Sri Krishna College of Engineering and Technology

An Autonomous Institution, Affiliated to Anna University

Coimbatore – 641 008

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM AND SYLLABI

B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATION 2022 (BATCH: 2023 – 2027)

**SRI KRISHNA COLLEGE OF
ENGINEERING AND TECHNOLOGY**

DEPARTMENT OF

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATION 2022

(BATCH: 2023 – 2027)

B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

ABOUT THE DEPARTMENT

VISION

To produce globally competitive professionals in Artificial Intelligence and Data Science by imparting cognitive learning and encouraging industry collaboration towards serving the greater cause of society.

MISSION

1. Impart knowledge in cutting edge Artificial Intelligence and Data Science technologies in par with industrial standards.
2. Inculcate research and lifelong learning that benefit society at large.
3. Promote ethical values and entrepreneurial skills.

PROGRAMME OUTCOMES (POs)

Artificial Intelligence and Data Science Graduates will be able to:

PO1 - **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 - **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 - **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of thelimitations.

PO6 - **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 - **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 - **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions.

PO11- Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 - **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1:
To build a successful career in IT/relevant industry or carryout research in advance areas of Artificial Intelligence, Data Science and address various issues in the society.

PEO 2:
To develop problem solving skills and ability to provide solution for real time problems.

PEO 3:
To develop the ability and attitude of adapting themselves to emerging technological Challenges.

PEO 4:
To excel with excellent communication skills, leadership qualities and social responsibilities.

PROGRAMME SPECIFIC OBJECTIVES (PSO)

PSO 1:
Understand, analyze and develop innovative solutions for real world problems in industry and research establishments related to Artificial Intelligence and Data Science.

PSO 2:
Ability to choose or develop the right tool for Data analysis and develop high end intelligent systems.

PSO 3:
Apply programming principles and practices for developing software solutions to meet future business and society needs.

Mapping of PO's to PEO's

Programme Educational Objectives (PEO)	Program Outcomes (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
PEO1	3	3	3	3	3	3	3	2	1	2	2	3
PEO2	3	3	3	3	3	2	2	2	2	3	3	3
PEO3	1	3	1	2	3	2	3	1	1	2	2	2
PEO4	1	1	3	2	1	3	3	3	3	3	3	1

Mapping of PO's to PSO's

Programme Specific Outcomes (PSO)	Programme Outcomes (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
PSO1	3	3	3	3	1	2	1	1	1	2	2	2
PSO2	3	3	3	1	3	1	1	1	2	2	2	3
PSO3	3	3	3	1	1	3	3	2	3	2	2	3

Mapping of PSO's & PEO's

Programme Specific Outcomes (PSO)	Programme Educational Objectives (PEO)			
	PEO1	PEO2	PEO3	PEO4
PSO1	3	3	2	2
PSO2	3	3	2	1
PSO3	3	2	3	3

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

B. TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATION 2022 (Batch: 2023 – 2027)

SEMESTER I

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23EC111	Digital Logic Design and Computer Architecture	3/1/0	4	4	60/40	ESC
2.	23MA101	Mathematics I	3/1/0	4	4	60/40	BSC
3.	23TA101	Heritage of Tamils/ தமிழர் மரபு	1/0/0	1	1	60/40	HSMC
4.	23IT101	Application Development Practices	1/0/4	5	3	50/50	ESC
5.	23CS101	Problem Solving using C++	1/0/4	5	3	50/50	ESC
6.	23EN101	Oral and Written Communication Skills	2/0/2	4	3	50/50	HSMC
7.	23MC101	Mandatory Course-I (Induction Programme)		3 weeks			MC
			Total	**23**	**18**	**700**	

SEMESTER II

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23AD201	Artificial Intelligence and Machine Learning Basics	3/1/0	4	4	60/40	PC
2.	23MA201	Mathematics II	3/1/0	4	4	60/40	BSC
3.	23AS101	Applied Science	4/0/0	4	4	60/40	BSC
4.	23TA201	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	1/0/0	1	1	60/40	HSMC
5.	23CS201	Data Structures and Algorithms	1/0/4	5	3	50/50	PC
6.	23CD201	Database Management Systems	1/0/4	5	3	50/50	PC
7.	23CY201	Java Programming	1/0/4	5	3	50/50	PC
8.	23AS102	Applied Science Laboratory	0/0/4	4	2	40/60	BSC
9.	23MC102	Mandatory Course II – Environmental Science	2/0/0	2	0	0/100	MC
			Total	**34**	**24**	**900**	

SEMESTER III

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY CUM PRACTICAL							
1.	23GE301	Universal Human Values	3/0/0	3	3	60/40	HSMC
2.	23MA301	Mathematical Foundations for Computer Science	3/1/0	4	4	60/40	BSC
3.	23AD301	Design and Analysis of Algorithms	1/0/4	5	3	50/50	PC
4.	23IT301	Web Technology using React	1/0/4	5	3	50/50	PC
5.	23CS301	Advanced Java Programming	1/0/4	5	3	50/50	PC
6.	23CY202	Operating Systems	3/0/2	5	4	50/50	PC
7.	23MCXXX	Mandatory Course III – Indian Constitution	2/0/0	2	0	0/100	MC
			Total	**29**	**20**	**700**	

SEMESTER IV

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23AD401	Python for Data Science	3/0/0	3	3	60/40	PC
2.	23AD402	Basics of Data Engineering	3/1/0	4	4	60/40	PC
3.	23AD403	Managing Cloud and Containerization	1/0/4	5	3	50/50	PC
4.	23CS402	Software Testing	1/0/4	5	3	50/50	PC
5.	23IT402	Web Frameworks using REST API	1/0/4	5	3	50/50	PC
6.	23AD404	No SQL DB	3/0/2	5	4	50/50	PC
7.	23AD405	Python for Data Science Laboratory	0/0/4	4	2	40/60	PC
			Total	**31**	**22**	**700**	

SEMESTER V

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23AD501	Machine Learning Models	3/1/0	4	4	60/40	PC

2.	23AD502	Biology for Engineers	3/0/0	3	3	60/40	ESC
3.	23XXXXX	Open Elective –I	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	OEC
4.	23AD503	Big Data Analytics	3/0/2	5	4	50/50	PC
5.	23AD9XX	Professional Elective – I	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
6.	23AD9XX	Professional Elective – II	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
7.	23AD504	Mini Project	0/0/4	4	2	40/60	PW
			Total	25	22	700	

SEMESTER VI

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23AD601	Virtual Reality and Augmented Reality	3/1/0	4	4	60/40	PC
2.	23ADXXX	Emerging Elective – I	3/0/2 or 3/1/0	5/4	4	50/50 or 60/40	EEC
3.	23AD602	Deep Learning with Keras and Tensorflow	3/0/2	5	4	50/50	PC
4.	23AD603	Data on Cloud - Services on cloud for Data Engineers	3/0/2	5	4	50/50	PC
5.	23AD9XX	Professional Elective – III	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
6.	23AD9XX	Professional Elective – IV	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
			Total	24	22	600	

SEMESTER VII

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23AD9XX	Professional Elective –V	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
2.	23AD9XX	Professional Elective –VI	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
3.	23XXXXX	Open Elective –II	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	OEC

4.	23ADXXX	Emerging Elective –II	3/0/2 or 3/1/0	5/4	4	50/50 or 60/40	EEC
5.	23XXXXX	Principles of Management	3/0/0	3	3	60/40	HSMC
6.	23IT501	Internet of Things	3/0/0	3	3	60/40	ESC
7.	23IT502	Internet of Things Laboratory	0/0/4	4	2	40/60	ESC
8.	23EES01	Employability Enhancement Skills (Summer Internship / Summer Training – 4 weeks)			2	0/100	EES
			Total	**23**	**23**	**800**	

SEMESTER VIII							
S.No	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
1	23AD801	Project	0/0/24	24	12	40/60	PW
			Total	**24**	**12**	**100**	

HUMANITIES (11 CREDITS)

S.No	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Category**
1	23EN101	Oral and Written Communication Skills	2/0/2	4	3	HSMC
2	23TA101	Heritage of Tamils/ தமிழர்மரபு	1/0/0	1	1	HSMC
3	23TA201	Tamils and Technology/ தமிழரும்தொழில்நுட்பமும்	1/0/1	1	1	HSMC
4	23GE301	Universal Human Values	3/0/0	3	3	HSMC
5	23XXXXX	Principles of Management	3/0/0	3	3	HSMC

BASIC SCIENCES (18 CREDITS)

S.No	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Category**
1	23AS101	Applied Science	4/0/0	4	4	BSC
2	23MA102	Mathematics I	3/1/0	4	4	BSC
3	23AS102	Applied Science Laboratory	0/0/4	4	2	BSC
4	23MA202	Mathematics II	3/1/0	4	4	BSC

5	23MA302	Mathematical Foundations for Computer Science	3/1/0	4	4	BSC

ENGINEERING SCIENCE (18 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	23EC111	Digital Logic Design and Computer Architecture	3/1/0	4	4	ESC
2.	23AD502	Biology for Engineers	3/0/0	3	3	ESC
3.	23IT101	Application Development Practices	1/0/4	5	3	ESC
4.	23CS101	Problem Solving using C++	1/0/4	5	3	ESC
5.	23IT501	Internet of Things	3/0/0	3	3	60/40
6.	23IT502	Internet of Things Laboratory	0/0/4	4	2	40/60

PROFESSIONAL CORE (68 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	23AD201	Artificial Intelligence and Machine Learning Basics	3/1/0	4	4	PC
2.	23CS201	Data Structures and Algorithms	1/0/4	5	3	PC
3.	23CD201	Database Management Systems	1/0/4	5	3	PC
4.	23CY201	Java Programming	1/0/4	5	3	PC
5.	23AD301	Design and Analysis of Algorithms	1/0/4	5	3	PC
6.	23IT301	Web Technology using React	1/0/4	5	3	PC
7.	23CS301	Advanced Java Programming	1/0/4	5	3	PC
8.	23CY202	Operating Systems	3/0/2	5	4	PC
9.	23AD403	Managing Cloud and Containerization	1/0/4	5	3	PC
10.	23CS402	Software Testing	1/0/4	5	3	PC

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
11.	23IT402	Web Frameworks using REST API	1/0/4	5	3	PC
12.	23AD404	No SQL DB	3/0/2	5	4	PC
13.	23AD401	Python for Data Science	3/0/0	3	3	PC
14.	23AD405	Python for Data Science Laboratory	0/0/4	4	2	PC
15.	23AD402	Basics of Data Engineering	3/1/0	4	4	PC
16.	23AD503	Big Data Analytics	3/0/2	5	4	PC
17.	23AD501	Machine Learning Models	3/1/0	4	4	PC
18.	23AD602	Deep Learning with Keras and Tensorflow	3/0/2	5	4	PC
19.	23AD603	Data on Cloud - Services on cloud for data engineers	3/0/2	5	4	PC
20.	23AD601	Virtual Reality and Augmented Reality	3/1/0	4	4	PC

PROFESSIONAL ELECTIVES (18 CREDITS)

PROFESSIONAL ELECTIVE STREAM I

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23AD901	Working with Data	1/0/4	5	3	PEC
2.	23AD902	ETL Tools	1/0/4	5	3	PEC
3.	23AD903	APP Development	0/0/6	3	3	PEC
4.	23IT901	UI / UX Application Development	3/0/0	3	3	PEC
5.	23CS901	Cloud services and Integration	3/0/0	3	3	PEC
6.	23AD904	Project Management and Finance	3/0/0	3	3	PEC
7.	23AD905	IPR and Design Thinking	3/0/0	3	3	PEC
8.	23AD906	Software Agents	3/0/0	3	3	PEC
9.	23AD907	Brain and Neuroscience	3/0/0	3	3	PEC

PROFESSIONAL ELECTIVE STREAM II

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23AD911	Power BI Data Visualization	1/0/4	5	3	PEC
2.	23AD912	SQL Server Services	1/0/4	5	3	PEC
3.	23AD913	Statistics and Machine Learning	3/0/0	3	3	PEC
4.	23AD914	Predictive Analytics	3/0/0	3	3	PEC
5.	23AD915	Artificial Neural Networks	3/0/0	3	3	PEC
6.	23AD916	Computer Vision	3/0/0	3	3	PEC
7.	23AD917	Soft Computing	3/0/0	3	3	PEC
8.	23AD918	Bayesian Data Analysis	3/0/0	3	3	PEC
9.	23AD919	Information Extraction and Retrieval	3/0/0	3	3	PEC

PROFESSIONAL ELECTIVE STREAM III

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23AD921	Ethical Hacking	3/0/0	3	3	PEC
2.	23AD922	Ethical Hacking and Auditing Frameworks	3/0/0	3	3	PEC
3.	23IT921	Cyber Security	3/0/0	3	3	PEC
4.	23CS921	Cyber Threats and Vulnerabilities	3/0/0	3	3	PEC
5.	23AD923	Semantic Web	3/0/0	3	3	PEC
6.	23AD924	Computational Statistics for Data Science	3/0/0	3	3	PEC
7.	23AD925	Ethics in Data Science	3/0/0	3	3	PEC
8.	23AD926	Intelligent Multi Agent and Expert systems	3/0/0	3	3	PEC
9.	23AD927	Web and Social media Mining	3/0/0	3	3	PEC

OPEN ELECTIVE COURSES (6 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	23AD001	Fundamentals of Data Structures	1/0/4	5	3	OEC
2.	23AD002	Information Retrieval Techniques	3/0/0	3	3	OEC
3.	23AD003	Machine Learning Algorithms in Python	3/0/0	3	3	OEC
4.	23AD004	Data Visualization using R	3/0/0	3	3	OEC
5.	23AD005	Data Science and Analytics	3/0/0	3	3	OEC
6.	22AD006	Deep Learning Essentials	3/0/0	3	3	OEC

EMERGING ELECTIVE COURSES (8 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	23CS007	Node JS	3/0/2	5	4	EEC
2.	23CY007	Application Security	3/1/0	4	4	EEC
3.	23AD007	Product Prototyping using Generative AI	3/0/2	5	4	EEC
4.	23AD008	Crypto currencies	3/0/2	5	4	EEC
5.	23CD501	Product Analytics	3/1/0	4	4	EEC

EMPLOYABILITY ENHANCEMENT SKILLS (2 CREDITS)

S.No	Course Code	Course	Duration	Credit	Category
1.	23EES01	Employability Enhancement Skills (Summer Internship / Summer Training)	4 WEEKS	2	EES

MANDATORY COURSES (NON-CREDIT)

S.No	Course Code	Course	Category
1.	23MC101	Induction Programme	MC

2.	23MC102	Environmental Sciences	MC
3.	23MC103	Soft Skills	MC
4.	23MC104	Management Organizational Behaviour	MC
5.	23MC105	General Aptitude	MC
6.	23MC106	Life Skills and Ethics	MC
7.	23MC107	Stress Management	MC
8.	23MC108	Constitution of India	MC
9.	23MC109	Essence of Indian Traditional Knowledge	MC
10.	23MC110	Biology	MC

VALUE ADDED COURSES

S.No	Course Code	Course	Category
1.	23VA701	Data Representation and Interpretation using Python	VAC
2.	23VA702	Android Enterprise	VAC
3.	23VA703	Chatbot Development	VAC
4.	23VA704	Hardware and Troubleshooting	VAC
5.	23VA705	Rapid Development for AI	VAC
6.	23VA706	Robotic Process Automation	VAC
7.	23VA707	Spark and Scala	VAC
8.	23VA130	Effective Communication Skills	VAC

