goals and milestone design Weekly planning and prioritization	5
4	**Execution and Reflection** • Monitoring progress through written reflection • Understanding success and failure as data Peer feedback and discussion	5
5	**Process Improvement** • Reviewing and redesigning action plans • Strengthening problem-solving and resilience Creating a personal improvement cycle (PDCA)	5
6	**Final Presentation** • Presentation of personal growth portfolio Reflection on mindset, behaviour, and outcomes	5

Text Book:

1. Kunio Hara, KAMI-MEMO: Successful Future Will Be Ahead for You with the Method of Writing Notes on a Piece of Paper, English Edition, Kindle Edition.

Reference books:

1. Nathaniel Branden, The Six Pillars of Self-Esteem, Bantam Books.
2. Carol S. Dweck, Mindset: The New Psychology of Success, Ballantine Books.

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Universal Human Values

Course Name: **Universal Human Values**	L	T	P	Credits
CourseCode:**25CS306**	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic knowledge of management, Communication Skill

Course Objective: The course aims:	
1	Develop clarity of human values to enable students to understand harmony at individual, family, society, and nature levels.
2	Help students identify their aspirations related to happiness and prosperity.
3	Enable students to evaluate ethical and moral issues in personal and professional life.
4	Promote responsible behavior, social commitment, and holistic development among engineering students.

Course Outcomes:	
CO1	Understand the concept of human values and the need for value-based education.
CO2	Analyze the relationship between self, family, society, and nature for achieving harmony.
CO3	Apply universal human values in personal, social, and professional decision-making.
CO4	Demonstrate ethical conduct, social responsibility, and sustainable thinking as an engineer.

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	2	-	2	-	1	2	-	-	-
CO2	-	2	-	-	-	3	2	2	1	1	2	-	-	-
CO3	-	-	-	-	-	3	-	3	2	2	3	-	-	-
CO4	-	-	-	-	-	3	3	3	1	1	3	-	-	-

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Universal Human Values** Introduction to Value Education, Need and importance of Universal Human Values, Self-exploration and self-awareness, Natural acceptance, Right understanding, Relationship between values, skills, and knowledge.	05
2	**Understanding Happiness and Prosperity** Concept of happiness and prosperity, Difference between happiness and pleasure, Short-term vs long-term happiness, Continuous happiness and prosperity, Role of values in achieving sustainable happiness.	05
3	**Harmony in the Individual (Self)** Human aspirations, Co-existence of self and body, Understanding needs of self and body, Right utilization of physical facilities, Holistic development of individual.	05
4	**Harmony in Family and Society** Family as a basic unit of society, Values in family: trust, respect, affection, care, guidance, Reverence, Social harmony, Justice, equality, and mutual cooperation, Ethical human conduct, Impact of technology on society.	05
5	**Harmony in Nature and Existence** Relationship between human beings and nature, Mutual enrichment, Sustainable development, Environmental responsibility, Concept of co-existence, Role of engineers in environmental protection.	05
6	**Professional Ethics and Value-Based Engineering** Ethical responsibilities of engineers, Professional ethics, Social accountability, Case studies related to ethical dilemmas in engineering practice, Value-based decision making, Ethics in emerging technologies, Role of engineers in ensuring transparency, fairness and accountability in technological systems.	05

Textbooks:

1. Gaur, R. R., Sangal, R., and Bagaria, G. P., A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi.
2. Tripathi, A. N., *Human Values*, New Age International Publishers.

Reference Books:

1. Universal Human Values, AICTE Model Curriculum
2. Ethics in Engineering, Mike Martin and Roland Schinzinger, McGraw Hill.
3. Professional Ethics and Human Values, R. Subramanian, Oxford University Press.

MOOC/NPTEL Platform:

1. Sharma, A. K., Exploring Human Values: Visions of Happiness and Perfect Society, NPTEL, IIT Kanpur. https://nptel.ac.in/courses/109104068
2. Kapur, N. S., and Sreesailam, V., Applied Ethics, SWAYAM. https://onlinecourses.swayam2.ac.in/nou26_ge38/preview
3. Pandey, A., Essential Values and Ethics: Cultivating Professional Excellence and Career

Advancement, SWAYAM. https://onlinecourses.swayam2.ac.in/imb26_mg88/preview

Mini Project-I

Title of the Course Name: Mini Project-I **Course Code:**25CS307	**L**	**T**	**P**	**Credit**
	--	--	2	1
Evaluation Scheme:	ISE 1	MSE	ISE 2	ESE
Marks:	25	–	25	–

Pre-Requisite: Awareness of social, community, or environmental issues relevant to engineering solutions

Course Objectives: The course aims:

1. To develop awareness of social responsibility and community challenges.
2. To enable students to identify real-life problems and design practical solutions.
3. To promote teamwork, leadership, and communication skills.
4. To enhance ethical conduct and professional documentation practices.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Identify community needs through interaction and field surveys.
CO2	Analyze societal problems and design feasible intervention strategies.
CO3	Implement community-based projects using participatory methods.
CO4	Evaluate project outcomes and prepare professional technical documentation.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	–	3	2	2	1	2	–	–	–	–
CO2	1	3	3	2	1	2	2	2	2	2	1	–	–	–
CO3	–	2	3	2	2	3	3	2	3	3	2	–	–	–
CO4	–	2	2	2	1	2	2	3	2	3	3	–	–	–

Course Overview: The Mini Project-I course is designed to instill social responsibility among students and strengthen the connection between academic institutions and local communities. The project encourages students to apply their academic knowledge to solve real-life societal challenges and contribute towards sustainable development.

- The guiding motto of this course is: **"Campus to Community"**
- Students are expected to identify socially relevant issues under the guidance of faculty mentors and propose or implement practical solutions. These projects promote collaboration, empathy, leadership skills, and civic responsibility, enabling students to gain real-world experience while benefiting society.
- A group of students (max. 4 and min. 2) could be assigned with a project guide.

The topics for the course may cover the following diverse sectors (but not limited to):

- **Health**: Free health check-up camps, mental health awareness programs.
- **Livelihood**: Skill development workshops, micro-entrepreneurship support.
- **Education**: Digital literacy programs, mobile libraries, career guidance camps.
- **Environment**: Rainwater harvesting awareness, solar lighting initiatives.
- **Cultural Heritage**: Documentation of local history, cultural exchange programs.

Through such initiatives, communities become active partners in development, creating a more inclusive and resilient society.

Sr. No.	Guidelines
1	**Project Overview:** Students will engage with a local community or a specific group within the community, such as schools, women's groups, farmers, etc. to identify challenges and collaboratively develop solutions. This hands-on project allows students to apply their knowledge and skills while fostering social responsibility. **Key Components of the Project:** **1. Community Selection & Understanding:** • **Community Identification:** Choose a community in need of support, whether it's based on location (urban, rural) or a demographic group (youth, elderly, marginalized populations). • **Problem Identification:** Engage with community members to identify pressing issues or challenges, such as education, health, environment, or livelihoods. • **Cultural Sensitivity:** Understand the cultural, social, and economic background of the

community before engaging.

2. Engagement Approach:

Participatory Method:

Involve the community at every stage—from identifying problems to developing and implementing solutions.

Partnership with Local Leaders:

Collaborate with community leaders, NGOs, or local government representatives to ensure the project's effectiveness.

Capacity Building:

Focus on empowering community members with knowledge and skills that promote self-reliance.

3. Community Engagement Methodology:

A. **Pre-Engagement Research:**

Conduct preliminary research on the community to understand its demographics, socio-economic conditions and existing services or infrastructure.

Review similar case studies or projects to gain insights into best practices.

B. **Initial Field Visits:**

Arrange field visits to meet with key stakeholders and community members. Hold informal meetings to build rapport and trust.

C. **Needs Assessment:**

Use surveys, interviews or focus group discussions to gather information about the community's needs.

Assess both short-term and long-term needs related to areas such as education, healthcare, sanitation, livelihoods and environment.

D. **Project Design:**

Based on the findings from the needs assessment, propose actionable solutions.

Ensure that the proposed interventions are feasible, sustainable and culturally appropriate.

Examples of interventions could include awareness campaigns, skill development workshops, environmental conservation activities or infrastructure improvements.

4. Implementation Plan:

A. **Action Plan:**

- **Timeline:** Create a clear timeline for implementing the project, with specific milestones.
- **Roles & Responsibilities:** Assign specific tasks to team members and involve community members in the implementation process.
- **Resource Management:** Identify the resources (financial, material, human) needed to implement the project and create a budget.

B. Pilot Project (if applicable):

- Consider implementing a pilot phase to test the intervention on a smaller scale and make necessary adjustments before full-scale implementation.

C. Community Participation:

- Encourage community ownership by involving them in the execution phase (e.g., labor, materials, decision-making).
- Provide opportunities for community members to gain skills during the implementation, such as through training sessions or workshops.

5. Monitoring & Evaluation:

Monitoring Progress:

Regularly assess the progress of the project against the action plan.

Identify any challenges or delays and address them promptly in collaboration with the community.

Evaluation:

Measure the impact of the project by comparing pre-project and post-project conditions.

Use both qualitative and quantitative methods to evaluate success (e.g., improvements in literacy rates, health outcomes, or income levels).

Community Feedback:

Gather feedback from the community on the effectiveness of the intervention.

Hold feedback sessions with community leaders and participants to assess whether the project has met their expectations and addressed their needs.

6. Reporting & Documentation:

Final Report:

Prepare a comprehensive report documenting the entire project process, from the initial engagement to implementation and evaluation.

Include sections on:

- Introduction and community background
- Needs assessment findings
- Project design and implementation strategy
- Challenges and lessons learned
- Outcomes and impact analysis
- Recommendations for future engagement

Visual Documentation:

Include photographs, videos or other visual media to document the process and outcomes.

Create info graphics or presentations that highlight key results and impact.

7. Reflection and Learning:

Team Reflection:

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- Hold a reflection session with your project team to discuss the experiences, challenges, and personal growth resulting from the project.
- Identify what worked well and what could be improved for future community engagement efforts.

C. Community Reflection:

- Engage the community in a reflective discussion about their experience with the project and the changes they have observed or experienced.

8. Ethical Considerations:

A. Informed Consent:

- Ensure that community members give informed consent before participating in the project, especially in data collection activities (e.g., interviews, surveys).
- Maintain transparency about the project's goals and the expected outcomes.

C. Respect for Cultural Norms:

- Respect the community's cultural practices, beliefs, and social norms throughout the project.
- Avoid imposing external solutions that may not align with the community's values.

D. Confidentiality:

- Ensure confidentiality and privacy when dealing with sensitive information, especially personal or demographic data.

9. Submission Guidelines:

A. Final Report:

- Submit a well-organized report that includes all phases of the project.

B. Presentation:

- Prepare a final presentation summarizing the project, including key results, challenges and recommendations.
- Use visual aids, such as photos, videos or maps to illustrate the community engagement process and outcomes.

10. Evaluation Criteria:

- **Community Involvement (25%):**

Extent of community participation in the project.

- **Problem-Solution Match (25%):**

Appropriateness of the solution developed for the identified community needs.

- **Implementation Effectiveness (20%):**

How effectively the project was executed, including timeliness and resource use.

- **Impact (20%):**

Tangible improvements or changes in the community.

- **Reflection and Learning (10%):**

Depth of insight gained through reflection on the process and outcomes.

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	11. Timeline: • Week 1-2: Community research and selection. • Week 3-4: Field visits and needs assessment. • Week 5-6: Project design and planning. • Week 7-10: Implementation and monitoring. • Week 11-12: Evaluation and reporting.
2.	**Deliverables** • Mini Project Proposal (Hard copy and Soft copy – before implementation) • Weekly Progress Logbook duly signed by the project guide • Final Project Report (Hard copy and PDF) • Working Model / Simulation Output (As applicable) • Presentation Slides (PPT) • Final Viva-Voce Source Code / Design Files (Pen Drive / Cloud Link) if any.

Object Oriented Programming using C++

Course Name: Object Oriented Programming using C++	L	T	P	Credits
Course Code: **25CS308**	1	--	2	2
Evaluation Scheme:	ISE		ESE	
Marks:	50		50	

Pre-Requisite: Programming in C

Course Objective:	
1	Apply object-oriented principles to solve programming problems using C++.
2	Develop C++ programs using classes, inheritance, polymorphism, and dynamic memory management.
3	Implement STL, templates, and exception handling to build efficient applications.
4	Design modular, reusable, and maintainable C++ solutions following industry coding standards.

Course Outcomes:	
CO1	Apply object-oriented principles such as encapsulation, inheritance, abstraction, and polymorphism in C++ programs.
CO2	Develop C++ applications using classes, objects, constructors, destructors, and dynamic memory management.
CO3	Implement STL, templates, and exception handling to create efficient and robust solutions.
CO4	Design modular, reusable, and maintainable C++ programs following standard programming practices.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	-	-	-	-	-	2	2	3	2
CO2	3	2	3	-	2	-	-	-	-	-	2	2	3	3
CO3	2	2	3	-	3	-	-	-	-	-	2	2	3	3
CO4	2	2	3	-	3	-	-	-	-	-	2	2	3	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Foundations of Object Oriented Programming –** Need of Object Oriented Programming, Procedural vs. Object Oriented Approach Basic OOP Concepts: Object, Class, Encapsulation, Data Abstraction and Information Hiding, Data Hiding, Structure of a C++ Program, Object as a Data Type.	2
2	**Constructors, Destructors and Object Handling -** **Constructors**: default, parameterized, copy, Destructors, Objects as function arguments, Returning objects from functions, Scope resolution operator, Passing objects by value vs. reference, Returning objects and temporary objects	2
3	**Operator Overloading and Type Conversion –** Concept of Operator Overloading, Overloading unary and binary operators, Rules and limitations of operator overloading, Type conversion: basic to class, class to basic	2
4	**Inheritance and Runtime Polymorphism –** Concept of Inheritance, Types of inheritance (single, multilevel, multiple – overview), Access control in inheritance Base and derived classes, Function overriding, Virtual functions, Abstract classes ,Friend functions, Static Binding and Dynamic Binding.	2
5	**Streams and File Handling-** Streams, Stream output and input, Stream manipulators, Built-in manipulators: endl, setw, set precision fixed, Formatting output using manipulators, File Handling Concepts, File Stream Classes: Creating, Reading, Updating sequential and random files, Exception Handling Concepts.	3
6	**Introduction to Standard Template Library (STL)-** Concept of Generic Programming, Overview and Architecture of STL, Components of STL- Containers, Algorithms, Sequence Containers, Common STL	3