Scheme of Distribution

S.NO	Stream	Credits/Semester								Credits	AICTE Norms
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities (HSMC)	4	1	3				3		11	12
2.	Basic Sciences(BSC)	4	10	4						18	24
3.	Engineering Sciences(ESC)	10				3		5		18	29
4.	Professional Core (PC)		13	13	22	8	12			68	49
5.	Professional Electives(PEC)					6	6	6		18	18
6.	Open Elective(OEC)					3		3		6	12
7.	Emerging Electives(EEC)						4	4		8	
8.	Project work (PW)					2			12	14	15
9.	Employability Skills							2		2	
10.	Mandatory Course (MC)									-	
	Total	**18**	**24**	**20**	**22**	**22**	**22**	**23**	**12**	**163**	
	AICTE(CSE)	17.5	20.5	23	22	21	22	20	15		159

23EC111	DIGITAL LOGIC DESIGN AND COMPUTER ARCHITECTURE	3/1/0/4
Nature of Course	G (Theory Analytical)	
Pre requisites	Nil	

Course Objectives:

1.	To understand number systems, logic gates and boolean functions
2.	To familiarize combinational and sequential logic circuits
3.	To learn the basic structure and operations of a computer
4.	To understand control unit design and memory organization
5.	To discuss pipelining and parallelism and multicore architecture
6.	To explore the I/O communication and interfacing

Course Outcomes

Upon completion of the course, students shall have ability to

C111.1	Implement logic circuits and simplify boolean functions	[AP]
C111.2	Analyze combinational and sequential logic circuits	[A]
C111.3	Interpret the design of control unit	[U]
C111.4	Illustrate cache memory and virtual memory	[AP]
C111.5	Examine parallelism in multicore and hazards in pipelining	[AP]
C111.6	Distinguish the different ways of communication with I/O devices	[U]

Course Contents:

MODULE I Digital logic 20 Hours

Number Systems - Boolean algebra – Minimization of Boolean Functions using Karnaugh Maps – Implementation of Logic Circuits using Gates – **Combinational Logic:** Adder, Subtractor, Multiplexer, Demultiplexer, Encoders, Decoders – **Sequential Logic:** Flip flops, Registers, Counters – Finite State Machines

MODULE II Computer Organization 20 Hours

Basic Operational Concepts - Instruction Format – Instruction Sets - Addressing Modes - Design of CPU - Hardwired Control unit design - Micro Programmed Control unit design – Memory organization - Programmable Logic Array - Programmable Array Logic - Cache memory - Virtual Memory – Multicycle MIPS

MODULE III Pipelining and Communication 20 Hours

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets, Data Path and Control Consideration, Superscalar Operation, Instruction Level Parallelism, Multicore Architecture. **I/O Communication:** Handshaking, Buffering, I/O techniques, Buses, Interrupts

Total Hours:	**60 Hours**

Text Books:

1.	David Harris, Sarah L. Harris, "Digital Design and Computer Architecture", 1st Edition, Morgan Kaufmann, 2021
2.	M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson, 2018
3.	William Stallings, "Computer Organization & Architecture", Pearson ,11th Edition, 2022.
4.	Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, "Computer Organization and Embedded Systems", McGraw Hill, 6th Edition 2018.

Reference Books:

1.	John P.Hayes, "Computer Architecture and Organization", McGraw-Hill, 3rd Edition, 2017.	
2.	John F. Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson,2018	

Web References:

1.	https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
2.	https://www.tutorialspoint.com/digital_circuits/digital_circuits_logic_gates.htm
3.	https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

Online Resources:

1.	https://www.coursera.org/learn/comparch
2.	https://onlinecourses.nptel.ac.in/noc23_ee29/preview

Continuous Assessment				End Semester Examination	Total
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**	**End Semester Examination**	**Total**
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C111.1, C111.2	Apply	Tutorial	20
C111.3	Understand	Assignment	20
C111.4, C111.5	Apply	Case Study	20
C111.6	Understand	Quiz	20

Assessment based on Summative and End Semester Examination

Revised Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	30	20	20
Understand	30	30	20
Apply	20	50	40
Analyse	20	-	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination							
Continuous Assessment (40%) [200 Marks]							End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks				
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)			
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)		

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C111.1	3	3	2									2	3		2
C111.2	3	3	2									2	3		2
C111.3	3	3	2									2	3		2
C111.4	3	3	2									2	3		2
C111.5	3	3	2									2	3		2
C111.6	3	3	2									2	3		2

23MA101	MATHEMATICS I	3/1/0/4

Nature of Course	J (Problem Analytical)
Pre requisites	-

Course Objectives:

1	To use logical notation to define the fundamental data types and structures used in computer algorithms and systems.
2	To use the concepts of graph theory in practical situations.
3	To acquire thorough knowledge of fundamental notions of proof's and its application in Cryptography.
4	To analyse data pertaining to discrete and continuous random variables to interpret the results.
5	To impart the knowledge of counting principles, to think critically and apply it in real world problems.

Course Outcomes (Theory)
Upon completion of the course, students shall have ability to

C101.1	Recall the basic concepts of logical laws, structures and probability.	[R]
C101.2	Understand the concepts of proof techniques, structures and random variables.	[U]
C101.3	Apply the logical and foundational structures of mathematics with an emphasis on writing proofs.	[AP]
C101.4	Apply the concepts of graph and number theory in cryptography.	[AP]
C101.5	Apply the probability concepts in transition from real problem to a probabilistic model.	[AP]

Course Contents:

MODULE I : LOGICAL PROOF'S & FUNCTIONS (20 Hrs)
Proofs: Definitions - Proof by cases - Proof by contradiction - Logical formulas - Propositions - Truth table - Logical operators - Tautologies and Contradictions – Contrapositive - Equivalences and implications - Predicates - Free and bound variables – Quantifiers - Universe of discourse - **Sets:** Basic sets - Operations on Sets – Law on Sets (without proof) - Cartesian product of sets. **Relations:** Binary relation -Types of relations and their properties - Relational matrix and graph of a relation - Equivalence relations - Partial ordering relation **Functions:** Classifications of functions – Induction - Ordinary induction and Strong induction - Recursive data types - Definition of recursive and structural induction.

MODULE II : NUMBER THEORY & GRAPH THEORY (20 Hrs)
Number Theory: Divisibility - Greatest common divisor - Euclid's algorithm - Prime numbers - Fundamental theorem of arithmetic - Modular arithmetic - Remainder arithmetic - Multiplicative inverses and cancelling - Relatively prime - Euler's theorem.- Chinese Reminder Theorem **Graph Theory:** Vertices and Degrees - Types of graphs - Handshaking theorem - Adjacency matrices - Walks and paths - Connectivity - Isomorphism - Directed acyclic graphs and scheduling – Matchings - The Stable marriage problem –Forests and trees - Spanning trees - Minimum weight spanning trees – Prim's algorithm - Kruskal's algorithm..

MODULE III : COUNTING & PROBABILITY (20 Hrs)
Sums and Asymptotics - Sums of Powers - Harmonic Numbers - Asymptotic Notation -The Division Rule - Counting Subsets - Sequences with Repetitions - The Pigeonhole Principle -Events and Probability Spaces - The Four Step Method - Conditional Probability - The Four-Step Method for Conditional Probability - The Law of Total Probability - Baye's theorem - Random Variables – Discrete and continuous random variables - Distribution Functions - Bernoulli Distribution - Uniform Distribution - Binomial Distribution - Great Expectations - Conditional Expectation - Linearity of Expectation - Infinite Sums - Expectations of Products

	Total Hours:	**60**

Text Books:

1	Tremblay J.P and Manohar R, "Discrete Mathematical Structures with applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
2	Koshy. T, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, Second Edition, 2007.
3	Eric Lehman, F. Thomson Leighton and Albert R. Meyer, "Mathematics for Computer Science", 14[th]Edition, MIT Open courseware, 2018.

Reference Books:

1	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, —Discrete Mathematical Structures, sixth edition, Pearson Education Pvt Ltd., New Delhi, 2017
2	Kenneth H. Rosen, - Discrete Mathematics and its Applications, Eight Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Eight Edition, 2021.
3	Thomas Koshy, —Discrete Mathematics with Applications, Elsevier Publications, 2004.
4	P. Grimaldi, - Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education sia, New Delhi, Fifth Edition, 2019.

Web References:

1	https://onlinecourses.nptel.ac.in/noc23_cs109/preview
2	https://onlinecourses.nptel.ac.in/noc23_cs120/preview
3	https://onlinecourses.nptel.ac.in/noc23_ma77/preview
4	https://onlinecourses.nptel.ac.in/noc23_ma72/preview

Online Resources:

1	https://www.coursera.org/specializations/discrete-mathematics
2	https://www.cs.ucdavis.edu/~rogaway/classes/20/fall21/mit-book.pdf
3	https://mathworld.wolfram.com/topics/DiscreteMathematics.html
4	https://mathworld.wolfram.com/topics/NumberTheory.html

Assessment Methods & Levels (based on Blooms' Taxonomy)

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C101.1	Remember	Quiz	20
C101.2	Understand	Presentation	20
C101.3 – C101.5	Apply	Tutorial	20
C101.3 – C101.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1: 100 Marks			CA 2: 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)(Theory)															
COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C101.1	1	1											1		
C101.2	2	2											1		
C101.3	3	3													
C101.4	3	3											1		
C101.5	3	3													

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

23TA101	HERITAGE OF TAMILS	1/0/0/1

Nature of Course:	C (Theory Concept)

Pre requisites:	NIL

Course Objectives:

1	To know various concepts of Tamil Language families.
2	To know about the essentialities of Heritage.
3	To understand the Aram concepts of Tamils and the cultural influence.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Know about the language families in India, impact of religions and the contribution of Bharathiyar and Bharathidhasan.	[U]
C101.2	Observe the growth of sculpture, making of musical instruments and the role of temples in socio and economic lives.	[U]
C101.3	Understand the significance of folklore and martial arts.	[U]
C101.4	Learn the sangam literature, sangam age and overseas conquest of Cholas.	[U]
C101.5	Understand the contribution of Tamils to Indian Freedom Struggle, role of Siddha medicine and print history of Tamil Books.	[U]

Course Contents:
Language and Literature: Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

Heritage - Rock Art Paintings to Modern Art – Sculpture: Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils. **FolkAndMartialArts:** Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

Thinai ConceptOfTamils - Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas. ContributionofTamilstoIndiannationalmovementandindianculture:Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

	Total Hours:	15

Text-cum-Reference Books:

1	தமிழகவரலாறு – மக்களும்பண்பாடும்–கே.கே.பிள்ளை(வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2	கணினித்தமிழ் – முனைவர்இல. சுந்தரம் . (விகடன்பிரசுரம்).
3	கீழடி – வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4	பொருநை – ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Continuous Assessment			Total Continuous Assessment	End Semester Examination	Total
Formative Assessment	Summative Assessment	Total			
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C101.1	Understand	Quiz	20
C101.2	Understand	Seminar	20
C101.3	Understand	Seminar	20
C101.4	Understand	Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	40	40	40
Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination	
Continuous Assessment (40%) [200 Marks]	End Semester Examination (60%)

CA 1 : 100 Marks			CA 2 : 100 Marks			[100 Marks]
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
C101.2	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
C101.3	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
C101.4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
C101.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-

23IT101	APPLICATION DEVELOPMENT PRACTICES	1/0/4/3
Nature of Course	F (Theory programming)	
Pre requisites	Nil	

Course Objectives:

1.	To discuss the essence of agile development methods.
2.	Ability to understand and apply Scrum framework.
3.	To set up and create a GitHub repository.
4.	To impart the knowledge of web application development platforms.
5.	To create interactive websites using HTML, CSS.
6.	To recognize the user experience design methodologies like Java script for responsive web design.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Relate the concepts of agile software engineering and its advantages in software development.	[R]
C101.2	Demonstrate the roles and responsibilities of Scrum, Lean Software Development and how to setup the GitHub repository.	[U]
C101.3	Analyze the working model and learn basic web concepts to develop Static and Dynamic websites.	[A]
C101.4	Utilize the knowledge of HTML, CSS and Bootstrap using forms to build modern interactive web applications.	[AP]
C101.5	Develop dynamic web pages using HTML5 with validation using Java Script objects and by applying different event handling mechanisms.	[AP]

Course Contents:

Module - I: **15 Hours**

History of Traditional Software Development Model, Software Development Model and SDLC, "Waterfall Model" – An Overview, Waterfall or Sequential Based Development Model, "Real Life" – Waterfall Model, "Waterfall Model" – Advantages, "Waterfall Model" – Disadvantages, Agile Software Development – Definition, Agile Development Model, Graphical Illustration of Agile Development Model, Why use Agile?, Agile Manifesto and Principles, 12 Principles of Agile Methods, Agile Values, What is NOT an Agile software development?, Foundation of an Agile software development Method, Common Characteristics of Agile Methods, Agile Methods and Practices, When to use Agile Model?, Advantages of Agile Model, Disadvantages of Agile Model, Difference between Agile and Waterfall Model, Agile – Myths and Reality, Agile Market Insight. Introduction to SCRUM, Scrum Roles and Responsibilities, Scrum Core Practices and Artifacts, User Story, Sprint, Release Planning Meeting, Sprint Planning Meeting, Daily Scrum Meeting (Daily Stand up), Sprint Review Meeting, Retrospective, Product Backlog, Sprint Backlog, Burn-Down Chart, Velocity, Impediment Backlog. Definition of "Done", Splitting User Story into Task, Why to Split User Story into Task?, Guidelines for Breaking Down a User Story into Tasks, Examples of Scrum Task Board, Planning Poker®, Planning Poker - Process/Steps, What are Story Points?, How do We Estimate in Story Points?, What Goes into Story Points? Introduction to Extreme Programming, The Rules of Extreme Programming, Extreme Programming (XP) – Principles, Extreme Programming (XP) – Key Terms, Introduction to Lean Software Development, Principles of Lean Software Development, What is Kanban? Introduction to Git - Getting a Git Repository, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Tagging, Git Aliases, Git Branching, Branches in a Nutshell, Basic Branching and Merging, Branch Management, Remote Branches, Rebasing. Introduction to GitHub – Introduction, Set up Git, Create a repository, GitHub Flow, Contribution to Projects, Communicating on GitHub. Linux Basic Commands - Linux Basic Commands, Linux File Permissions, Basic System Administration, Process Management, Archival. Linux Shell Script - Shell Basics, Writing first script, Conditional statements, Loops, Command line arguments, Functions & file

manipulations, Background processes, Scheduling processes -At, batch & Cron - Networking.

Module - II: **15 Hours**
HTML Basics - Understand the structure of an HTML page, New Semantic Elements in HTML 5, Learn to apply physical/logical character effects, Learn to manage document spacing. Tables - Understand the structure of an HTML table, Learn to control table format like cell spanning, cell spacing, border. List - Numbered List, Bulleted List, Working with Links, Understand the working of hyperlinks in web pages, Learn to create hyperlinks in web pages, Add hyperlinks to list items and table contents. Image Handling - Understand the role of images in web pages, Learn to add images to web pages, Learn to use images as hyperlinks. Frames - Understand the need for frames in web pages, Learn to create and work with frames. HTML Forms for User Input - Understand the role of forms in web pages, Understand various HTML elements used in forms, Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box. New Form Elements - Understand the new HTML form elements such as date, number, range, email, search and data list, Understand audio, video, article tags.