Text books:

1. E. Balagurusamy, Object Oriented Programming with C++, McGraw-Hill Publication, 6th Edition, 2013

Reference books:

1. Robert Lafore, Object Oriented Programming in C++, Sams Publishing, 4th Edition, 2001.
2. Dr. B. B. Meshram, Object Oriented Paradigms with C++ Beginners Guide for C and C++, SPD Publication, 1st Edition, 2016
3. Rajesh R. Shukla, Object-Oriented Programming in C++, Wiley India Publication, 1stEditio, 2008

Object Oriented Programming using C++ - Laboratory

Pre-Requisite: Programming in C

Course Objectives: The course aims:

1. Apply object-oriented concepts to analyze and solve real-world problems using C++.
2. Design and develop C++ programs using OOP principles and standard language constructs.
3. Demonstrate understanding of OOP and C++ syntax through program implementation.
4. Develop efficient, modular, and reusable C++ applications to enhance problem-solving skills.

Course Outcome:	
CO1	Understand problems and develop C++ programs using basic object-oriented concepts.
CO2	Apply C++ programming constructs to solve problems through coding.
CO3	Use dynamic memory management features in C++ programs.
CO4	Develop modular and reusable C++ programs for real-world applications.

CO-PO Mapping:

CO / PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	–	2	1	–	–	–	1	1	–	2	1	3	2
CO2	–	–	–	–	–	1	–	–	–	1	–	–	–	–
CO3	–	1	–	–	2	–	–	–	1	–	–	–	–	–
CO4	2	–	–	2	–	2	–	–	–	1	–	1	–	–

Course Content		
Experiment No.	**Experiment Title and Contents**	**Hrs**
1	Write a program to show the use of arithmetic, relational, and logical operators, type casting, arithmetic promotion, and calling methods created by the user.	2
2	Write a program to perform array creation, traversal, searching, and basic operations (sum, average, maximum) on 1D and 2D arrays.	2
3	Implement student grading system using class and object concept in C++.	2
4	Implement a Rectangle class with attributes for length and width. Include constructors, a destructor, and member functions to calculate area and perimeter.	2
5	Implement a program to perform multiple inheritance for an Educational Institute database.	2
6	Implement a program to find the area of different shapes using function overloading.	2
7	Implement Friend Function and Friend Class concept in C++	2
8	Develop a program in which a base class Shape has a virtual function area(). Inherit Circle and Rectangle classes from Shape and calculate the area in each derived class	2
9	Program on file handling and stream manipulation.	2
10	Write a program using try, catch, and throw to manage divide-by-zero exceptions.	2
11	Write a program using a function template to determine the largest of two values.	2
12	Develop a program to demonstrate basic operations using STL containers such as vector, list, and map.	2
Note:	*Any 10 practical/experiments will be completed.	

Text books:

1. The Complete Reference C++ by Herbert Schildt, Tata McGraw-Hill, 4th Edition and onwards.
2. The C++ Programming Language by Bjarne Stroustrup, Pearson Education.

Reference books:

1. Object-Oriented Programming with C++ by E. Balagurusamy, Tata McGraw-Hill, 6th Edition.
2. C++ Programming: An Object-Oriented Approach by Behrouz A. Forouzan and Richard F. Gilberg, Tata McGraw-Hill.

Title of the Course Name: Data Structures Lab	L	T	P	Credits
Course Code:**25CS309**	--	--	2	1
Evaluation Scheme:	ISE			ESE
Marks:	50			50

Pre-Requisite: Programming in C

Course Objectives

1. To enable students to implement fundamental data structures using C programming.
2. To develop the ability to apply searching and sorting algorithms for efficient problem solving.
3. To provide hands-on experience in using linear and non-linear data structures such as stacks, queues, linked lists, trees, and graphs.
4. To enhance logical thinking and algorithmic skills through practical implementation and analysis of data structures.

Course Outcome:	
CO1	Implement basic data structures and algorithms using C.
CO2	Apply searching and sorting techniques to solve problems.
CO3	Develop and use linear and non-linear data structures.
CO4	Analyze and validate program outputs for correctness and efficiency.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	1	1	-	-	-	-	-	-	-	-	2	2

Experiment No.	Experiment Title and Contents	Hrs
1	Write a C program to understand basic concepts of data structures, ADTs, and algorithm analysis (time complexity).	2
2	Implement array operations such as insertion, deletion, searching, and traversal.	2
3	Implement Linear Search and Binary Search and compare their performance.	2
4	Implement Bubble Sort, Selection Sort, and Insertion Sort.	2
5	Implement Merge Sort and Quick Sort.	2
6	Implement stack operations using arrays and linked lists; applications like infix to postfix conversion.	2
7	Implement Simple Queue and Circular Queue using arrays.	2
8	Implement Deque and Priority Queue using arrays or linked lists.	2
9	Implement Singly Linked List operations: create, insert, delete, traverse, and reverse.	2
10	Implement Doubly Linked List and Circular Linked List operations.	2
11	Implement Binary Tree and Binary Search Tree with traversal techniques (Inorder, Preorder, Postorder).	2
12	Represent graphs using adjacency matrix/list and implement BFS and DFS algorithms.	2
Note:	*Any 10 practical/experiments will be completed.	

Text books:

1. Data Structures Using C – Reema Thareja (Oxford University Press)
2. Fundamentals of Data Structures in C – Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed (Universities Press)

Reference books:

1. Data Structures and Algorithm Analysis in C – Mark Allen Weiss (Pearson)
2. Schaum's Outline of Data Structures with C – Seymour Lipschutz & John R. Hubbard (McGraw-Hill)

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Design & Analysis of Algorithms

Course Name: **Design & Analysis of Algorithms**	L	T	P	Credits
Course Code:25CS401	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Data Structures

Course Objective:	
1	To understand the fundamentals of algorithm design and analysis.
2	To analyze algorithm efficiency using time and space complexity.
3	To apply algorithm design techniques for solving real-world problems.
4	To develop skills in designing optimal algorithms for various problem domains.

Course Outcomes:	
CO1	Analyze the correctness and efficiency of algorithms.
CO2	Apply basic algorithm design techniques (divide & conquer, greedy, dynamic programming).
CO3	Design and implement algorithms for graph problems and optimization tasks.
CO4	Solve computational problems by selecting appropriate algorithmic strategies

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	–	–	–	–	–	–	–	-	2	1
CO2	3	3	2	-	–	–	–	–	–	–	–	-	3	2
CO3	3	3	3	1	–	–	–	–	–	–	–	1	3	3
CO4	3	3	2	-	–	–	–	–	–	–	–	-	3	2

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Algorithms:** Definition, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithms Analysis, Order of Growth, Asymptotic Notations – Big Oh, Omega, Theta and related examples.	5
2	**Divide and Conquer:** Introduction, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.	5
3	**Greedy Algorithms:** Introduction to Greedy Technique, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Minimum Spanning Tree Prim's, Kruskal's Algorithm.	8
4	**Dynamic Programming:** Introduction, Characteristics of Dynamic Programming, Component of Dynamic Programming, Longest Common Subsequence, matrix multiplication, shortest paths: Bellman-Ford, Floyd Warshall, Application of Dynamic Programming – Multistage Graph & Optimal Binary Search Tree, Comparison of Divide-and-Conquer and Dynamic Programming Techniques,	10
5	**Backtracking:** Backtracking Concept, N–Queens Problem, Four–Queens Problem, Eight–Queen Problem, Hamiltonian Cycle, Sum of Subsets Problem, **Branch and Bound:** Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and Branch and Bound.	8
6	**NP Completeness:** Introduction to Computational Complexity Classes, Definition of computational complexity, Classification of problems based on solvability efficiency, Need for complexity theory, Complexity Classes – Class P, NP, NP Complete, NP Hard, P verses NP, Polynomial-Time Reductions - Definitions and examples, Role of reductions in proving NP-Completeness, Classic NP-Complete Problems - Hamiltonian Cycle, Graph Coloring.	6

Text Books:

1. T. Cormen, Introduction to Algorithms, PHI Publication, 4th Edition, 2022.
2. Jon Kleinberg & Éva Tardos, Algorithm Design, Pearson, 1St Edition, 2006.

Reference Books:

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1st Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, Algorithm Design – Foundation, Analysis & Internet Examples, Wiley Publication, 2nd Edition,2006.

Database Management System

Course Name: Database Management System	L	T	P	Credits
Course Code:25CS402	3	--	2	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Data Structures, Programming Fundamentals.

Course Objective:	
1	**Explain** the fundamental concepts of database management systems, including data models, database architecture, entity–relationship modeling, and types of databases.
2	**Apply** relational database design principles, normalization techniques, and SQL constructs for defining, querying, and managing relational databases.
3	**Explain** the concepts of parallel and distributed database systems, including query parallelism, distributed storage, transaction management, and cloud-based databases.
4	**Explain** file organization, indexing and hashing techniques, query processing and optimization, and transaction management concepts including ACID properties, concurrency control, and recovery mechanisms.

Course Outcomes:	
CO1	Explain the concepts of database management systems, data models, database architecture, entity–relationship modeling, and types of databases.
CO2	Apply relational database design and normalization concepts, along with SQL language constructs for defining, querying, and managing relational databases.
CO3	Explain parallel and distributed database concepts, including query parallelism, distributed data storage, transaction management, and cloud-based database systems.
CO4	Explain file organization, indexing and hashing techniques, query processing and optimization, transaction management concepts, ACID properties, concurrency control, and recovery mechanisms in database systems.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	2	2	-	-	-	-	-	-	1	2	2	2
CO2	1	3	3	3	3	-	-	-	-	-	1	2	2	2
CO3	1	2	2	2	-	-	-	-	-	-	1	2	2	3
CO4	1	2	2	2	-	-	-	-	-	-	1	2	2	2

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction of Database System :** Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS, View of Data, Data Models, Database Architecture, The Entity-Relationship Model – Constraints, keys, E-R Diagrams, Weak Entity Sets, Extended E-R features.	6
2	**Relational Data Model, Relational Algebra and Calculus :** Structure of relational Databases, Relational Database Design, Features of Good Relational, Database Schema, Relational algebra: Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra.	6
3	**Introduction to SQL :** Overview of SQL, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operators, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database Intermediate SQL : Join Expressions, Views, Transactions, Advanced SQL : Assessing SQL from Programming Language, JDBC, ODBC, Embedded SQL, Functions and Procedures, Triggers, Cursor.	8
4	**Normalization :** Introduction, Non loss decomposition and functional dependencies, First, Second and third normal forms, Boyee/Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and fourth normal form.	8
5	**File Organization, Indexing & Hashing :** Overview of File Organization, Organization of Records in Files, Data-Dictionary Storage, Basic Concepts of Indexing and Hashing, Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing.	7
6	**Transaction Processing :** Transaction Concept, A simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, ACID Properties, Serializability Concurrency Control Techniques: Lock based Protocols, Deadlock handling, Multiple Granularity, Time stamp-Based Protocols, Recovery System.	7

Text books:

1. Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw-Hill.
2. "Database Systems – A Practical Approach to Design, Implementation and Management", Thomas Connolly, Carolyn Begg, 4th Edition, Addison Wesley.
3. "MySQL Cookbook", Paul DuBois, 3rd Edition, O'REILLY.

Reference books:

1. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B. Navathe, 6th Edition, Addison Wesley.
2. "Database Systems – Design, Implementation and Management", Rob & Coronel, 5th Edition, Thomson Course Technology.

Computer Network

Course Name: **Computer Network**	L	T	P	Credits
Course Code: **25CS403**	3	--	--	3
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Data Communication

Course Objective: The course aims:	
1	To understand the fundamental concepts, architecture, and components of computer networks, including physical and data link layers.
2	To analyze and apply network layer and transport layer protocols for efficient and reliable data communication.
3	To apply application layer protocols and networking tools to design and implement real-world network solutions.

Course Outcomes:	
CO1	Describe the basic concepts, applications, interconnection devices, and physical layer functions of computer networks.
CO2	Apply framing, flow control, error control mechanisms, data link layer protocols (HDLC, PPP), routing algorithms, and subnetting techniques to solve network communication problems.
CO3	Explain the services, features, and operation of transport layer protocols (UDP, TCP, SCTP).
CO4	Apply application layer protocols such as DNS, FTP, HTTP, SMTP, and POP3 for network communication.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	2	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	2	1	-	-
CO3	3	2	-	-	-	-	-	-	-	-	2	1	-	-
CO4	3	2	-	-	1	-	-	-	-	-	2	1	-	-

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Course Content		
Unit No.	Unit title and Content	Hrs
1	**Computer Networks**: Definition, applications, Advantages and Disadvantages Interconnection Devices: Hub, Bridges, Switch, Routers, Repeater, Gateway, etc. Network models overview (OSI & TCP/IP – introductory level)	7
2	**Physical Layer & Switching Techniques:** Physical Layer: Services, Responsibilities, Interfaces Switching Techniques: Circuit Switching, Packet Switching, Message Switching	7
3	**Error detection & correction:-** Introduction, Block coding, Linear block codes, Cyclic codes, Checksum **Data Link Control**:-Framing, Flow & error control, Noisy and Noiseless channels Protocols, HDLC protocol, Point to Point Protocol.	7
4	**Network Layer:** Routing algorithms Network Layer Design Issues, Routing algorithms- optimality principle, shortest path routing, Flooding, distance vector routing, link state routing, Subnetting	7
5	**Transport Layer :** Process to Process delivery **UDP**: Introduction, User Datagram, Services, UDP operation, use of UDP. **TCP**: Services, Features, Segment, Connection, flow control, error control SCTP: Introduction, Services, Features, Packet Format.	7
6	**Application Layer: DNS, FTP** **DNS:**-Name space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS message. Types of records. **FTP:**Control connection and Data connection, **WWW:** Architecture Web Documents & HTTP, HTTPS, SMTP, POP3	7

Text books:

1. Behrouz A. Forouzan, "Data Communications and Networking", McGraw Hill Education, 5th Edition, 2013.

Reference books:

1. William Stallings, "Data and Computer Communications", Pearson Education, 10th Edition, 2013.
2. Andrew S. Tanenbaum and David J. Wetherall,"Computer Networks", Pearson Education, 5th Edition, 2010.