Module - III: **15 Hours**
Introduction to Cascading Style Sheets - What CSS can do, CSS Syntax, Types of CSS. Working with Text and Fonts - Text Formatting, Text Effects, Fonts. CSS Selectors - Type Selector, Universal Selector, ID Selector, Class selector. Colors and Borders – Background, Multiple Background, Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border, Implementing CSS3 in the "Real World" – Modernizr, HTML5 Shims, SASS, and Other CSS Preprocessors, CSS Grid Systems, CSS Frameworks. Introduction to Bootstrap – Introduction, Getting Started with Bootstrap, Bootstrap Basics, Bootstrap grid system, Bootstrap Basic Components, Bootstrap Components, Page Header, Breadcrumb, Button Groups, Dropdown, Nav & Navbars. JavaScript Essentials - Var, Let and Const keyword, Arrow functions, default arguments, Template Strings, String methods, Object de-structuring, Create, apply, prototype, bind method, Spread and Rest operator, Typescript Fundamentals, Types & type assertions, Creating custom object types, function types, Typescript OOPS - Classes, Interfaces, Constructor, Decorator & Spread Operator, Difference == & === , Asynchronous Programming in ES6, Promise Constructor, Promise with Chain, Promise Race.

	Total Hours	45

Lab Component:

S. No	List of Experiments
1	Design a web page using HTML basic tags.
2	Develop web site with suitable contents and links.
3	Design web pages using lists and tables.
4	Build a web client-side Login, Registration form and Dashboard with drop down menus.
5	Develop a HTML form and validation using HTML5 features.
6	Create a website using HTML: To embed an image map in a web page. To fix the hot spots. Show all the related information when the hot spots are clicked.
7	Apply style specification in HTML page using CSS.
8	Develop dynamic web application using HTML, CSS and JavaScript.

	Total Hours	30

Text Books:	
1.	Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1st Edition, 2010.
2.	Jeff Sutherland, "Scrum the Art of Doing Twice the Work in Half the Time", Random House Publisher,1st Edition, 2015.
3.	Scott Chacon, Ben Straub, "Pro GIT", CreateSpace Independent Publishing Platform, 2017.
4.	Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley India Pvt. Limited, 2020.
5.	Jennifer Niederst Robbins., "Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics", O'Reilly Media, 5th Edition, 2018.
6.	Jennifer Smith and the AGI Creative Team, "Web Design with HTML and CSS",Wiley Publisher,1st Edition, 2011.
7.	Stephen Blumenthal, "JavaScript: JavaScript for Beginners - Learn JavaScript Programming with ease",1st Edition, 2017.
Reference Books:	
1.	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2nd Edition, 2014.
2.	Mike Cohn, "User Stories Applied: For Agile Software", Addison Wesley,2nd Edition, 2016.
3.	Thomas a Powell, "HTML & CSS: The Complete Reference", 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
4.	Russ Ferguson, "Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development", Apress Publishers, 3rd Edition, 2019.
5.	Deitel, Deitel, Goldberg, "Internet and World Wide Web – How to program", 5th Edition, Prentice Hall Publishers, 2012.
Web References:	
1.	https://www.coursera.org/specializations/agile-development
2.	https://www.edx.org/learn/agile
3.	https://nptel.ac.in/courses/106/105/106105182/
4.	https://developer.mozilla.org/en-US/docs/Web/HTML
5.	https://developer.mozilla.org/en-US/docs/Web/CSS
6.	https://developer.mozilla.org/en-US/docs/Web/JavaScript
Online Resources:	
1.	http://www.agilenutshell.com/
2.	https://www.atlassian.com/agile/scrum
3.	https://www.youtube.com/user/AgileMikeCohn
4.	https://www.coursera.org/learn/html-css-javascript-for-web-developers
5.	https://online-learning.harvard.edu/subject/javascript

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C101.1	Remember	Assignment - 1	20
C101.2, C101.3	Understand Analyze	Quiz	20
C101.4	Apply	Case Study	20
C101.5	Apply	Assignment - 2	20

Assessment based on Summative - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]	
	CIA1: (60 Marks)	CIA2: (60 Marks)
Remember	20	10
Understand	30	30
Apply	40	50
Analyse	10	10
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination – Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	30	20	20
Understand	20	30	30
Apply	40	40	40
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination	
Continuous Assessment (50%)	End Semester Practical

CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Examination (50%)
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	2	2	1	1								2	3	2	2
C101.2	3	2	3	3	3	2						2	3	3	2
C101.3	3	2	3	3	3	2						2	3	3	2
C101.4	3	2	3	3	3	2						2	3	3	2
C101.5	3	2	3	3	3	2						1	3	3	2

23CS101		**PROBLEM SOLVING USING C++**	1/0/4/3
Nature of Course		K (Problem Programming)	
Pre requisites		NIL	

Course Objectives:

1	To learn the fundamental programming concepts and methodologies which are essential to build good C++ programs.
2	To gain knowledge on control structures and functions in C++.
3	To provide the basic object-oriented programming concepts and apply them in problem solving.
4	To introduce file streams and operations for storing data permanently.
5	To know generic programming paradigm.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Illustrate the fundamental concepts and methodologies required to develop a program for given problems.	[U]
C101.2	Develop a program for real-time problems with pointers and objects.	[AP]
C101.3	Apply the Constructors, destructors, and Overloading concepts to solve the solve.	[AP]
C101.4	Develop C++ programs with Interfaces, Exception and File processing	[AP]
C101.5	Implement the concepts on file streams, I/O and Lambda Expression.	[AP]

Course Contents:

Module I C++ Programming Fundamentals   **15 Hours**
C vs C++, Basic of OOPS, the main () function, Header files, Basic Input and Output (I/O) using cin and cout, Variable, Constant. **Operators:** Arithmetic Operators, Assignment Operators, Relational Operators, Logical Operators, Bitwise Operators, Other Operators, Operator Precedence. Control Statements: if, if...else and Nested if...else, switch case, break and continue, Loops - for loop, while loop, do while loop, goto. **Arrays and Strings:** 1D array, 2D array, Strings, String functions. **Function:** Basics, call by value, call by reference & return by reference, Inline function, overloading Functions, inline Functions, Recursive Functions. **Pointers:** Pointer, Dynamic Memory Allocation.

Module II Object Oriented Concepts   **15 Hours**
Classes and Objects, public, private, protected. **Constructors and destructors**: Overloaded Constructor, Copy Constructor, Shallow Copying Deep Copying. **Overloading:** this' Pointer, structs vs Classes, Friends of a class, Operator Overloading, Inheritance, Overloading vs Overriding, Polymorphism, Virtual Functions, Pure Virtual Functions and Abstract Classes.

Module III Files and Generic Programming   **15 Hours**
Abstract Classes as Interfaces, Exception, Files, Streams and I/O, STL, Generic Programming, Lambda Expression.

	Total Hours (Theory)	**45 Hours**

Lab Component

S.No.	Lab Exercise
1.	Practice of C Programming using Branching and Iterative constructs.
2.	Programs using arrays and strings.
3.	Programs using Functions.
4.	Programs using Structures and Pointers.
5.	Programs using classes and objects.
6.	Programs using constructor and destructor.
7.	Programs using method overloading, operator overloading and polymorphism concepts.
8.	Programs using friend class.
9.	Programs using virtual functions and abstract class.
10.	Programs using inheritance concepts.
11.	Programs using exception handling concept.

12.	Programs using Files.		
13.	Mini project		
		Total Hours (Lab)	**30 Hours**
		Total Hours(45+30)	**75 Hours**

Text Books:

1.	E Balagurusamy,"Object Oriented Programming With C++", 4th Edition, Tata McGraw-Hill Education, 2008.
2.	YashavantP. Kanetkar, "Let us C++", BPB Publications, 2020.
3.	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.

Reference Books:

1.	Herbert Schildt, "The Complete Reference C++", 4th edition,MH, 2015.
2.	John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.

Web References:

1.	https://www.geeksforgeeks.org/c-plus-plus/
2.	http://web.stanford.edu/class/cs106l/

Online Resources:

1.	https://nptel.ac.in/courses/106101208
2.	https://www.hackerrank.com/domains/cpp
3.	https://codeforces.com/blog/entry/74684
4.	https://www.hackerearth.com/practice/notes/tricky-and-fun-programming-in-c/

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment,Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C101.1	Understand	Quiz	20
C101.2 & C101.3	Apply	Assignment	20
C101.4	Apply	Group Assignment	20
C101.5	Apply	Case Study	20

Assessment based on Summative Assessment - Theory		
Bloom's Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	20	20
Understand	40	30

Bloom's Level		
Apply	40	50
Analyse	-	-
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Practical Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	20	20
Understand	30	20	20
Apply	50	50	50
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Practical Examination

Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
	FA 1			FA 2				
SA 1 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	SA 2 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	FA (75M)	SA (25M)	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	3	3											3		
C101.2	3	3	3	2	2				2	1		3	3	2	1
C101.3	3	3	3	2	3				2	1		3	3	2	1
C101.4	3	3	3	3	3				3	2		3	3	2	2
C101.5	3	3	3	3	3				2	2		2	3	2	1
C101	**3**	**3**	**3**	**3**	**3**				**3**	**2**		**2**	**3**	**2**	**2**
	3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed							

23EN101	ORAL AND WRITTEN COMMUNICATION SKILLS	2/0/2/3

Nature of Course	Theory Skill Based
Pre requisites	Basics of English Language

Course Objectives:

1	To empower students to comprehend different aspects of communication using LSRW skills.
2	To highlight the essential aspects of effective oral & written communication necessary for professional success.
3	To expand the skills of the students in preparing job search artefacts and negotiating their use in GDs and interviews.
4	To enable students to communicate contextually in specific, personal and professional situations with courtesy.
5	To enrich students to carry out day to day communication at the work place to facilitate efficient interpersonal communication.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Remember and expand writing skills through guided activities.	R
C101.2	Apply communication skills in a corporate environment.	AP
C101.3	Analyse and collaborate better with colleagues, building stronger professional and personal relationships.	AN
C101.4	Apply technical writing skills to write letters, emails and prepare technical documents.	AP
C101.5	Analyze and communicate effectively in personal and professional situations.	AN

Course Contents:
Module I

Reading : Reading techniques -Skimming and scanning - Cloze reading - Reading and understanding technical articles – Reading for detailed comprehension: Email and letters - Reading advertisements - Table completion: Interpreting charts and graphs - Verbal reasoning – Comprehending reviews – Reading and responding to instant messages.

Module II

Writing : Formal letters (Sales letter, calling for quotations, seeking clarification, placing an order, complaint letter, inviting, accepting and declining letters) - Emails - Minutes of meeting - Professional report writing - Proposal writing - Resume / job application letter - Case study.

Module III

Listening : Situational listening - Listening about an experience - Listening about short extracts - Listening an interview - Conversational speaking. Speaking : Conversational speaking - Decipher the picture given and answer the question posed along with it - Decipher the mind map given and speak about it - Listen to the questions posed and answer them appropriately.
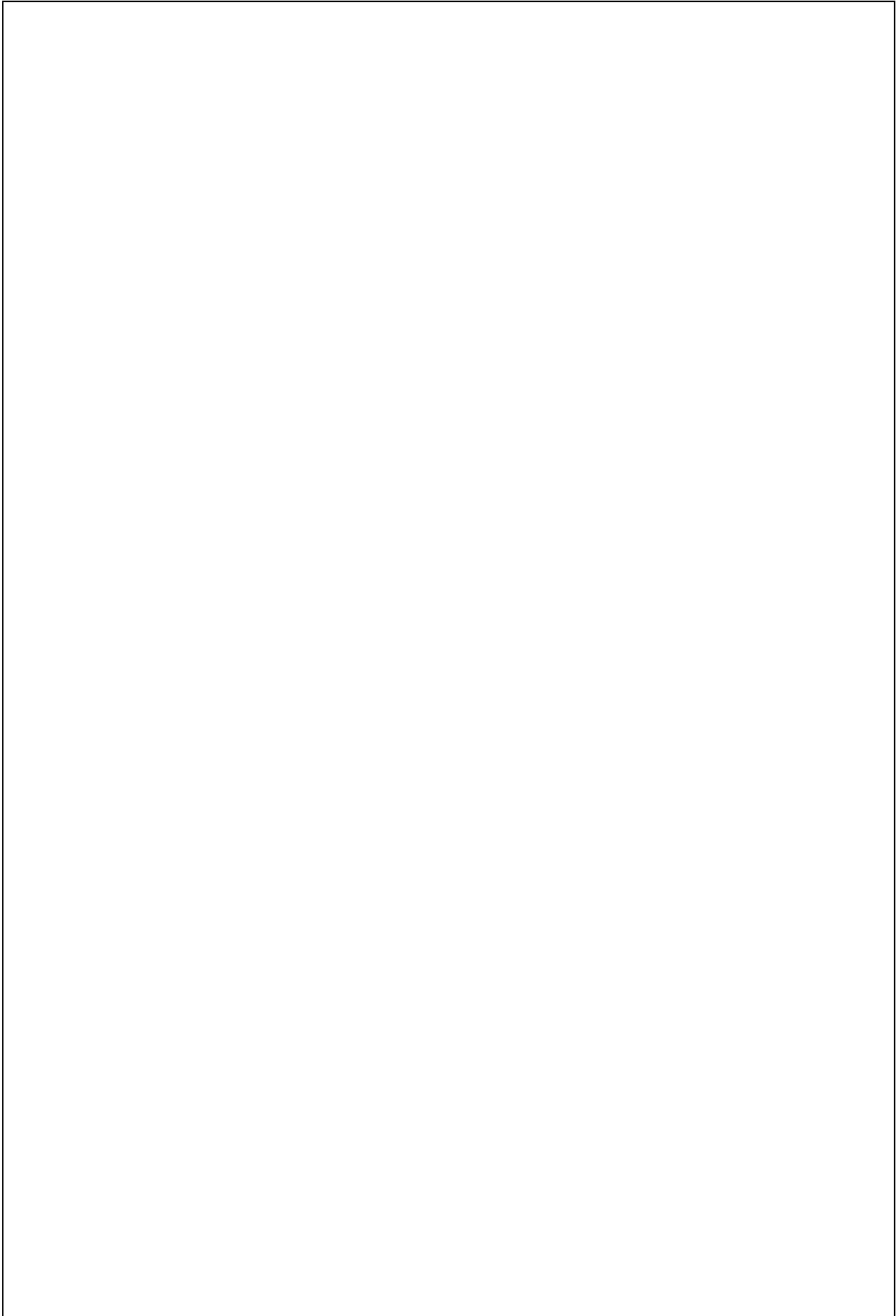
Lab Components		
1	Conversational listening	[U]
2	Speaking - Pictography	[AP]
3	Listening about an experience	[U]
4	Listening to short extracts	[U]
5	Writing - Resume Writing, Job application letter	[AP]
6	Mock interview	[AP]
	Total Hours:	60

Text Books:	
1	Jay Sullivan, "Simply Said: Communicating Better at Work and Beyond", Wiley Publication, 2018.
2	Alred J Gerald, Brusaw T Charles,. Oliu E Walter, "Handbook of Technical Writing", Bedford/St. Martin's Boston publication,New York, 2012.
3	Liz Hamp-Lyons and Ben Heasly, "Study Writing :A Course in Written English for Academic Purposes", Updated Edition, Cambridge University Press, 2006.
4	Dr.Praveen Sam and K N Shoba - A Course in Technical English by Cambridge University press, 2020.

Reference Books:	
1	Rutherfoord J Andrea, " Basic Communication Skills for Technology", Upper Saddle River, N.J. : Prentice Hall, 2001.
2	Singh Hardeep (Author), Kothari (Author), "Written & Oral Technical Communication Skills For Engineers/Scientists" - LAMBERT Publications, 2019.