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Python Programming

Title of the Course Name: (MDM) Python Programming	L	T	P	Credits
Course Code: 25CS404(A)	1	--	2	2

Pre-Requisite: Basic Knowledge of C & C++ Programming

Course Objectives: The course aims:

1. To introduce the fundamentals of Python programming language
2. To develop problem-solving skills.
3. To provide hands-on experience with Python's built-in data structures
4. To expose students to file handling, exception handling, and modular programming concepts.

Course Outcomes: At the end of the course, students will be able to:

	Course Outcomes
CO1	Understand and apply fundamental Python concepts including syntax, variables, data types, operators, and control structures.
CO2	Develop Python programs using functions and core data structures such as strings, lists, tuples, dictionaries, and sets.
CO3	Design object-oriented Python applications using classes, objects, inheritance, and encapsulation.
CO4	Perform file handling, exception handling, modular programming, and data processing using Python libraries.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	1	-	3	-
CO2	3	3		-	2	-	-	-	-	-	1	-	3	2
CO3	2	3	3	-	2	-	-	2	-	-	1	-	2	3
CO4	2	3	2	2	3	1	-	-	2	2	2	3	2	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Python** History and Features of Python, Installing Python, Python IDEs, Basic Syntax and Semantics, Variables and Datatypes, Input/Output Functions, Operators , Type Conversion and Casting Comments and Indentation.	2
2	**Control Structures and Functions** Conditional Statements: if, if-else, Loops: for, while Loop Control Statements: break, continue, pass Introduction to Functions Defining and Calling Functions	3
3	**Data Structures in Python** Strings: operations, methods, formatting Lists: creation, indexing, slicing, operations Tuple: immutable sequences Dictionaries: key-value pairs, methods Sets: operations and methods	2
4	**Object-Oriented Programming (OOP)** Introduction to OOP, Classes and Objects, Constructor (__init__), Instance vs Class Variables, Inheritance: single, multilevel Polymorphism and Method Overriding	2
5	**File Handling, Modules, and Applications** File Operations: open, read, write, append, close Handling text and binary files Exception Handling:- try, except, else, finally, Python Modules and Packages:-math, random, datetime, custom modules, Introduction to Libraries: NumPy, matplotlib (basic use)	3
6	**Database Connectivity with Python** Introduction to Databases, SQLite with Python, Connecting to database, Closing database connections	2

Text books: Python Data Science Handbook, Jake VanderPlas,1st Edition / O'Reilly Media

Reference books:

- Python Programming: An Introduction to Computer Science" – John Zelle, 3rd Edition
- Python Programming: A Modern Approach – Vamsi Kurama, Pearson

Online Resources:

- **Geeks for Geeks – Python Programming**
https://www.geeksforgeeks.org/python-programming-language/
- **Coursera – Python for Everybody (University of Michigan)**
https://www.coursera.org/specializations/python

NPTEL Video Lectures: Introduction to Programming in Python
Instructor: Prof. Madhavan Mukund, Chennai Mathematical Institute
https://nptel.ac.in/courses/106106145

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Python Programming

Title of the Course Name: (MDM) Python Programming	L	T	P	Credits
Course Code: 25CS404(B)	1	--	2	2

Pre-Requisite: Basic Knowledge of C & C++ Programming

Course Objectives: The course aims:

1. To introduce the fundamentals of Python programming language
2. To develop problem-solving skills.
3. To provide hands-on experience with Python's built-in data structures
4. To expose students to file handling, exception handling, and modular programming concepts.

Course Outcomes: At the end of the course, students will be able to:

	Course Outcomes
CO1	Understand and apply fundamental Python concepts including syntax, variables, data types, operators, and control structures.
CO2	Develop Python programs using functions and core data structures such as strings, lists, tuples, dictionaries, and sets.
CO3	Design object-oriented Python applications using classes, objects, inheritance, and encapsulation.
CO4	Perform file handling, exception handling, modular programming, and data processing using Python libraries.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	1	-	3	-
CO2	3	3		-	2	-	-	-	-	-	1	-	3	2
CO3	2	3	3	-	2	-	-	2	-	-	1	-	2	3
CO4	2	3	2	2	3	1	-	-	2	2	2	3	2	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Python** History and Features of Python, Installing Python, Python IDEs, Basic Syntax and Semantics, Variables and Datatypes, Input/Output Functions, Operators , Type Conversion and Casting Comments and Indentation.	2
2	**Control Structures and Functions** Conditional Statements: if, if-else, Loops: for, while Loop Control Statements: break, continue, pass Introduction to Functions Defining and Calling Functions	3
3	**Data Structures in Python** Strings: operations, methods, formatting Lists: creation, indexing, slicing, operations Tuple: immutable sequences Dictionaries: key-value pairs, methods Sets: operations and methods	2
4	**Object-Oriented Programming (OOP)** Introduction to OOP, Classes and Objects, Constructor (__init__), Instance vs Class Variables, Inheritance: single, multilevel Polymorphism and Method Overriding	2
5	**File Handling, Modules, and Applications** File Operations: open, read, write, append, close Handling text and binary files Exception Handling:- try, except, else, finally, Python Modules and Packages:-math, random, datetime, custom modules, Introduction to Libraries: NumPy, matplotlib (basic use)	3
6	**Database Connectivity with Python** Introduction to Databases, SQLite with Python, Connecting to database, Closing database connections	2

Text books: Python Data Science Handbook, Jake VanderPlas,1st Edition / O'Reilly Media

Reference books:

- Python Programming: An Introduction to Computer Science" – John Zelle, 3rd Edition
- Python Programming: A Modern Approach – Vamsi Kurama, Pearson

Online Resources:

- **Geeks for Geeks – Python Programming**
https://www.geeksforgeeks.org/python-programming-language/
- **Coursera – Python for Everybody (University of Michigan)**
https://www.coursera.org/specializations/python

NPTEL Video Lectures: Introduction to Programming in Python
Instructor: Prof. Madhavan Mukund, Chennai Mathematical Institute
https://nptel.ac.in/courses/106106145

Human Computer Interaction

Course Name: **Human Computer Interaction** (Open Elective - I) Course Code: 25CS405	**L**	**T**	**P**	**Credits**
	2	--	--	2
Evaluation Scheme:	**ISE-I**	**MSE**	**ISE-II**	**ESE**
Marks:	10	30	10	50

Pre-Requisite: Basic Computer Fundamentals

Course Objective:	
1	To introduce the fundamental concepts of Human Computer Interaction, emphasizing the importance of user-centered design and effective interaction between humans and computer systems.
2	To develop basic understanding of human thinking abilities, different ways of interaction, and interface elements used to design easy-to-use and user-friendly interfaces.
3	To explain the role of usability principles, design guidelines, and evaluation techniques in developing efficient, accessible, and user-friendly interactive systems.

Course Outcomes:	
CO1	Explain fundamental concepts, importance, and principles of Human Computer Interaction.
CO2	Describe human cognitive factors such as memory, perception, and emotions affecting interaction design.
CO3	Identify and classify interaction styles, models, and user interface components.
CO4	Apply usability principles, design guidelines, and evaluation techniques to user interface design.