Web References:	
1	http://www.academiccourses.com/Courses/English/Business-English
2	https://www.liveworksheets.com/worksheets/en/English_as_a_Second_Language_(ESL)/Technical_English

Online Resources:	
1	https://www.coursera.org/specializations/business-english
2	https://www.businessenglishresources.com/learn-english-for-business/student-section/practice-exercises-new/

Assessment										
Theory				Practical			Total (A+B)	Total Continuous Assessment	End Semester Continuous Examination	Total
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (10%) [80 Marks]
C101.1 C101.2	Understand	Listening to Short Extracts	20
C101.3	Apply	Speaking - Pictography	20
C101.4	Apply	Mock Interview	20
C101.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (25%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (25%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1										3			1	1	1
C101.2								2		3			1	1	1
C101.3								2		3	2		1	1	1
C101.4										3			1	1	1
C101.5										3		3	1	1	1

23MC101	INDUCTION PROGRAMME	1/0/0/0

Nature of Course	Induction Programme
Pre requisites	Nil

Course Objectives:

1.	To have broad understanding of society and relationships
2.	To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being
3.	To incorporate meta skills and values

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Explore academic interest and activities	[AP]
C101.2	Work for excellence	[AP]
C101.3	Promote bonding and give a broader view of life and character	[AP]

Course Contents:

PHYSICAL ACTIVITY: Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.(CO mapping: C101.1, C101.2, C101.3)

CREATIVE ARTS (students can select any one of their choice): Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on. .(CO mapping: C101.1, C101.2, C101.3)

UNIVERSAL HUMAN VALUES: Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community – local and global- and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills. .(CO mapping: C101.1, C101.2, C101.3)

LITERARY AND PROFICIENCY MODULES: Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage with societal institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of Reading, writing, speaking – debate, role play etc.Communication and computer skills. (CO mapping: C101.1, C101.2, C101.3)

LECTURES BY EMINENT PEOPLE: Teaching with Lectures. ... It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During

the induction period students will attend to Guest lectures by subject experts.(CO mapping: C101.1, C101.2, C101.3)

VISIT TO LOCAL AREAS:Traveling is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near college to learn new things. Eg.Meditation centre/orphanage/Hospital.(CO mapping: C101.1, C101.2, C101.3)

FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION: Hod's of different branches will present about their department followed by department visit to view various facilities available at their department, new innovations from students and faculties etc. .(CO mapping: C101.1, C101.2, C101.3)

Course Articulation Matrix (Lab)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1						3	3	3	3	3	3	3			1
2						3	3	3	3	3	3	3			1
3						3	3	3	3	3	3	3			1
Avg						3.0	3.0	3.0	3.0	3.0	3.0	3.0			1.0
1	Reasonably agreed			2		Moderately agreed				3		Strongly agreed			

23AD201	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING BASICS	3 / 1 / 0 / 4
Nature of Course:	H (Theory Technology)	
Pre requisites:	NIL	

Course Objectives:

1	To learn the basic concepts of Artificial Intelligence and Machine Learning.
2	To familiarize the artificial intelligence techniques for building well-engineered and efficient intelligent systems.
3	To provide an insight to different Classification, Regression techniques and to explore discovering clusters in the given data.
4	To enable the students to understand machine learning algorithms and their applicability to real world problems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Interpret the basic principles of AI in solutions that require problem solving, inference, perception and learning.	[U]
C201.2	Devise the acquired knowledge to solve constraint satisfaction problems, make optimal decisions and search strategies in AI powered applications.	[A]
C201.3	Understand the concepts behind different types of classification and regression algorithms and their appropriateness.	[U]
C201.4	Analyse the differentiation of clustering kind of learning algorithms and importance of Markov models to apply suitably in real world problems.	[A]
C201.5	Examining the challenges and considerations involved in deploying AI applications and perception.	[AP]

Course Contents:

MODULE I - OVERVIEW OF ARTIFICIAL INTELLIGENCE AND AGENTS   (15 hrs)

Introduction to AI, Types of AI, Intelligent Agents, Agents & Environment - Problem Solving - Defining the problem as state space search, production system, problem characteristics and issues in the design of search programs - Problem solving agents - Search strategies - Uniformed and informed, Breadth first search, Depth first search - Heuristic search strategies: Greedy best - first search, A* search, AO* search, Optimization problems: Hill climbing search, Simulated annealing search, Local beam search. **Case Study:** AI powered contextual intelligence.

MODULE II - CLASSIFICATION AND REGRESSION   (15 hrs)

Introduction, Linear classification, Perceptron update rule - Perceptron convergence, Generalization - Maximum margin classification - Classification errors – Regularization - Logistic regression - Linear regression - estimator bias and variance - Active learning - non-linear predictions, Kernals - Kernal regression - Support Vector Machine - kernel optimization - Model selection - Feature selection - Boosting, margin, and complexity. **Case Study:** Spam Filtering.

MODULE III - CLUSTERING (15 hrs)

Margin and generalization - Mixture models – EM Algorithm – EM Regularization – Clustering - Spectral clustering, Markov models - Hidden Markov models (HMMs) - Bayesian networks - Learning Bayesian networks – Machine Learning Applications – Issues – Challenges. **Case Study:** Fraud Detection on Financial Transactions.

	Total Hours: 45

Text Books:

1.	Utpal Chakraborty, "Artificial Intelligence for All: Transforming Every Aspect of Our Life", BPB Publications, February 2020.
2.	Ethem Alpaydın, "Introduction to Machine Learning", 4th Edition, The MIT Press, 2020.
3.	Harsh Bhasin, "Machine Learning for Beginners", BPB Publications, January 2020.
4.	Kevin P. Murphy, "Machine Learning A probabilistic Perspective", MIT press, 2018.
5.	Tom M. Mitchell , " Machine Learning", 3rd Edition, Tata McGrawHill, 2015.
6.	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015.

Reference Books:

1.	Abhivardhan, "Artificial intelligence: Ethics & International Law", 3rd edition, BPB Publications, January 2019.
2.	Hastie, T., R. Tibshirani, and J. H. Friedman, "The Elements of Statistical Learning: Data Mining, Inference and Prediction" New York, NY: Springer, 2001.
3.	Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2017.
4.	I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2018.

Web References:

1.	http://www.nptelvideos.in/2012/11/artificial-intelligence.html

2.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems.htm
3.	https://onlinecourses.nptel.ac.in/noc16_cs18/
Online Resources:	
1.	http://www.nptelvideos.in/2012/11/artificial-intelligence.html
2.	http://freevideolectures.com/Course/2257/Machine-Learning
3.	https://towardsdatascience.com/machine-learning/

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C201.1	Understand	Quiz	20
C201.3	Understand		
C201.2	Analyze	Group Assignment	20
C201.4	Analyze	Idea Presentation	20
C201.5	Apply	Tutorial	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	20
Understand	30	30	30
Apply	20	20	20
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination				
Continuous Assessment (40%) [200 Marks]				End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks		CA 2 : 100 Marks		
SA 1	FA 1 (40 Marks)	SA 2	FA 2 (40 Marks)	

(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	2	2	2	2	2	3				1		1	3	1	2
C201.2	2	3	2	2	2	3				1	1	1	2	2	2
C201.3	2	2	2	2	2	3				1	1	1	1	2	2
C201.4	2	2	2	2	2	3				2	2	2	2	1	2
C201.5	2	2	2	2	2	3				1	1	2	1	1	2

23MA201	MATHEMATICS II	3/1/0/4

Nature of Course	J (Problem analytical)
Prerequisites	-

Course Objectives:

1	To study the basic probability concepts.
2	To apply mathematical linear programming techniques to solve constrained problems.
3	To formalize the notion of strategic thinking and rational choice by using the tools of game theory.
4	To acquaint the student with transform techniques which are used in variety of engineering fields.
5	To introduce the concepts of Group theory.

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Recall the concepts of basic probability	[R]
C201.2	Formulate and analyze the existence of solutions to optimization problems	[U]
C201.3	Formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.	[AP]
C201.4	To apply game theory in searching, auctioning and trading.	[AP]
C201.5	Apply Fourier transform to discrete time sequence and use of group theory and coding theory in communication.	[AP]

MODULE 1: Probability theory   (20 hrs)
Deviation from mean - Markov's inequality – Chebyshev's theorem - properties of variance – sums of random variables – Gambler's ruin - Random walk on graphs - Chebyshev's inequality – Deviation on sum of independent random variables - weak law of large numbers – Van der Waerden's theorem (Statement only) - Chernoff bounds – above the mean and under the mean of Chernoff Bound.

MODULE 2: Linear Programming and Game Theory   (20 hrs)
Basics of Linear Programming – Formulations of Linear Programming Problems - Graphical method - Simplex Method - Linear Programming in Matrix Form – Two phase method - Duality - Transportation Problem - Initial Basic Feasible solutions - Optimal solution by MODI method. Game theory: Introduction - Zero-Sum Matrix Games – payoff matrix - The Minimax and Maximin theorem - mixed strategies – graphic solution of games.

MODULE 3: Fourier Analysis & Group Codes   (20 hrs)
Fourier series: Half range series – Discrete Fourier transform - Properties: Statement and Problems – Computing using convolution of sequences using Fast Fourier transform – Fourier transforms modulo p and faster integer multiplication. Concept and simple Applications of Groups, subgroups, cosets – linear codes – error correcting codes – hamming codes – perfect codes.

	Total Hours:	**60 Hrs**

Text Books:

1	H. Pishro-Nik, "Introduction to probability, statistics, and random processes", Kappa Research LLC, 2014.
2	Hamdy A. Taha, Operations Research: An Introduction, 10th Edition, Pearson,2019.
3	T Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGrawHill, New Delhi, 2007.
4.	Erwin Kreyszig, "Advanced Engineering Mathematics", 13th Edition, John Wiley & Sons, Inc.

Reference Books:

1	S.C. Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, twelth edition, Sulthan Chand and sons,2014.
2	Eric Lehman, F.Thomson Leighton and Albert R.Meyer, Mathematics for Computer Science, 14thEdition, MIT Open courseware, 2018.
3	Kanti Swarup, P.K.Gupta, Manmohan, Operations research, 2nd Edition, Sultan Chand and Sons, 2015

Web References:

1	https://archive.nptel.ac.in/courses/111/105/111105090/
2	https://archive.nptel.ac.in/courses/110/104/110104063/
3	https://archive.nptel.ac.in/courses/111/101/111101164/
4	https://archive.nptel.ac.in/courses/111/106/111106113/

Online Resources:

1	http://discrete.openmathbooks.org/dmoi3.html
2	https://ocw.mit.edu/courses/18-310-principles-of-discrete-applied-mathematics-fall-2013/pages/syllabus/
3	https://www.csie.ntu.edu.tw/~sylee/courses/dm/resources.htm
4	https://www.maa.org/press/ebooks/resources-for-teaching-discrete-mathematics
5	https://see.stanford.edu/Course/EE261/137

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C201.1	Remember	Quiz	20
C201.2	Understand	Seminar	20
C201.3 – C201.5	Apply	Tutorial	20
C201.3 – C201.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1: 100 Marks			CA 2: 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	1	1	1										1		
C201.2	1	2	1										2		
C201.3	3	3	2										2		
C201.4	1	1	2										1		
C201.5	2	1	2										2		

23AS101		**APPLIED SCIENCE**	**L/T/P/C**
			4/0/0/4

Nature of Course	: E (Theory based)
Pre requisites	: Fundamental knowledge in applied sciences

Course Objectives:

1	To learn the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems.
2	To make the students enrich basic knowledge in various fields such as Electrostatics and magnetism.
3	To understand the principle and applications of electrochemistry and Polymer science, and explore the knowledge of various energy sources and storage devices.
4	To understand the concepts of photophysical and photochemical processes in spectroscopy.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Understand the principles of electrostatics and problems relating to electric field and electric potential.	[U]
C101.2	Realize the nature of magnets, properties and the magnetic effect of electric current.	[U]
C101.3	Describe the nature of electromagnetic wave and its propagation through different media and interfaces involved in different situations.	[AP]
C101.4	Understand the principle and working of reference electrodes, energy storage devices and polymer products in engineering fields.	[U]
C101.5	Interpret the principle and working of analytical techniques.	[AP]

Course Contents:

Electrostatics: **15 hours**
Charges and their conservation; Coulomb's law - superposition principle. Electric field – electric field due to a point charge, electric field lines; electric dipole, electric field intensity due to a dipole - behaviour of a dipole in a uniform electric field. Electric potential - potential difference - electric potential due to a point charge and dipole - equipotential surfaces – electrical potential energy of a system of two point charges. Electric flux-Gauss's law and its applications. Electrostatic induction-capacitor and capacitance – dielectrics- electric polarisation – parallel plate capacitor with and without dielectric – applications of capacitor – energy stored in a capacitor - Capacitors in series and in parallel – Van de Graaff generator.

Magnetism: **15 hours**
Definitions of fundamental terms – Magnetic field around a current carrying conductor – Direction of magnetic field and current – Biot-Savart law and its application: Magnetic field due to Line charge – Ampere's law and its application: magnetic field due to a solenoid. Electromagnetic Induction and Alternating Current: Electromagnetic induction - Faraday's law - induced emf and current - Lenz's law. Self-induction - Mutual induction - self-inductance of a long solenoid - mutual inductance of two long solenoids. Methods of inducing emf - (i) by changing magnetic induction (ii) by changing area enclosed by the coil and (iii) by changing the orientation of the coil. AC generator - (Single phase, three phase). Eddy current - applications - transformer - Alternating current - AC circuit with resistance - AC circuit with inductor - AC circuit with capacitor - LCR series circuit - Resonance and Q - factor - power in AC circuits.

Chemistry of Batteries and Polymers: **15 hours**

Chemistry of batteries-Introduction-Cells and its types-emf series-Nernst equation and its applications. Reference electrodes-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH-measurement. Discussion of energy storage-Lead acid, Nickel cadmium and Lithium-ion batteries-Energy Sources-Fuel cells (H2-O2). Polymers-Classifications-addition and condensation polymerization-free radical mechanism. Atomic and molecular Spectroscopy: Beer Lambert's law, principle, instrumentation, and applications of electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and atomic spectrum-Flame emission spectroscopy (FES).

	Total Hours:	**45**

Text Books:

1	Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2016.
2	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11th edition, Wiley, 2018.
3	Gaur, R.K. and Gupta, S.L., "Engineering Physics", DhanpatRai Publishers, 2012.
4	Bhattacharya, D.K. and Poonam, T., "Engineering Physics II", Oxford University Press, 2015.
5	Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015.
6	Jain P. C. & Monica Jain., "Engineering Chemistry", 16 th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
7	Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994.

Reference Books:

1	Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics"S.Chand& Co Ltd, 2018.
2	Sadiku M H, "Principles of Electromagnetics", Oxford University Press Inc.,New Delhi,2015
3	R. Wolfson, "Essential University Physics", Volume 1 & 2. Pearson, 2016.
4	S.O. Kasap, "Principles of Electronic Materials and Devices", McGraw Hill Education, 2017.
5	David Griffiths 'Introduction to Electrodynamics' 4th Edition, Cambridge University Press 2017.
6	Perez, Nestor," Electrochemistry and Corrosion Science", Springer, 2016.
7	Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and Francis group, 2012.

Web References:

1	https://nptel.ac.in/courses/115101005
2	https://www.udemy.com/course/electrostatics-1-electric-charges-fields-and-related-laws/
3	https://openlearninglibrary.mit.edu/courses/course-v1:MITx+8.02.1x+1T2019/about
4	https://onlinecourses.nptel.ac.in/noc22_ph31/preview
5	https://ocw.mit.edu/courses/8-02t-electricity-and-magnetism-spring-2005/
6	https://unacademy.com/batch/legend-2o-for-jee-main-and-advanced-2022/7IXHRCZE/topics/WQCLD/courses/RAATL
7	https://archive.nptel.ac.in/courses/108/106/108106073/
8	https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry
9	www.corrosionsource.com/

10	https://www.sciencedirect.com/book/9780750646253/battery
11	http://www.rnlkwc.ac.in/pdf/study-material/chemistry/Spectroscopy
12	https://ocw.mit.edu/courses/chemistry
13	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf
14	https://ocw.mit.edu/courses/chemistry

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C101.1	Understand	Assignment - I	20
C101.2	Understand	Quiz - I	20
C101.3	Apply		
C101.4	Understand	Assignment - II	20
C101.5	Apply	Quiz – II	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	30	30	30
Understand	50	50	50
Apply	20	20	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

C101.1	3	2	2		1						1	1			1
C101.2	3	2	2		1						1	1		1	1
C101.3	3	2	2	1	1						1	1		1	
C101.4	3	2	2		1						1	1			1
C101.5	3	2	2	1	1						1			1	1

23TA201	TAMILS AND TECHNOLOGY	1/0/0/1

Nature of Course:	C (Theory Concept)
Pre requisites:	NIL

Course Objectives:	
1	To know about weaving, ceramic, design and construction technologies in sangam age.
2	To know the significance of technologies such as manufacturing, agriculture and irrigation.
3	To understand the development of Scientific Tamils and Tamil Computing.

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Describe about the weaving industry in sangam age and ceramic technology.	[U]
C201.2	Observe the design of houses, sculptures and construction of temples.	[U]
C201.3	Relate the various manufacturing materials and stone types in Silappathikaram.	[U]
C201.4	Understand the significance of agriculture and irrigation technology in ancient period.	[U]
C201.5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.	[U]

Course Contents:
Weaving and Ceramic Technology: Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. **Design and Construction Technology:** Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - ThirumalaiNayakarMahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Manufacturing Technology: Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and gold - Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram. **Agriculture and Irrigation Technology:** Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

Scientific Tamil & Tamil Computing: Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

	Total Hours:	15

Text-cum-Reference Books:

1	தமிழகவரலாறு – மக்களும்பண்பாடும்–கே.கே.பிள்ளை(வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2	கணினித்தமிழ் – முனைவர்இல. சுந்தரம் . (விகடன்பிரசுரம்).
3	கீழடி – வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)

4	பொருநை – ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C201.1	Understand	Seminar	20
C201.2	Understand	Quiz	20
C201.3, C201.4	Understand	Quiz	20
C201.5	Understand	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	40	40	40
Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.3	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.5	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1

23CS201		**DATA STRUCTURES AND ALGORITHMS**	**1/0/4/3**
Nature of Course:		F (Theory Programming)	
Prerequisites:		Problem Solving using C++	

Course Objectives:	
1.	To introduce list data structure and its applications.
2.	To impart the importance of stacks and queues in problem solving.
3.	To provide knowledge on Tree and Graph data structures.
4.	To discuss the role of hashing in information storage and retrieval.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C201.1	Implement the basic data structures like array and LinkedList.	[AP]
C201.2	Solve real world problems efficiently by applying stack and queue data structures.	[AP]
C201.3	Enumerate the applications with tree data structures.	[AP]
C201.4	Discuss the importance of hashing techniques in information storage.	[U]
C201.5	Employ graph algorithms for solving real time computing problems and analyze them.	[A]

Course Contents:

Module I Linked List & Stack **15 Hours**

Linked List: Array vs Linked list - Types of linked list - Singly, Doubly and Circular Linked list - Applications of linked list. **Stack:** Stack Model, Array and Linked list implementation of Stack –Applications of Stack - Infix, Prefix and Postfix expressions - infix to postfix conversion - Expression Evaluation- Balancing Parenthesis.

Module II Queue and Trees **15 Hours**

Queue: Queue Model, Array and Linked list implementation of Queue-Priority Queue - Applications of Queue. **Trees:** Binary Tree - Binary Search Tree - Insertion, Deletion, Traversal - Inorder, Preorder, Postorder, Level order traversal.

Module III Graphs and Hashing **15 Hours**

Graphs: Weighted and Directed graphs - Adjacency matrix and list implementation - Traversal – Breadth First Search & Depth First Search. **Hashing:** Direct Address Table, Hash function, Collision resolution techniques, Linear Probing, quadratic probing, double hashing.

	Total Hours (Theory):	**45 Hours**

S. No.	Lab Exercises
1	Implementation of Singly, Doubly and Circular Linked List.
2	Implementation of Stack using Arrays.
3	Implementation of Stack using Linked List.
4	Implementation of Stack applications
5	Implementation of Queue using Arrays.
6	Implementation of Queue using Linked List.
7	Implementation of Queue applications.
8	Implementation of Hashing techniques
9	Implementation of Binary Search Tree.

10	Implementation of Graph Traversal algorithms.		
		Total Hours (Lab):	**30 Hours**
		Total Hours: (45+30)	**75 Hours**

Text Books:	
1	Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.
2	Anany Levitin, Introduction to the design & analysis of algorithms , 3rd Edition, Pearson Education, 2021.
3	Michael T. Goodrich, "Data Structures and Algorithms in C++", 2nd Edition, Wiley Publication, 2011.
Reference Books:	
1	SeymourLipschutz, "DataStructuresbySchaumSeries",2ndedition, Tata McGrawHill, 2013.
2	NarasimhaKarumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles",5thEdition, CareerMonk, 2016.
3	DebasisSamanta,"Classic data structures",Prentice Hall of India, 2ndedition,2014.
Web References:	
1	https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms
2	https://www.edx.org/course/data-structures-algorithms-using-c
Online Resources:	
1	https://www.programiz.com/dsa l
2	https://freevideolectures.com/course/2519/c-programming-and-data-structures
3	https://www.cprogramming.com/algorithms-and-data-structures.html

Continuous Assessment									**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C201.1	Apply	Quiz	20
C201.2	Apply	Case Study	20
C201.3, C201.4	Apply	Group Assignment	20
C201.5	Analyze	Assignment	20
Assessment based on Summative Assessment - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		
	CIA1: (60 Marks)		**CIA2: (60 Marks)**

Remember	20	20
Understand	40	30
Apply	40	40
Analyse	-	10
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Practical Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	30	30	30
Apply	60	40	40
Analyse	-	20	20
Evaluate		-	-
Create	-	-	-

Assessment based on Continuous and End Semester Practical Examination

Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
	FA 1			FA 2				
SA 1 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	SA 2 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	FA (75M)	SA (25M)	

Course Outcome (CO)	ProgrammeOutcomes(PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	3	3	2									1	3	1	1
C201.2	3	3	3	3	3				2	1		2	3	2	2
C201.3	3	3	3	3	3				2	1		2	3	2	2
C201.4	3	3	3	3	3				2	1		2	3	2	2
C201.5	3	3	3	3	3				2	1		2	3	2	2
C201	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**2**	**3**	**2**	**2**
	3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed							

23CD201	DATABASE MANAGEMENT SYSTEMS	1/0/4/3
Nature of Course:	D (Theory Application)	
Prerequisites:	Nil	

Course Objectives:

1	To introduce fundamental concepts of Data Base Management Systems and concepts of Relational Data Models.
2	To explain Relational algebra, Relational calculus and Normalization.
3	To implement different relational model constraints and SQL queries.
4	To manage Database using transactions, concurrency and query optimization.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C201.1	Discuss the basic concepts and various data models used in database design	[U]
C201.2	Illustrate Relational algebra, Relational calculus and Normalization.	[AP]
C201.3	Write SQL commands and Subqueries with Constraints.	[AP]
C201.4	Determine Appropriate transactions, views, cursors and triggers to perform the given task.	[AP]
C201.5	Analyze database storage structures, query processing and recovery system.	[A]

Course Contents:

MODULE I INTRODUCTION **15 Hours**

Introduction to DBMS, Characteristics of DBMS, DBMS vs File Systems, need for DBMS, Three Level DBMS Architecture, Data Models – Introduction, Benefits, and Phases, ER Diagrams – Symbols, Components, Relationships, Weak entities, Attributes, Cardinality, Relational Algebra, Domain Relational Calculus, Tuple Relational Calculus, Normalization - 1NF, 2NF, 3NF, BCNF, 4NF

MODULE II CONSTRAINTS AND SQL COMMANDS **15 Hours**

DDL Commands - Create, Drop, Alter, Truncate, Rename, Keys - primary Key, Foreign Key DML Commands - Select, Insert, Update, Delete, Any, All, In, Exists, Non Exists, Union, Intersection, Subqueries - nested, correlated, Joins- Inner, Outer, and Equi, Functions - SUM, COUNT, AVG, MIN, MAX, Clauses - Group By, Having By, Embedded SQL, Dynamic SQL, Transaction Concepts – Transaction model – ACID Properties – Serializability –Transactions as SQL statements.

MODULE III QUERIES AND TRANSACTIONS **15 Hours**

Creation and Dropping of Views, Creation and Execution of Stored Procedures Cursors and Triggers - Opening, Fetching and Closing, Creation , Insertion, Deletion and Updating Database Applications: Payroll Processing Systems, Railway Reservation Systems, Bank Management System Introduction, Storage media and file structures, B+ Tree Hashing – static and Dynamic, Introduction to Query Processing – Issues in query optimization – Steps in query processing, Concurrency control and transactions, Lock based protocols Recovery System – Failure classification

Lab Experiments:

1**.** Conceptual Database design using E-R DIAGRAM

2. Implementation of SQL commands DDL, DML, DCL and TCL

3. Queries to demonstrate implementation of Integrity Constraints

4. Practice of Inbuilt functions

5. Implementation of Join and Nested Queries AND Set operators

6. Implementation of virtual tables using Views

7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)

8. Mini Project (Application Development)

   i) IT Training Group Database

  ii) Blood Donation System

  iii) Salary Management System

  iv) Traffic Light Information System

	Total Hours:	45+30

Text Books:

1	Abraham Silberschatz, Henry F Korth, S Sudarshan, "Data base System Concepts", 7th Edition, McGraw hill, 2020.
2	Vijay Krishna Pallaw, "Database Management Systems", 2nd Edition Asian Books Private Limited, 2010.
3	Mark L. Gillenson, "Fundamentals of Database Systems", 7th Edition, Wiley India Pvt. Limited, 2008.

Reference Books:

1	Raghu Ramakrishnan, Johannes Gehrke, Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw-Hill Education, 2017
2	C. Date, "SQL and Relational Theory", O'Reilly Media, Incorporated, 2011.

Web References:

1	http://www.sqlcourse.com/
2	https://www.w3schools.com/sql/
3	https://www.geeksforgeeks.org/dbms/

Online Resources:

1	https://www.coursera.org/learn/database-management
2	https://www.udemy.com/database-management-system/
3	https://onlinecourses.swayam2.ac.in/cec22_cs18/preview

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C201.1	Understand	Quiz	20
C201.2	Apply	Case Study	20
C201.3, C201.4	Apply	Tutorial	20
C201.5	Analyse	Assignment	20
Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		

	CIA1: (60 Marks)	CIA2: (60 Marks)
Remember	10	10
Understand	40	30
Apply	50	40
Analyse	-	20
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	20	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	20	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)							End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)	
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)		

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	3	3	2	2								2	3	2	2
C201.2	3	3	2	2	2				2	2	2	3	3	2	3
C201.3	3	3	2	2	2				2	2	2	3	3	2	3
C201.4	3	3	2	2	2				2	2	2	3	3	2	3
C201.5	3	3	2	2								3	3	2	3

23CY201	JAVA PROGRAMMING	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	-	

Course Objectives:

1	To understand the basic concepts of core java.
2	To employ different types of modifiers and Control statements
3	To implement and interpret Arrays and Strings concepts
4	To implement streams and java console formatting features

Course Outcomes :
Upon completion of the course, students shall have ability to

C201.1	Infer the basic concepts of java programming.	[U]
C201.2	Illustrate the usage of different aspects of Controls statements in real world scenarios.	[AP]
C201.3	Apply Array and strings in real time environment.	[AP]
C201.4	Analyse and Interpret StringBuffer and StringBuilder Classes	[A]
C201.5	Utilize the functionalities of streams and java console class.	[AP]

Course Contents:

MODULE I Introduction to Java **15 hours**

Introduction to Java: Java Architecture- JVM, JRE & JDK, Keywords, Features of Java, Console input and output statements, variables and Identifiers, Scope of Variables, Data types, Type Conversion, Comments, Command Line Arguments, Access Modifiers **Operators** - Unary Operator- Arithmetic Operator- Shift Operator - Relational Operator - Bitwise Operator - Logical Operator - Ternary Operator and Assignment Operator. **Decision Statements** - if Statements, if-else Branching, switch Statements.

MODULE II Loops, Array & Strings **15 Hours**

Looping Statements: using for loop, using while Loops, Using do Loops. **Jump Statements:** using break and continue, Unlabelled Statements, Labelled Statements. **Arrays:** Declaration, Instantiation and Initialization of Java Array, Types of Array - Single Dimension array, Multi-dimension array - **Strings:** String, StringBuilder, and StringBuffer, The String Class, Important Facts About Strings and Memory, Important Methods in the String Class, The StringBuffer and StringBuilder Classes, Important Methods in the StringBuffer and StringBuilder Classes, File Navigation and I/O.

MODULE III Java I/O **15 Hours**

Streams: Types of Streams, The Byte-stream I/O hierarchy, Character Stream Hierarchy, Random Access File class, The java.io.Console Class, Serialization, Dates, Numbers, and Currency, Working with Dates, Numbers, and Currencies, Parsing, Tokenizing, and Formatting, Locating Data via Pattern Matching, Tokenizing.

	Total Hours	**45**

List of Component:

S. No.	Lab Exercises
1	Implementation of simple java program using Command Line Arguments
2	Implementation of simple java programs using decision making statements
3	Implementation of simple java programs using Looping statements
4	Implementation of Simple java programs using Jump statements
5	Implementation of 1D Array
6	Implementation of 2D Array
7	Implementation of String functions
8	Implementation of simple java program using Streams
9	Implementation of simple java program using Date and Number classes
10	Implementation of simple java program using Tokenizing

	Total Hours	**30**

Text Books:

1.	Herbert Schildt, "Java: The Complete Reference", 9th edition, Tata McGraw Hill, 2014.
2.	Kathy Sierra, "Head First Java: A Brain-Friendly Guide, 2nd Edition, Oreilly, 2009.
3.	Herbert Schildt, "Java A Beginner's Guide, Create, Compile and Run Java Programs Today", 8th edition, Tata McGraw Hill, 2020.

Reference Books:

1.	Paul Deitel, Harvey Deitel, "Java How To Program", 10th Edition, Prentice Hall Publications, 2014.

2.	Y. Daniel Liang, "Introduction to Java Programming", 9th Edition, Prentice Hall Publications, 2015.
3.	Ed Roman, RIma Patel, Sriganesh, Gerald Brose, "Mastering Enterprise JavaBeans" 3rd edition, Wikely, 2005.