CO	**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	1	-	-	1	-	-	-	-	2	2	1	1
CO2	2	2	1	-	-	2	-	-	-	-	2	1	-	2
CO3	2	2	2	-	1	-	-	-	-	-	2	2	2	2
CO4	2	3	3	2	2	1	-	1	2	-	2	3	2	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Human Computer Interaction** Human Computer Interaction – Definition, Importance of HCI, Goals of HCI, Disciplines involved in HCI, User-Centered Design (UCD), Principles of Good Interface Design.	5
2	**Understanding the Human** Input–Output Channels, Human Memory, Thinking – Reasoning and Problem Solving, Human Emotions, Individual Differences, Cognitive Aspects in Design.	5
3	**Understanding the Interaction** Models of Interaction, Interaction Styles (Command Line, Menu, Form Fill-in, Direct Manipulation), Ergonomics, Interactivity, Context of Interaction, User Experience (UX).	5
4	**HCI Design Process** Interaction Design Process, User Focus, Scenarios, Navigation Design, Screen Design, Prototyping Techniques, Wireframing, Introduction to MVC Concept.	5
5	**Design Rules and Evaluation Techniques** Usability Principles, Design Guidelines, Standards, Golden Rules and Heuristics, Usability Evaluation, Expert Evaluation, User-Based Evaluation, Universal Design Principles.	4
6	**Modern Interfaces and Applications** Ubiquitous Computing, Mobile and Touch Interfaces, Virtual Reality (VR), Augmented Reality (AR), Information and Data Visualization, Future Trends in HCI.	4

Text books:

1. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, **Human–Computer Interaction**, Pearson Education, Latest Edition.

Reference books:

1. B. Shneiderman, Designing the User Interface, Addison-Wesley Publishing Company.
2. Jenny Preece, Helen Sharp, Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, Wiley Publication, 4th Edition, 2015.
3. Gerard Jounghyun Kim, Human–Computer Interaction: Fundamentals and Practice, CRC Press, 2015.
4. Jenifer Tidwell, Designing Interfaces, Patterns for Effective Interaction Design, O'Reilly Media, 2nd Edition, 2010.

Entrepreneurship Development

Title of the Course Name: Entrepreneurship Development	**L**	**T**	**P**	**Credits**
Course Code: 25CS406	1	--	--	1

Pre-Requisite: Basic knowledge of management

Course Objectives: The course aims:

1. To introduce the concept of entrepreneurship and its significance in economic development.
2. To develop entrepreneurial competencies and motivation.
3. To familiarize with business planning and project management.
4. To create awareness about startup ecosystem, government schemes, and legal frameworks.

Course Outcomes: At the end of the course, students will be able to:

CO	**Course Outcomes**
CO1	Understand the role and characteristics of an entrepreneur
CO2	Develop business ideas and conduct market surveys
CO3	Prepare a basic business plan and understand project financing
CO4	Identify government policies, start-up ecosystem support, and legal requirements

CO-PO Mapping Table

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	–	–	–	2	–	2	1	1	–	2	–	–	2
CO2	2	3	2	2	1	2	1	–	2	2	1	2	1	2	3
CO3	2	2	3	2	1	1	–	1	2	2	3	1	2	2	3
CO4	1	1	–	–	–	3	2	3	1	1	2	2	–	1	3

Course Content		
Unit No.	**Contents**	**Hrs.**
1	**Introduction to Entrepreneurship:** Definition, Importance, Entrepreneur vs. Manager, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship.	**3**
2	**Corporate Entrepreneurship:** Introduction, Flavors of corporate entrepreneurship, Corporate venturing, Entrepreneurship, organizational transformation, Industry rule bending, Need for corporate entrepreneurship, domain of corporate entrepreneurship	**4**
3	**Business Plan and Project Management:** Idea generation, Screening and Project Identification, Creative Performance, feasibility study, market survey, business plan elements, TRL	**4**
4	**Family and Non Family Entrepreneur & Women entrepreneurs:** Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, , Factors influencing women entrepreneur, Challenges for women entrepreneurs, Growth and development of women entrepreneurs in India	**4**

Text Books:

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing.
2. S.S. Khanka, Entrepreneurial Development, S. Chand.
3. P. Saravanavel, Entrepreneurship Development, Ess Pee Kay Publishing House.

Reference Books:

1. C.B. Gupta & N.P. Srinivasan, Entrepreneurial Development, Sultan Chand & Sons.
2. Hisrich, Peters & Shepherd, Entrepreneurship, McGraw Hill.
3. David H. Holt, Entrepreneurship: New Venture Creation, Prentice Hall of India.

MOOC/NPTEL Platform:

1. **Entrepreneurship Prof. S. S. S. Kumar (IIT Madras)**
   https://nptel.ac.in/courses/110106141
2. **Entrepreneurship and Innovation Prof. V. Gopal (IIT Roorkee)**
   https://nptel.ac.in/courses/110107094
3. **Developing Soft Skills and Personality Prof. T. Ravichandran (IIT Kanpur)**
   https://nptel.ac.in/courses/109104115

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Quantitative Aptitude & Logical Reasoning – I

Course Name: Quantitative Aptitude & Logical Reasoning – I	L	T	P	Credits
Course Code: **25CS407**	1	--	--	1
Evaluation Scheme:	**ISE**	**MSE**	**--**	**ESE**
Marks:	50	--	--	--

Pre-Requisite: None

Course Objective:	
1	To introduce fundamental numerical concepts used in quantitative aptitude.
2	To develop basic logical and analytical reasoning abilities.
3	To enhance problem-solving skills using structured and logical approaches.
4	To prepare students for aptitude-based assessments and employability skills.

Course Outcomes:	
CO1	Explain basic quantitative concepts such as number systems, percentages, and ratios.
CO2	Apply fundamental quantitative aptitude techniques to solve numerical problems.
CO3	Analyze logical reasoning problems including series, coding-decoding, and analogies.
CO4	Solve aptitude and reasoning problems relevant to competitive exams and placements.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	3	-	-	-	-	3	-	-	-	-	-
CO4	-	-	3	-	1	-	2	-	-	1	-	-	-	-

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Fundamentals of Quantitative Aptitude** Number System - Natural, Whole, Integers, Even & Odd numbers, Prime & Composite numbers, Factors and Multiples, Simplification, BODMAS rules, Fractions and Decimals, Squares and Cubes (basic) , Solve problems	3
2	**Percentage, Ratio, and Average** Percentage Concept Increase & Decrease, Simple applications, Ratio and Proportion, Basic ratios, Direct and Inverse proportion, Average, Simple average problems, Concept-based questions, Solve problems	2
3	**Time, Work, and Interest (Introductory)** Time and Work, Work–efficiency concept, Simple work problems, Time, Speed, and Distance, Speed formula, Basic distance problems, Simple Interest, Formula Numerical applications, Solve problems	3
4	**Basic Logical Reasoning** Introduction to Logical Reasoning, Series Completion, Number series, Alphabet series, Coding–Decoding, Letter coding	2
5	**Basic Logical Reasoning -Numbering** Number coding, Analogy, Number and alphabet analogy, Classification (Odd One Out) Solve problems	2
6	**Applied Logical Reasoning** Direction Sense Test, Blood Relations (basic), Venn Diagrams, Two-set and three-set problems, Basic Logical Puzzles, Simple arrangements, Reasoning-based decision problems, Solve problems	2

Text books:

1. Quantitative Aptitude – Primary Textbook, Book Title: Quantitative Aptitude for Competitive Examinations, Author: Dr. R.S. Aggarwal, Publisher: S. Chand
2. Logical Reasoning – Primary Textbook, Book Title: A Modern Approach to Verbal & Non-Verbal Reasoning, Author: Dr. R.S. Aggarwal, Publisher: S. Chand

Reference books:

1. Quantitative Aptitude Supplement, Book Title: Quantitative Aptitude Quantum CAT, Author: Sarvesh K. Verma, Publisher: Tata McGraw-Hill

Constitution of India

Course Name: **Constitution of India** Course Code: 25CS408	L	T	P	Credits
	2	-	-	2
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	25	--	25	--

Course Description: This course provides an overview of the Indian Constitution, focusing on its historical background, structure, and key features. It covers fundamental rights, directive principles, duties, and the functioning of the Union, State, and local governments. The course also explains constitutional bodies, amendment processes, emergency provisions, and Centre–State relations. It promotes active citizenship and highlights the role of engineers in democratic governance and nation-building.