Web References:

1	http://www.nptel.ac.in
2	http://www.javaworld.com
3	https://www.learnjavaonline.org/
4	https://www.codecademy.com/learn/learn-java

Online Resources:

1	https://www.coursera.org/courses?query=java
2	https://www.tutorialspoint.com/java/index.htm
3	https://www.w3schools.com/java/java_intro.asp

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+ B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model – Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C201.1	Apply	Quiz & Assignment	20
C201.2	Apply	Assignment	20
C201.3	Apply	Case study	20
C201.4	Analyze	Group Assignment	20
C201.5	Analyze		20
Assessment based on Summative Assessment – Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		
	CIA1: (60 Marks)		CIA2: (60 Marks)
Remember	-		-
Understand	20		-
Apply	80		80
Analyse	-		20
Evaluate	-		-
Create	-		-
Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	-	-	-
Understand	20	-	10

Apply	80	80	80
Analyze	-	20	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)									End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)				Practical Exam (100 Marks)		
	FA 1			FA 2					
SA 1 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	SA 2 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	FA (75M)	SA (25M)		

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	2	2	2	-	-	-	-	2	-	-	2	2	-	2
C201.2	3	3	3	-	-	-	-	2	2	2	-	2	2	2	2
C201.3	2	2	3	-	2	-	-	2	-	-	3	-	-	3
C201.4	3	2	2	-	2	-	-	2	2	2	-	3	-	2	3
C201.5	3	2	2	-	2	-	-	2	2	2	-	3	-	2	3

23AS102	APPLIED SCIENCE LABORATORY		L/T/P/C
			0/0/4/2

Nature of Course	: E (Skill based)	
Pre requisites	: Basic Applied Science laboratory skills	

Course Objectives:

1.	To carry out experiments to understand the basic laws of magnetism.
2.	To Understand of how objects become electrically charged and how electrical charge is transferred from one object to another.
3.	To understand the principles and applications of electrochemistry and learning electro-analytical methods, and explore the knowledge of various energy sources and storage devices.
4.	To understand the concepts of photo-physical and photochemical processes in spectroscopy.

Course Outcomes:
Upon completion of the course, students shall have ability to

C103.1	To determine the magnetic field around a current carrying conductor	[E]
C103.2	To determine the rate of growth or decay in a resistor -capacitor circuit and to estimate the resonant frequency and Q-factor.	[E]
C103.3	To determine the relationship between the magnetic flux density and the magnetizing field strength and to find the specific resistance of the wire.	[E]
C103.4	To determine the pH, single electrode potential using reference electrodes and Electroplating process based on electrolytic cell.	[E]
C103.5	Interpret the principle and working of Spectroscopic technique.	[E]

Lab Components:

1	Determination of Magnetic field along the axis of current carrying coil-Stewart and Gee method.	[E]
2	Determination of characteristics of RC circuit to find the time constant.	[E]
3	Determination of characteristics of LCR circuits.	[E]
4	Determination of Hysteresis loss.	[E]
5	Determine the Specific resistance- Carey fosters bridge	[E]
6	Determination of strength of strong acid by pH metry.	[E]
7	Estimation of dissolved oxygen in waste water using Winkler's method.	[E]
8	Determination of single electrode potential of Zinc and Copper by Potentiometric method.	[E]
9	Determination of cathode efficiency of Nickel using electroplating process.	[E]
10	Spectrophotometry-Estimation of iron in sample water.	[E]
	Total Hours:	**30**

Text Book:

1	Anoop Sing Yadav "Applied Physics Lab Manual" Vayu Education of India Publisher, 2018.
2	P. Kulkarni, Manual for Experiments in Engineering Physics,2015
3	S. K. Gupta, "Engineering physics practical's", Krishna Prakashan Pvt. Ltd., 2014.
4	P. R. Sasikumar "Practical Physics", PHI Ltd., 2011.
5	Method of Sampling and Test (Physical and Chemical) for Water and Wastewater- Iron, 2003, Part-53; First Revision.
6	Method of Sampling and Test (Physical and Chemical) for Water and Wastewater: pH Value (1983; Part-11; First Revision).

7	Method of Sampling and Test (Physical and Chemical) for Water and Wastewater, Biochemical Oxygen Demand, 1993, Part-44; First Revision.
8	Chemistry Laboratory Manual by CSOS, Chhattisgarh State Open School, E-Book. NIOS.

References:

1	Dr. Ruby Das and Prashant Kumar Sahu,A Textbook of Engineering Physics Practical , 2016,2nd Edition
2	S. L. Gupta and Dr. V. Kumar, "Practical physics with viva voice", Pragati Prakashan Publishers, Revised Edition, 2009.
3	M. N. Avadhanulu, A. A. Dani and Pokely P.M, "Experiments in Engineering Physics", S. Chand&Co,2008.
4	Sawyer, C. N., McCarty, P. L., and Parkin, G. F. 2000. Chemistry for Environmental Engineering. Fourth Edition, McGraw-Hill, Inc., New York.
5	American Public Health Association et al, Standard Methods for the Examinations of Water and Waste Water, APHA. 1998.
6	AWWA, WEF, APHA, 1998, Standard Methods for the Examination of Water and Wastewater (Method: 5210B,BOD).

Web References:

1	https://vlab.amrita.edu/
2	https://bop-iitk.vlabs.ac.in/basics-of-physics/
3	http://vlabs.iitb.ac.in/
4	https://www.iitg.ac.in/
5	https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html
6	https://ee1-nitk.vlabs.ac.in/exp/determination-of-biological-oxygen/simulation.html
7	https://www.youtube.com/watch?v=pORJQyP-2j8
8	https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html
9	https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
75	25	100	60	40	100

Assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (60%) [100 Marks]		End Semester Practical Examination (40%) [100 Marks]
	FA (75 Marks)	SA (25 Marks)	
Remember	-	-	-
Understand	10	10	10
Apply	30	30	30
Analyse	30	30	30
Evaluate	30	30	30

Create	-		-			-	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C103.1	3	2	1	2					2			1	1		1
C103.2	2	1	1	2					2			1	1	1	1
C103.3	3	2	1	2					2			2	1	1	
C103.4	3	2	1	2					2			2	1		1
C103.5	3	2	1	2					2			1		1	1

23MC102	**ENVIRONMENTAL SCIENCES**	**2 /0 /0 /0**

Nature of Course	:C (Theory Concept)
Pre requisites	:Basics in Environmental Studies

Course Objectives:

1	To learn the integrated themes on various natural resources.
2	To gain knowledge on the type of pollution and its control methods.
3	To have an awareness about the current environmental issues and the social problems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
C201.2	Illustrate the importance of natural resources and conservation of biodiversity.	[U]
C201.3	Interpret and analyze the impact of engineering solutions in a global and societal context.	[U]
C201.4	Apply the gained knowledge to overcome pollution problems.	[AP]
C201.5	Apply the gained knowledge in various environmental issues and sustainable development.	[AP]

Course Contents:

Natural Resources:

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources-Soil erosion and desertification – Role of an individual in conservation of natural resources.

Environmental Pollutions:

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Greenhouse effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedy. Water pollution c. Soil pollution - Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

Social issues and the Environment:

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard.

	Total Hours:	**30**

Text Books:

1	AnubhaKaushik and C P Kaushik "Perspectives in Environmental Studies"4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi
2	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2015.

Reference Books:

1	Tyler Miller, Jr., "Environmental Science", Brooks/Cole a part of Cengage Learning, 2014.
2	William Cunningham and Mary Cunningham, "Environmental Science", 13th Edition, McGraw Hill,2015.
3	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Third Edition, Pearson Education, 2014.

Web References:

1	http://nptel.ac.in/courses/104103020/20
2	http://nptel.ac.in/courses/120108002
3	http://nptel.ac.in/courses/122106030

4	http://nptel.ac.in/courses/120108004/
5	http://nptel.ac.in/courses/122102006/20
Online Resources:	
1	https://www.edx.org/course/subject/environmental-studies
2	www.environmentalscience.org

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:50)

Course Outcome	Bloom's Level	Assessment Component	Marks
C201.1	Remember	Quiz	10
C201.2	Understand	Case study based on environmental aspect	20
C201.3	Understand	Class presentation	10
C201.4& C201.5	Apply	Assignment	10

Summative assessment based on Continuous Assessment

Bloom's Level	Continuous Assessment		Term End Assessment [50 marks]
	CIA-I [0 marks]	CIA-II [0 marks]	
Remember	-	-	30
Understand	-	-	40
Apply	-	-	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	K	l	1	2	3
C201.1							3								
C201.2							3								
C201.3						2	3								
C201.4							3								
C201.5							3								
		3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed						

23GE301	UNIVERSAL HUMAN VALUES	3/0/0/3

Nature of Course	Descriptive
Pre-Requisites	Interpersonal Communication and Value Sciences

Course Objectives:

1	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3	Strengthening of self-reflection.
4	Development of commitment and courage to act.
5	Helping the students to appreciate the essential complementarily between 'VALUES' and' SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
6	Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:
Upon completion of the course, students shall have ability to

C301.1	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
C301.2	Apply responsibilities towards their commitments (human values , human relationship and human society).	[AP]
C301.3	Apply what they have learnt to their own self indifferent day-to-day settings in real life, atleast a beginning would be made in this direction.	[AP]
C301.4	Analyze ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[A]
C301.5	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in nature.	[U]

Course Contents:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being-Harmony in Myself!

15 Hours

Self-evaluation of the students- Pre-test of UHV- Purpose and motivation for the course. Self-Exploration–Its content and process- A look at basic Human Aspirations. Understanding Happiness and Prosperity correctly-Understanding the needs of Self('I') and 'Body'-Understanding the Body as an instrument of 'I'(being the doer, seer and enjoyer)-Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding theharmony of'I' with the Body- Social activities – Waste Management - Water Conservation-Soil Pollution - Physical Health and related activities - Lectures by eminent persons- Literary activities.

Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence- Whole existence as Coexistence

15 Hours

Understanding values in human relationship - Understanding the harmony in the society (society being an extension of family): - Visualizing a universal harmonious order in society-Understanding the harmony in Nature.-Understanding Existence as Coexistence of mutually

Interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence-Buddy program- Relationships-Homesickness- Managing peer pressure-Projects-Socially responsible engineers-Visit to local areas (orphanages, special children)- Physicalactivities(games).

Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics

15 Hours

Natural acceptance of human values- Definitiveness of Ethical Human Conduct- Basis for Humanistic Education-Humanistic Constitution and Humanistic Universal Order-Competence in professional ethics-Case studies of typical holistic technologies, management models and eco-friendly production systems - Strategy for transition from the present state to Universal Human Order-Sum up: Self-evaluation of the students-Post test of UHV.

		Total Hours:	45

Text Books:

1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2	Rajni Setia, Priyanka Sharma, "Human Values", Genius Publication", Jaipur, 2019.

Reference Books:

1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2	The Story of My Experiments with Truth –by Mohandas Karamchand Gandhi
3	India Wins Freedom-Maulana Abdul Kalam Azad.

Web References:

1	https://examupdates.in/professional-ethics-and-human-values/
2	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html
3	https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf

Online Resources:

1	https://nptel.ac.in/courses/109/104/109104068/
2	https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b
3	https://www.thebalancecareers.com/life-skills-list-and-examples-4147222

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	tTotal	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C301.1	Understand & Apply	Online Quiz	20
C301.2	Understand & Apply	Group Assignment	20
C301.3	Understand	Presentation	20
C301.4	Apply		
C301.5	Apply	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	10	20	20
Apply	40	40	40
Analyse	40	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination					
Continuous Assessment (40%) [200 Marks]					**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**		
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**	
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C301.1						3							1	1	1
C301.2						3		3					1	1	1
C301.3						3	3						1	1	1
C301.4						3	3	3			2		1	1	1
C301.5						3	3						1	1	1

23MA301	MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE	3/1/0/4

Nature of Course	B (100% Analytical)	
Pre requisites	-	

Course Objectives:

1	To realise that the subject evolves as a generalization of solving a system of linear equations.
2	To simplify the complexity in high-dimensional data using Principal component analysis
3	To Gain practical experience in programming tools for data sciences
4	To apply quantitative modelling and data analysis techniques to the solution of real-world business problems
5	To explore the societal and ethical implications of computational systems.

Course Outcomes(Theory)
Upon completion of the course, students shall have ability to

C301.1	Recall the basic concepts of differentiation in image transformation.	[R]
C301.2	Understand the practical importance of solving differential equations in climate Sciences.	[U]
C301.3	Utilize Matrix decomposition techniques to perform data analysis.	[AP]
C301.4	Utilise Correlation and regression techniques in data science.	[AP]
C301.5	Apply numerical techniques to obtain approximate solutions of ODE and PDE in climate sciences.	[AP]

Course Contents:
Module 1: Linear Transformations   (20 Hours)
Automatic Differentiation: Univariate functions - Scalar Valued Multivariate functions – Jacobins - Linear Transformations - Matrix – Inverses - Solving equations - Solving equations using the Newton method - Taking Advantage of Structure: Rank of a matrix Eigen Values and Eigenvectors - Principal Component Analysis: Singular-Value Decomposition.
Module 2: Data Science   (20 Hours)
Data science – Root mean square distance: Mean - Standard deviation – Correlation – Scatter diagram – Regression: Linear Model - Optimization: Simulation –   Monte Carlo methods in simulation – Curve fitting : Method of least squares – Method of group averages
Module 3: Differential Equations   (20 Hours)
Time Stepping: Euler method - Ordinary differential equation and Parameterized Types- Solving ODE and systems of ODEs - Modelling bacterial growth - Advection and diffusion in 2D – Solving inverse problems: Unconstrained optimization - Constrained optimization- Numerical solution of PDE – Elliptic Equation: Liebmann's iteration process - Parabolic Equation: Bender Schmidt's difference Scheme – Hyperbolic Equations.

	Total Hours:	60

Text Books:		
1	Guttag, John," Introduction to Computation and Programming Using Python: With Application to Understanding Data", 2nd ed, MIT Press, 2016.
2	Peter J. Denning, Matti Tedri , "Computational Thinking, MIT Press,2019

3	Erwin Kreyszig, "Advanced Engineering Mathematics", 13th Edition, John Wiley & Sons, Inc.
4	S.C. Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, twelth edition, Sulthan Chand and sons,2014.

Reference Books:

1	Gilbert Strang, Introduction to linear algebra, 5th edition.
2	B. S. Grewal, Higher Engineering Mathematics, 43rd edition.
3	I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers",8th edition, Pearson Education.

Web References:

1	https://www.youtube.com/channel/UC9IuUwwE2xdjQUT_LMLONoA
2	https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/
3	https://archive.nptel.ac.in/courses/111/104/111104032/

Online Resources:

1	https://www.coursera.org/specializations/image-processing
2	https://www.coursera.org/projects/principal-component-analysis-numpy
3	https://cheatsheets.quantecon.org/
4	https://www.coursera.org/learn/julia-programming?

Assessment Methods & Levels (based on Blooms' Taxonomy)

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C301.1	Remember	Quiz	20
C301.2	Understand	Presentation	20
C301.3 - C301.5	Apply	Tutorial	20
C301.3 - C301.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-

Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1: 100 Marks			CA 2: 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)(Theory)															
COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C301.1	1	1											1		
C301.2	2	2											1		
C301.3	3	3													
C301.4	3	3											1		
C301.5	3	3													
	3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed							

23AD301		**DESIGN AND ANALYSIS OF ALGORITHMS**	**1 / 0/ 4 / 3**

Nature of Course:	I (Problem Concepts)
Pre requisites:	Data Structures and Algorithms

Course Objectives:

1	To understand the techniques for analyzing the computer algorithms.
2	To learn the paradigms for designing the algorithms.
3	To analyze the efficiency of various algorithm design techniques / paradigms for the same problem.
4	To understand the graphical algorithms for solving problems.

Course Outcomes:
Upon completion of the course, students shall have ability to

C301.1	Illustrate the searching and sorting algorithms.	[U]
C301.2	Interpret the design principles of greedy and pattern searching algorithms with examples.	[AP]
C301.3	Explore problem-solving methodology used in Backtracking.	[A]
C301.4	Analyse the time and space complexities of dynamic programming strategy in solving complex problems.	[A]
C301.5	Employ range query and graph algorithms in real world problems.	[AP]

Course Contents:

Sorting, Searching and String Algorithms: **[15 Hours]**

Time Complexity Analysis – Mathematical Analysis of Recursive and Non Recursive algorithms - Searching & Sorting, Divide and Conquer – Bubble sort, Insertion sort, Selection sort, Binary search, quick sort, merge sort – Heaps & Hashing –Binary heap, heapsort - Greedy Algorithms–Activity selection problem, Fractional knapsack - String algorithms - Naive algorithm, Rabin Karp algorithm, KMP algorithm, Z algorithm, Manacher's algorithm – Huffman coding.

Greedy and Dynamic Programming: **[15 Hours]**

Backtracking - Rat in a maze, Permutation and Combination, N Queen problem and Problems on Backtracking, Knight's Tour Problem, Subset Sum, M-Coloring Problem, Hamiltonian Cycle Problem, Sudoku Solver, Sieve of Sundaram, Prime Numbers after P with Sum. Dynamic Programming – Greedy vs Dynamic programming, Top-down and bottom-up approach, Longest Common Subsequence, Longest increasing subsequence, Edit distance, 0-1 Knapsack, Coin change problem, Minimum Cost Path, Subset Sum Problem, Maximum Size Square Sub Matrix with all 1s, Longest Palindromic Subsequence.

Tree and Graph Algorithms: **[15 Hours]**

Range query Algorithms - Range Minimum Query (Brute Force Approach). Segment Tree, Range Minimum Query on the Constructed Segment Tree, Range Minimum Query Using Sparse Table. Graph Algorithms –Single source shortest path algorithm, Floyd warshall's Algorithm - Minimum Spanning Tree.

	Total Hours:	**45**

Lab Component	
1	Implementation of Linear, Binary Search and Tries.

2	Implementation of Sorting Algorithms - Bubble, Insertion, Selection, Merge Sort, Quick sort, Heap Sort.
3	Implementation of Greedy Algorithms.
4	Implementation of Pattern Searching Algorithms.
5	Implementation of Backtracking Algorithms.
6	Implementation of Dynamic Programming.
7	Implementation of Range Query Algorithms.
8	Implementation of Minimum Spanning Tree.
9	Implementation of Shortest path Algorithms.
10	Implementation of Maximum Flow Minimum cut Algorithm.

Total Hours : 30

Text Books:

1.	AnanyLevitin, "Introduction to Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2012.
2.	Thomas H.Cormen, Charles E.Leiserson, R.L.Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009.

Reference Books:

1	Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms/ C++", 2nd Edition, Universities Press, 2019.
2	Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rd Edition, 2008.

Web References:

1	https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
2	https://www.coursera.org/learn/introduction-to-algorithms
3	https://timroughgarden.org/videos.html

Online Resources:

1	https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2	https://www.csa.iisc.ac.in/~barman/daa18/E0225.html
3	https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory

Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C301.1	Understand	Quiz & Assignment	20
C301.2	Apply	Assignment	20
C301.3 & C301.4	Analyze	Case study	20
C301.5	Apply	Assignment	20

Assessment based on Summative Assessment - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]	
	CIA1: (60 Marks)	CIA2: (60 Marks)
Remember	10	10
Understand	40	40
Apply	40	40
Analyse	10	10
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Practical Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Practical Examination

Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Mapping of Course Outcomes (CO) with Programme Outcomes(PO) and Programme Specific Outcomes(PSO)

Cos	Pos												PSOs		
	a	b	C	d	e	f	g	h	i	j	k	l	1	2	3
C301.1	3	3	3	1	3	2	1	2			2	1	3	2	2
C301.2	3	3	3	1	3	2	1	2				1	3	2	2
C301.3	3	3	3	1	3	2	1	2			1	1	3	2	2
C301.4	3	3	3	1	3	2	1	2				2	3	2	2
C301.5	3	3	3	1	3	2	1	2				2	3	2	2

23IT301		**WEB TECHNOLOGY USING REACT**	**1/0/4/3**
Nature of Course		F (Theory Programming)	
Prerequisites		Java Programming	

Course Objectives:

1.	To discuss the essence of front-end development skills.
2.	To understand and use JavaScript in client-side web applications.
3.	To impart the knowledge of React components used in web application development.
4.	To deploy and test the React App used in Web Applications.

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Demonstrate the client-side JavaScript application development with React library.	[U]
C301.2	Construct the single page applications in React.	[AP]
C301.3	Apply the react features including components and forms.	[AP]
C301.4	Analyze the functionality of front-end UI applications using React.	[A]
C301.5	Examine the responsive react applications with CSS	[A]

Course Contents:

Introduction   **15 Hours**
Fundamentals of React – Requirements, JavaScript Essentials, Event loop, Node.js Fundamentals, Traditional Programming Limitations, React JSX, Overview of frameworks, libraries for client side Web applications, React DOM, Component Instantiation, Environment Setup for React Application, NPM commands, VS Code extensions for ES6, Handler Function-React(formatting and check styles), Hello world app in React, React Essential Features and Syntax, React App Project Directory Structure, Overview of Webpack, Babel, React Component Basic, Create React Component, Understanding JSX, Limitations of JSX, Working with Components and Reusing Components.

React Components and Styles   **15 Hours**
React Components - Props and State, Understanding and using Props and State, Handling Events with methods, Manipulating the State, Two way data-binding, Functional (Stateless) VS Class (Stateful) Components, Parent – Child Communication, Dynamically rendering contents, Showing Lists, List and keys, Styling Components, CSS Styling, Scoping Styles using Inline Styles, Limitations of inline styles, Inline Styles with Radium, Google Material UI, Installing Material UI, Material UI AppBar, Material UI's Toolbar, Custom React NavBar. CSS - Material UI Buttons, Using Material UI - Rendering a Button, Material UI Card, Material UI Checkbox, Material UI Grid Component, Material UI IconButton, Material UI Paper Component, Style Material UI Components with my own CSS, UI Templates for Business, Typography Usage, Debugging React Apps, Understanding React Error Messages, Handling Logical Errors, Debugging React apps using google developer tools and React DevTool. Understanding Error Boundaries, React Component life cycle, Updating life cycle hooks, Pure Components, React's DOM Updating Strategy, Returning adjacent elements, Fragments, React Component in Details, Higher Order Components, Passing unknown Props, Validating Props, Using References, React Context API, Updated LifeCycle hooks (16.3)

Deploying and Testing Web Applications   **15 Hours**
React Projects, Demo apps, HTTP Requests/Ajax Calls, HTTP Requests in React, Introduction of Axios package, HTTP GET Request, fetching & transforming data, HTTP POST, DELETE, UPDATE, Handing Errors, Adding/Removing Interceptors, Creating/Using Axios instances, Redux, React Thunk, Difference between Thunk & other, React hooks, Application Using React & Redux , React Routing, Routing and SPAs, Setting Up the Router Package, react-router vs react-router-

dom, Preparing the Project For Routing, Switching Between Pages. Routing-Related Props, The "withRouter" HOC & Route Props, Passing & extracting route/query parameters, Using Switch to Load a Single Route, Navigating Programmatically. React Forms and Form Validation, Creating a Custom Dynamic Input Component, Setting Up a JS Config for the Form, Dynamically Create Inputs based on JS Config, Adding a Dropdown Component. Handling User Input, Handling Form Submission, Adding Custom Form Validation, Fixing a Common Validation, Adding Validation Feedback, Showing Error Messages, Handling Overall Form Validity, Deploying React App to the Web, Testing React apps with Jasmine & implementing JEST.

	Total Hours	**45**

Lab Component:		
1.	Create a Stateless Functional Component	
2.	Create a Stateful Class Component	
3.	Implementation of Conditional Rendering using Class Component	
4.	Implementation of Communication (Parent-child) between Components	
5.	Create material UI Card using React	
6.	Design a Custom Navigation bar using React	
7.	Implementation of React component to handle HTTP requests	
8.	Implementation of a Dropdown component using React	
9.	Implementation of Routing in React	
10.	Implementation of FORM validation in React	
	Total Hours:	**30**

Text Books:	
1.	Robin Wieruch, "The Road to React", 2022 Kindle Edition.
2.	Alex Banks, Eve Porcello. "Learning React: Modern Patterns for Developing React Apps", O'Reilly Media,2020.
Reference Books:	
1.	Adam Bouch, "React and React Native", Packt Publishing, 3rd Edition, 2020.
2.	Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Pearson Education, 2nd Edition, 2018
3.	Adam Boduch, Roy Derks "React and React Native: A Complete Hands-on Guide to Modern Web and Mobile Development with React.js", Packt Publishing, 2020.
Web References:	
1.	https://www.coursera.org/learn/front-end-react
2.	https://www.geeksforgeeks.org/full-stack-development-with-react-node-js-live/
3.	https://www.edx.org/learn/front-end-web-development
4.	https://www.w3schools.com/REACT/DEFAULT.ASP
Online Resources:	
1.	https://reactjs.org/
2.	https://www.youtube.com/watch?v=3HMtarQAt3A
3.	https://frontendmasters.com/guides/front-end-handbook/2018/what-is-a-FD.html
4.	https://www.youtube.com/watch?v=HT82p_re-EY

Continuous Assessment										End Semester Practical Examination	Total
Theory				Practical							
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)	Total (A+B)	Total Continuous Assessment			
80	120	200	100	75	25	100	200	50		50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C301.1	Understand	Quiz	20
C301.2	Apply	Quiz	20
C301.3	Apply	Mini Project	20
C301.4	Analyze		
C301.5	Analyze	Mini Project	20
Assessment based on Summative Assessment - Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		
	CIA1: (60 Marks)		CIA2: (60 Marks)
Remember	-		-
Understand	30		30
Apply	40		30
Analyse	30		40
Evaluate	-		-
Create	-		-
Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	-	-	-
Understand	10	-	10
Apply	50	60	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination							
Continuous Assessment (50%)							End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)	
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)		

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C301.1	3	3	3	2	2				2	2	2	2	3	3	2
C301.2	3	3	3	2	2				2	2	2	2	3	2	3
C301.3	3	3	3	3	2				3	2	2	2	3	2	2
C301.4	3	3	3	2	3				2	2	2	2	3	3	3
C301.5	3	3	3	2	3				2	2	2	2	3	2	2

23CS301	ADVANCED JAVA PROGRAMMING	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	Java Programming	

Course Objectives:

1	To provide insight knowledge of OOP concepts and usage of this, static, super and final keywords.
2	To discuss about different type of Collection Frameworks.
3	To demonstrate threads, JDBC & exception handling with real world examples.
4	To illustrate designing of GUI applications using swing component.

Course Outcomes :
Upon completion of the course, students shall have ability to

C301.1	Illustrate the OOPs concepts like Constructors, Inheritance, Polymorphism and the usage of this, static, super and final keywords.	[AP]
C301.2	Apply the concepts of Exception Handling in real world applications and usage of collection frameworks.	[AP]
C301.3	Develop Multithreaded applications.	[AP]
C301.4	Develop GUI Applications using swing component and to explain the concept of Servlets.	[AP]
C301.5	Develop java application to interact with database by using relevant JDBC Driver.	[AP]

Course Contents:

Module I   Introduction to OOPS   15 Hours

Class and Object, Encapsulation and Abstraction, Inheritance, Polymorphism, Message Passing, Keywords : this, super, static, final, extends and implements. Method Signature and Prototype, Mutator Methods and Accessor Methods, Var-Arg Method, hashCode() and toString() methods. Immutable Objects Vs Mutable Objects, User defined Immutable Class, Constructors : Introduction, Default Constructor, User Defined Constructors, Constructor Overloading, Instance Variable, Instance Methods, Instance Block and Instance Flow Of Execution. Regular Expressions (RegEx).

Inheritance Introduction, Types of Inheritance, Up Casting, Down Casting, IS-A Relationship & HAS-A Relationship, Composition Vs Aggregation, **Polymorphism:** Method Overloading, & Method Overriding.

Module II   Abstraction, Exception Handling & Collections   15 Hours

Abstraction: Abstract Methods and Abstract classes. Interfaces, abstract classes and Interfaces, Concrete Methods Vs Abstract Methods, Differences between classes, abstract classes and Interfaces, Marker Interfaces

Exception - try catch block, Finally Block, Exception Hierarchy, Multiple Exceptions In a Catch Block, Parameterized Try Block, Overriding Methods And Exception. Creating Your Own Exception, The Assert Keyword, The Generics Framework, **Collections:** Set, List, Map & Tree, The Iterator Interface. Working with Hashtable Collection **Threads:** Introduction to Threads, Creating And Starting Threads, Basic Thread Control Methods. Multithreading, Working with Multiple, threads, Thread Life Cycle, Thread Priorities, Synchronizing Methods.

Module III   Swings, Servlets & JDBC   15 Hours

Swings: Introduction, JLabel, JButton, JTextField ,JTextArea, JPasswordField, JCheckbox, JComboBox, JRadioButton, JScrollBar, JMenuItem and JMenu.

JDBC: Drivers, CURD operations, Database connectivity
Servlets : Overview of Servlets , Servlet Life Cycle, Servlet Request and Response , web.xml

	and its need, Servlet Configuration, Session Tracking
Total Hours	**45 Hours**

List of Experiments
1. Implementation of default and parameterized constructors.
2. Implementation of method overloading and overriding.
3. Implementation of Inheritance.
4. Implementation of Abstract and Interface concepts.
5. Programs using collection Interface.
6. Implementation of multithreading Concepts.
7. Program to handle multiple exception using try, catch and finally block.
8. Implementation of swing components.
9. Implement Simple application using servlets.
10. Implement CURD operation using JDBC.

	Total Hours	**30 Hours**

Text Books:

1.	Herbert Schildt,"Java:TheCompleteReference",12th edition, Mc craw Hill, 2021.
2.	Robert Liguori, Patricia Liguori, "Java 8 Pocket Guide", O'Reilly Media, 2014.
3.	ShagunBakliwal, Hands-on Application Development using Spring Boot, bpb publisher, 2021.

Reference Books:

4.	Paul Deitel, Harvey Deitel, "Java How To Program",10th Edition, Prentice Hall Publications,2014.
5.	Cay S.Horstmann and GaryCornell, "Core Java, Vol.2: Advanced Features", 9th Edition, Prentice Hall,2013.

Web References:

1	https://www.javatpoint.com/java-tutorial
2	https://www.geeksforgeeks.org/java/
3	http://www.javatpoint.com/java-tutorial

Online Resources:

1	http://www.coursera.org/specializations/object-oriented-programming
2	http://www.udemy.com/topic/java-certification/
3	http://www.edx.org/learn/jav

Continuous Assessment										**End Semester Practical Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**			
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**					
80	120	200	100	75	25	100	200	50		50	100

Formative Assessment based on Capstone Model – Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C301.1 & C301.3	Apply	Quiz	20
C301.2	Apply	Assignment	20

C301.4 & C301.5	Apply	Case Study		40

Assessment based on Summative Assessment – Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]	
	CIA1: (60 Marks)	CIA2: (60 Marks)
Remember	20	20
Understand	40	40
Apply	40	40
Analyse	-	-
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C301.1	3	3	3	1					2	2		2	3	2	3
C301.2	3	3	3	3	2				3	2		2	3	2	2
C301.3	3	3	3	2	3				2	2		2	3	3	3

C301.4	3	3	3	2	3				2	2		2	3	3	3
C302.5	3	3	3	2	3				2	2		2	3	3	3
C301	**3**	**3**	**3**	**3**	**3**				**3**	**2**		**2**	**3**	**3**	**3**

23CY202	OPERATING SYSTEMS	3/0/2/4

Nature of Course:	F (Theory Programming)
Pre requisites:	Nil

Course Objectives:

1	To identify the structure and functions of Operating System.
2	To describe the OS mechanisms to handle processes and threads.
3	To experiment CPU scheduling policies, synchronization techniques and deadlock handling in real time problems.
4	To articulate Memory management schemes.
5	To discuss Device Management, I/O and File systems concepts.