Pre-Requisite: Basic knowledge of Indian History

Course Objective: The course aims to:	
1	Introduction to the historical and legal foundations of the Indian Constitution and its key features.
2	Understanding of the structure and functioning of Union, State, and local governments.
3	Familiarization with fundamental rights, duties, directive principles, and constitutional bodies.
4	Promotion of responsible citizenship and active participation in a democratic society.

Course Outcomes: At the end of the course, students will be able to:	
CO1	Understand the historical and legal foundations of the Indian Constitution and its key features.
CO2	Explain the structure and functions of government at Union, State, and local levels.
CO3	Describe fundamental rights, duties, directive principles, and the roles of constitutional bodies and governance mechanisms.
CO4	Understand responsibility of citizenship and active participation in a democratic society.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	–	–	–	–	–	2	2	–	1	–	1	–	–	–
CO2	–	–	–	–	–	2	2	–	1	–	1	–	–	–
CO3	–	–	–	–	–	3	3	–	1	–	1	–	–	–
CO4	–	–	–	–	–	3	3	–	2	–	2	–	–	–

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Course Content		
Unit No.	**Contents**	**hrs**
1	**Introduction to the Constitution:** Historical background of the Indian Constitution, Framing of the Constitution and the Constituent Assembly, Features of the Indian Constitution, Preamble and its significance, Citizenship: Types and constitutional provisions	5
2	**Fundamental Rights and Duties** Fundamental Rights: Definition, types, and limitations, Directive Principles of State Policy (DPSP), Fundamental Duties of Indian citizens Relationship between Fundamental Rights and DPSP	5
3	**Union Government Structure** Parliament: Lok Sabha and Rajya Sabha – composition and functions President: Powers, election, and role, Prime Minister and Council of Ministers, Judiciary: Supreme Court – structure, powers, and independence	5
4	**State Government and Local Governance** State legislature and Governor, Chief Minister and State Council of Ministers, High Courts and Subordinate Courts, Panchayati Raj System and Municipalities – 73rd & 74th Amendments	5
5	**Constitutional Bodies and Amendments** Different types of Constitutional Bodies, Constitutional amendment process (Article 368),Major constitutional amendments (42nd, 44th, 73rd, 74th, 86th)	4
6	**Important Provisions and Current Developments** Emergency provisions: National, State, and Financial, Official language and special provisions, Center-State relations: Legislative, administrative, financial, Recent constitutional and legal developments, Role of citizens and engineers in democracy and governance	5

Text Books:

1. M. Laxmikanth, Indian Polity, McGraw-Hill Education
2. D.D. Basu, Introduction to the Constitution of India, LexisNexis
3. J.N. Pandey, Constitutional Law of India, Central Law Agency

Reference Books:

1. Subhash C. Kashyap ,Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust
2. V.N. Shukla ,Constitution of India, Eastern Book Company
3. Brij Kishore Sharma, Introduction to the Constitution of India, Pearson Education

MOOC/NPTEL Platform:

1. NPTEL Course: Constitution of India,Prof. M.K. Bhandari (Rajasthan Technical University) https://nptel.ac.in/courses/109/104/109104074
2. Indian Government and Politics,Prof. R. Sudarshan (IIT Delhi) https://nptel.ac.in/courses/109/104/109104068

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Skill Enhancement

Course Name: **Skill Enhancement**	L	T	P	Credits
Course Code: **25CS409**	--	--	2	1
Evaluation Scheme:	--	MSE	ISE	ESE
Marks:	--	--	50	--

Pre-Requisite: None

Course Objective:	
1	To Convert ideas directly into working code and Use AI tools for rapid coding & debugging
2	To Build prototypes quickly (apps, scripts, tools)
3	To Develop confidence in coding without fear
4	To Adopt industry-style hackathon & startup workflows

Course Outcomes:	
CO1	Translate problem statements and ideas into effective natural-language prompts for AI-assisted coding.
CO2	Generate, understand, and modify working source code using AI tools for rapid prototyping.
CO3	Debug, refactor, and optimize AI-generated programs by applying logical reasoning and programming fundamentals.
CO4	Develop small applications, automation scripts, or prototypes using responsible and ethical AI-assisted coding practices.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	-	-	2	-	-	-	-	-	-	-	2	-
CO2	2	2	2	-	3	-	-	-	-	-	1	1	3	2
CO3	2	3	2	1	3	-	-	-	-	-	-	-	3	3
CO4	2	2	3	-	3		2	1	-	1	2	2	3	3

Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Git & GitHub for Developers-** Version control (must-have skill), Practical Skills, Git commands, Branching & merging, GitHub collaboration, Weekly Activities, Repository creation, Team-based commits, Lab: Experiment 1: Install Git and execute basic Git commands (init, status, add, commit, log). Experiment 2: Create a GitHub repository and perform clone, push, pull operations. Experiment 3: Implement branching, merging, and resolve merge conflicts using GitHub collaboration.	2
2	**Vibe Coding Mindset-** What is vibe coding? Idea-first, code-later approach, AI as coding partner, No-fear coding philosophy, Natural Language - Writing coding prompts, Asking AI for logic, not just code, Modifying generated code, Understanding before running, Lab: Experiment 4: Convert problem statements into plain-English prompts using the vibe coding approach. Experiment 5: Use AI as a coding partner to generate program logic before coding.	4
3	**Rapid Prototyping:** One-hour prototype challenges, Building mini tools & utilities, Copy–modify–improve workflow, Lab: Experiment 8: Develop a one-hour prototype for a real-world problem using copy–modify–improve workflow. Experiment 9: Improve prototype performance, usability, and feature set using AI prompts.	2
4	**Debugging the Vibe Way** - Explaining errors to AI, Fixing logic bugs, Code refactoring via prompts, Lab: Experiment 10: Debug broken code by explaining errors to AI and fixing logical issues. Experiment 11: Optimize and refactor inefficient programs using AI-guided debugging.	2
5	**Mini Project & Demo** - Idea selection, Rapid build, Live demonstration, Mini Projects (Examples): AI-assisted study helper, Code-based automation tool Simple web/app prototype Competitive programming helper	2
6	**Patent registration -** Experiment 12: Convert a project idea into a patentable concept by preparing problem statement, novelty, application area, and draft design/utility description.	2

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Text books:
1. Prompt Engineering for Generative AI: Future-Proof Inputs for Reliable AI Outputs, Authors: James Phoenix & Mike Taylor 2. Hands-On Prompt Engineering: Learning to Program ChatGPT Using OpenAI APIs Author: Apurv Sibal 3. AI-Assisted Coding Authors: Various expert contributors under SAP Press 4. The Art of Prompt Engineering with ChatGPT: A Hands-On Guide Author: Nathan Hunter

Reference books:
1. AI-Assisted Programming for Web and Machine Learning — Editorial/Technical Guide, Reference Global / tech publisher. 2. Learn AI-Assisted Python Programming: With GitHub Copilot & ChatGPT — Leo Porter & Daniel Zingaro, Manning Publications.

Python Programming

Title of the Course Name: Python Programming	L	T	P	Credits
Course Code: 25CS410	1	--	2	2

Pre-Requisite: Basic Knowledge of C & C++ Programming

Course Objectives: The course aims:

5. To introduce the fundamentals of Python programming language
6. To develop problem-solving skills.
7. To provide hands-on experience with Python's built-in data structures
8. To expose students to file handling, exception handling, and modular programming concepts.

Course Outcomes: At the end of the course, students will be able to:

Course Outcomes	
CO1	Understand and apply fundamental Python concepts including syntax, variables, data types, operators, and control structures.
CO2	Develop Python programs using functions and core data structures such as strings, lists, tuples, dictionaries, and sets.
CO3	Design object-oriented Python applications using classes, objects, inheritance, and encapsulation.
CO4	Perform file handling, exception handling, modular programming, and data processing using Python libraries.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	1	-	3	-
CO2	3	3		-	2	-	-	-	-	-	1	-	3	2
CO3	2	3	3	-	2	-	-	2	-	-	1	-	2	3
CO4	2	3	2	2	3	1	-	-	2	2	2	3	2	3

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Course Content		
Unit No.	**Unit title and Content**	**Hrs**
1	**Introduction to Python** History and Features of Python, Installing Python, Python IDEs, Basic Syntax and Semantics, Variables and Datatypes, Input/Output Functions, Operators , Type Conversion and Casting Comments and Indentation.	**2**
2	**Control Structures and Functions** Conditional Statements: if, if-else, Loops: for, while Loop Control Statements: break, continue, pass Introduction to Functions Defining and Calling Functions	**3**
3	**Data Structures in Python** Strings: operations, methods, formatting Lists: creation, indexing, slicing, operations Tuple: immutable sequences Dictionaries: key-value pairs, methods Sets: operations and methods	**2**
4	**Object-Oriented Programming (OOP)** Introduction to OOP, Classes and Objects, Constructor (__init__), Instance vs Class Variables, Inheritance: single, multilevel Polymorphism and Method Overriding	**2**
5	**File Handling, Modules, and Applications** File Operations: open, read, write, append, close Handling text and binary files Exception Handling:- try, except, else, finally, Python Modules and Packages:-math, random, datetime, custom modules, Introduction to Libraries: NumPy, matplotlib (basic use)	**3**
6	**Database Connectivity with Python** Introduction to Databases, SQLite with Python, Connecting to database, Closing database connections	**2**

Text books: Python Data Science Handbook, Jake VanderPlas,1st Edition / O'Reilly Media

Reference books:

- Python Programming: An Introduction to Computer Science" – John Zelle, 3rd Edition
- Python Programming: A Modern Approach – Vamsi Kurama, Pearson

Online Resources:

- **Geeks for Geeks – Python Programming**
https://www.geeksforgeeks.org/python-programming-language/
- **Coursera – Python for Everybody (University of Michigan)**
https://www.coursera.org/specializations/python

NPTEL Video Lectures: Introduction to Programming in Python
Instructor: Prof. Madhavan Mukund, Chennai Mathematical Institute
https://nptel.ac.in/courses/106106145

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Python Programming Lab Experiment

Course Content		
Experiment No.	**Experiment Title and Contents**	**Hrs**
1	Program to demonstrate Python basics: syntax, variables, data types, input/output, and type conversion	2
2	Program to implement arithmetic, relational, logical, and assignment operators in Python	2
3	Program to implement conditional statements (if, if–else, elif)	2
4	Program to implement looping constructs (for and while)	2
5	Program to demonstrate loop control statements (break, continue, pass)	2
6	Program to implement user-defined functions with different types of arguments	2
7	Program to perform string operations and formatting	2
8	Program to implement list and tuple operations	2
9	Program to implement dictionary and set operations	2
10	Program to implement object-oriented concepts using classes and objects	2
11	Program to implement inheritance and polymorphism in Python	2
12	Program to implement file handling, exception handling, and SQLite database connectivity using Python	2
Note:	*Any 10 practical/experiments will be completed.	

Database Management System – Lab

Title of the Course Name: **Database Management System – Lab**	L	T	P	Credits
Course Code:**25CS411**	--	--	2	1
Evaluation Scheme:	**ISE**			**ESE**
Marks:	50			50

Pre-Requisite: None

Course Objective:	
1	Design and maintain relational databases using SQL constraints and indexing.
2	Retrieve and manipulate data using SQL queries, joins, and aggregate functions.
3	Develop PL/SQL programs to automate database operations.
4	Perform CRUD operations on NoSQL (MongoDB) databases for real-world applications.

Course Outcomes:

CO	
CO1	Install database servers and design schemas using ER diagrams; create tables with constraints and perform data insertion.
CO2	Retrieve and manipulate data using SQL queries, joins, subqueries, set operations, and aggregate functions.
CO3	Develop PL/SQL programs using triggers, cursors, functions, and procedures to automate database operations.
CO4	Design normalized databases and implement real-world applications with presentation of results.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	-	-	3	-	-	1	2	-	2	2	3	3
CO2	3	3	-	2	2	-	-	1	1	-	2	2	3	3
CO3	3	3	2	2	2	1	1	1	-	-	2	2	3	3
CO4	3	3	2	2	2	-	-	-	-	-	2	2	3	3

Course Content		
Experiment No.	**Experiment Title and Contents**	**Hrs**
1	Installation of database server(My Sql,Oracle)	2
2	Defining schema for applications with ER Diagram(Hospital management System, Libraray Managrment etc.)	2
3	Creating tables, Renaming tables, Data constraints (Primary key, Foreign key, Not Null), Data insertion into a table.	2
4	Perform Grouping data, aggregate functions (mathematical, character functions).	2
5	Implement Sub-queries, Set operations, Joins.	2
6	Creation of databases, writing SQL and PL/SQL queries to retrieve information from the databases.	2
7	SQL program to perform trigger operations	2
8	SQL program to perform functions and procedures operations	2
9	SQL program to perform Cursor operations	2
10	Implementation of Normal Forms: First, Second, Third and Boyce Codd Normal Forms.	2
11	Design and Implementation of Database systems for applications such as office automation, hotel management, hospital management	2
12	Presentation on Designed Application (individual student)	2
Note:	*Any 10 practical/experiments will be completed.	

Text books:

1. Operating Systems A Concept Based Approach 3rd Edition, Mc-Graw Hill
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009

Reference books:

1. Operating Systems –Concepts and design –Milan Milenkovic (TMGH)
2. Operating Systems: Internals and Design Principles (8th Edition)-by William Stallings (Pearson Education International)
3. Modern Operating Systems by Andrew S. Tanenbaum (Pearson Education International

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