Course Outcomes

Upon completion of the course, students shall have ability to

C202.1	Review the basic concepts and functions of operating systems.	[U]
C202.2	Interpret the processes and threads in operating systems for real world problems.	[U]
C202.3	Examine CPU scheduling algorithms, process synchronization mechanisms and deadlock handling methods.	[AP]
C202.4	Practice memory management techniques including virtual memory and page replacement algorithms.	[AP]
C202.5	Illustrate the concepts related to mass storage, I/O and file system.	[AP]

Course Contents:

Module I Introduction **15 Hours**
Defining Operating Systems - User view - System view - Computer-System organization - Computer System Architecture - Operating System Operations - Resource Management - Virtualization - Computing Environments - OS Services - System Calls - Overview of Operating System Specific applications - OS Structures - System Boot. Process: Concept - Scheduling – Operations. Thread: Overview - Multicore Programming - Multithreading Models.

Module II Process & Memory Management **15 Hours**
CPU Scheduling - Process Synchronization: Synchronization Tools - Classic Problems of Synchronization – Deadlocks: System Model- Deadlock in Multithreaded Applications - Deadlock Characterization - Methods for Handling Deadlocks - Prevention - Avoidance -Detection – Recovery. Main memory: Background - Contiguous Memory Allocation – Paging - Structure of the Page Table – Swapping. Virtual memory - Background - Demand Paging - Copy-on-Write - Page Replacement - Allocation of Frames - Thrashing - Memory Compression.

Module III File Management, I/O and storage **15 Hours**
File-System Interface: File concept - Access methods-Directory Structure - Protection. File System Implementation: File System Structure- Directory implementation- Allocation Methods- Free Space Management. File system Internals: File Systems - File System mounting - Partitions and Mounting - File Sharing. I/O Systems: Overview - I/O Hardware. Mass Storage Structure: Overview - HDD Scheduling - NVM Scheduling - Storage Device Management - Storage Attachment. Case Study: NAND flash storage system, IPC in windows.

	Total Hours:	**45**

Laboratory Component:

S. No	List of Experiments
1.	Study of Basic Linux Commands, proc file system of linux, disk I/O, buffer caches, disk monitoring tool
2.	Implementation of Shell Programming
3.	Implementation of Unix System Calls

4.	Implementation of Non Pre emptive and Pre emptive CPU Scheduling Algorithms
5.	Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
6.	Implementation of Banker's Algorithm for Deadlock Avoidance
7.	Implementation of Memory Allocation and Management Techniques
8.	Implementation of Page Replacement Techniques
9.	Implementation of File organization Techniques and study on modern file systems like ZFS, btrfs, ext4 etc.
10.	Implementation of Disk Scheduling Algorithms. Compare CPU and Disk Scheduling algorithms in terms of the number of voluntary and involuntary context switches.
	Total Hours: 30

Text Books:

| 1. | Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts" 10th Edition, John Wiley, 2018 |
| 2. | D.M Dhamdhere, "Operating Systems"- A Concept based Approach, 3rdEdition, McGraw Hill,2017 |

Reference Books:

| 1. | Andrew S. Tanenbaum, Modern Operating Systems 5thEdition, Pearson Education, 2016. |
| 2. | William Stallings, "Operating Systems – Internals and Design Principles", 8thEdition, Pearson Publications, 2014. |

Web References:

1.	https://www.studocu.com/sg/course/nanyang-technological-university/operating-systems/1390534
2.	https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
3.	https://www.gatevidyalay.com/operating-system/

Online Resources:

| 1. | https://www.coursera.org/learn/os-power-user |
| 2. | https://nptel.ac.in/courses/106108101 |

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C202.1	Understand	Quiz	20
C202.2	Understand	Assignment	20
C202.3 & C202.4	Apply	Tutorial	20
C202.5	Apply	Case Study	20
Assessment based on Summative and End Semester Examination - Theory			

Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	20	20
Understand	40	30	40
Apply	40	50	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	20	20	20
Understand	40	20	30
Apply	40	60	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								End Semester Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Theory Examination (35%) Practical Examination (15%)
	FA 1			FA 2				
SA 1 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	SA 2 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	FA (75M)	SA (25M)	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C202.1	2	2	2	-	-	-	-	-	2	1	-	2	2	2	2
C202.2	3	3	3	2	2	-	-	-	2	1	-	3	3	2	2
C202.3	3	3	3	3	3	-	-	-	2	1	-	3	3	2	2
C202.4	3	3	3	3	3	-	-	-	2	1	-	3	3	2	2
C202.5	3	3	3	-	-	-	-	-	2	1	-	3	2	2	2

23AD401	PYTHON FOR DATA SCIENCE	3/0/2/3
Nature of Course	F (Theory and Programming)	
Prerequisite	Nil	

Course Objectives:

1	To understand and execute Python script using types and expressions.
2	To understand the difference between expressions and statements.
3	To utilize high level data types such as lists and dictionaries.
4	To import and utilize a module and to perform read & write operations on files.
5	To use the latest python libraries for data science in real time paradigms.

Course Outcomes:

Upon completion of the course, students shall have ability to

C401.1	Recognize the general principles and good algorithmic problem solving.	[U]
C401.2	Interpret the fundamental Python syntax and semantics and use of Python control flow statements.	[U]
C401.3	Understand variables, data types, control flow structures such as loops and conditionals), functions, and file handling.	[U]
C401.4	Design and implement modular and reusable code.	[AP]
C401.5	Examining compound data using Python lists, tuples and dictionaries.	[AP]
C401.6	Correlating how to leverage popular libraries such as NumPy, Pandas, and Matplotlib for data manipulation, analysis, and visualization.	[A]

Course Contents:

Algorithmic Problem Solving, Data, Expressions and Statements: **15 Hours**

Algorithms, Building Blocks of Algorithms (Statements, State, Control Flow, Functions), Notation (Pseudo Code, Flow Chart, Programming Language), Algorithmic Problem Solving, Simple Strategies For Developing Algorithms (Iteration, Recursion). Illustrative Problems: Find Minimum In A List, Insert A Card In A List Of Sorted Cards, Guess An Integer Number In A Range, Towers of Hanoi. **-** Python Interpreter and Interactive Mode; Values And Types: Int, Float, Boolean, String, And List; Variables, Expressions, Statements, Tuple Assignment, Precedence of Operators, Comments; Modules And Functions, Function Definition And Use, Flow of Execution, Parameters And Arguments; Illustrative Programs: Exchange The Values of Two Variables, Circulate The Values of N Variables, Distance Between Two Points. Case study- Boston housing price prediction.

Control Flow, Functions, Strings: **15 Hours**

Conditionals: Boolean Values And Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); Iteration: State, While, For, Break, Continue, Pass; Fruitful Functions: Return Values,

Parameters, Local And Global Scope, Function Composition, Recursion; Strings: String Slices, Immutability, String Functions And Methods, String Module;.Lists As Arrays. Illustrative Programs: Square Root, GCD. Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters, Tuples: Tuple Assignment, Tuple As Return Value; Dictionaries: Operations And Methods, Exception handling, Files-reading and writing - Case Study: Text Analysis.

Python Libraries for Data Science: **15 Hours**

Basics of Data Science: Loading the Data from CSV file, Cleaning the Data, Data Preprocessing, Visualization, Numpy and Data Analysis, Pandas and pandas operations, Seaborn, Linear and Polynomial model for Prediction, Matplotlib: Types of plots, GUI - Turtle. **Case study:** Analyse the academic performance of students and plot a graph.

	Total Hours:	45

Text Books:

1	Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, "Python Programming A Practical Approach", CRC Press, 2021.
2	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2018.
3	Jake Vanderplas, "Python Data Science Handbook: Essential Tools for Working with Data, Second Edition, O'Reilly, 2022.

Reference Books:

1	Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
2	Timothy A. Budd, "Exploring Python", Mc Graw Hill Education (India) Private Ltd., 2015.
3	John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2017.
4	Peter Morgan, "Data Analysis from scratch with python: Beginner guide using python, pandas, Numpy, SCIKIT-learn, IPython, TensorFlow and Matplotlib", AI Sciences, 2018.

Web References:

1	http://nptel.ac.in/courses/106106145/
2	https://www.codecademy.com/learn/learn-python
3	https://www.coursera.org/learn/python-data-analysis#syllabus

Online Resources:

1	https://www.programiz.com/python-programming
2	https://www.fullstackpython.com/best-python-resources
3	https://www.youtube.com/watch?v=edvg4eHi_Mw

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C401.1, C401.2	Understand	Tutorial	20
C401.3	Understand	Assignment	20
C401.4, C401.5	Apply	Case Study	20
C401.6	Analyze	Quiz	20

Assessment based on Summative and End Semester Examination			
Revised Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	30	20	20
Understand	30	30	20
Apply	20	50	40
Analyse	20	-	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)																
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C401.1	3	3	2	2	3	3	1		1	1	2	2	2	3	3
C401.2	3	3	3	3	2	2	1				2	3	3	3	2

C401.3	3	3	2	2	3	3	1		1	1	2	2	3	2	2
C401.4	3	3	3	3	2	2	1				2	3	2	2	3
C401.5	3	3	2	2	3	3	1				2	2	3	3	
C401.6	3	3	2	2	3	3	1				2	2	3	3	3

23AD402	BASICS OF DATA ENGINEERING	3/1/0/4
Nature of Course	F (Theory Programming)	
Prerequisite	Artificial Intelligence and Machine learning Basics	

Course Objectives:

1	Introduce Student to learn Data Engineering and differentiate it from Data Science.
2	Aspects of cloud computing capabilities and compare cloud computing with on-site implementations.
3	evaluation of Linux and the command line to perform computing tasks and explain how Linux is used.
4	Recall the concepts of Hadoop's and Spark's role in big data and explain batch versus in memory processing of big data.
5	Recognize the advanced concept of spark streaming.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C402.1	Identify and understand the basic concept of Data Engineering.	[U]
C402.2	Summarize cloud computing capabilities and compare cloud computing with on-site implementations.	[U]
C402.3	Understand Linux command and the command line to perform computing tasks.	[U]
C402.4	Classify Hadoop's and Spark's role in big data and explain batch versus in memory processing of big data.	[AP]
C402.5	Understand the advanced concept of spark streaming.	[AP]

Course Contents:

Foundations of Data Engineering **20 Hours**

Introduction to Data Engineering concepts and principles, Importance of Data Engineering in the modern data landscape, Role of Data Engineers in data-driven organizations, Introduction to Linux operating system, Basic Linux commands for file manipulation, navigation, and user management, Shell scripting fundamentals for automating tasks, Overview of GCP services and their applications, Setting up a virtual machine on GCP, Understanding the GCP console and cloud resources, Introduction to Hadoop ecosystem and its components, Hadoop Distributed File System (HDFS) and its role, MapReduce paradigm and its application in distributed computing. **Program:** Perform basic Linux commands such as file manipulation, navigation, and user management. **case study: Spark Streaming.**

Big Data Technologies **20 Hours**

Introduction to Distributed Computing and Hadoop -Understanding the fundamentals of distributed computing-Overview of Hadoop as a distributed computing framework-Hadoop ecosystem components: HDFS, MapReduce, and YARN - Installing and Configuring Hadoop - Detailed step-by-step guide for installing Hadoop- Configuration of Hadoop components for optimal performance- Testing Hadoop on a multi-node cluster. Spark Fundamentals- Introduction to Apache Spark: its origin, purpose, and advantages- Spark architecture: Spark Core, Spark SQL, Spark Streaming, MLlib, and GraphX- Basic Spark operations: transformations and actions. Relational Databases. Use SQL & PostgreSQL - Data Architecture, Data Governance. NoSQL Databases using MongoDB - Python, Anaconda Python, and API data sources. **Case Study: Revolutionizing Big Data Processing: A Hadoop Implementation.**

Advanced Spark Concepts **20 Hours**

Spark Streaming: Real-time data processing with micro-batching- Spark MLlib: Overview of machine learning capabilities in Spark- Hands-on exercises for each advanced concept- Introduction to Apache Flink and its positioning in the big data landscape- Flink architecture and features: data streaming and batch processing- Building a streaming data processing pipeline with Flink- Comparisons between Spark and Flink for different use cases- Strategies for optimizing Hadoop and Spark jobs- Performance tuning for Spark applications- Benchmarking and profiling tools for distributed computing. **Case study: Real-Time Insights Unleashed: A Spark Streaming.**

Total Hours:	60

Text Books:

1	"Designing Data-Intensive Applications" by Martin Kleppmann, O'Reilly Media 2023.
2	"Hadoop: The Definitive Guide" by Tom White O'Reilly Media 2022.
3	Learning Spark: Lightning-Fast Data Analytics" by Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia by 2022

Reference Books:

1	"Data Science for Business" by Foster Provost and Tom Fawcett, O'Reilly Media 2023.
2	"Professional Hadoop Solutions" by Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, wiley 2022
3	"Hadoop Application Architectures" by Mark Grover, Ted Malaska, O'Reilly Media 2022

Web References:

1	https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2	https://www.coursera.org/courses?query=data%20engineering

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C402.1, C402.2, C402.3	Understand	Assignment Quiz	20 20
C402.4, C402.5	Apply	Case Study Presentation	20 20

Assessment based on Summative and End Semester Examination			
Revised Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	30	20	20
Understand	30	30	20
Apply	20	50	40
Analyse	20	-	20
Evaluate	-	-	-
Create	-	-	-

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C402.1	3	3	3	2	3	2						2	2	2	2
C402.2	3	3	3	2	3	2						2	2	2	2
C402.3	3	3	3	3	3	2						2	2	2	2
C402.4	3	3	3	2	3	2						2	2	3	3
C402.5	3	3	3	3	3	3						3	3	2	2

23AD403	MANAGING CLOUD AND CONTAINERIZATION	1/0/4/3

Nature of Course	F (Theory Programming)
Pre requisites	Data Base Management Systems

Course Objectives:

1	To understand the evolution of AWS from the existing technologies.
2	To have knowledge on AWS security and various scaling methods.
3	To team the necessary skills for design, develop and deploy services in creatingwith the help of docker.
4	To implement automated system update and DevOps lifecycle
5	To understand virtualization and provide the perfect security for the entire infrastructure.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C403.1	Demonstrate the basic global infrastructure of the AWS Cloud.	[AP]
C403.2	Identify an appropriate solution using AWS Cloud services for various use cases.	[U]
C403.3	Interpret how the components of Docker containers support compute container implementations.	[AP]
C403.4	Examine common Infrastructure Servers, Availability and Scalability.	[A]
C403.5	Learn why automation, culture, and metrics are essential to a successful DevOps project.	[U]
C403.6	Analyze various cloud models and apply them to solve problems.	[A]

Course Contents:

MODULE I MANAGING CLOUD USING AWS   **15 Hours**

Introduction,Future of AWS, Services - AWS EC2, AWS S3 - Cloud storage, Types, Benefits, AWS IAM - AWS Security,Working of IAM, Components AWS CloudFront Working, Benefits. Introduction, Snapshots vs AMI, Different scaling plans. Introduction, Benefits, Algorithms used for load balancing. **Case study:** E-commerce Website Infrastructure on AWS.

MODULE II CONTAINERIZATION USING DOCKERS   **15 Hours**

Docker, Containers, Usage of containers, Terminology, Docker Run Static sites, Docker Images, Docker File, Docker on AWS, Docker Network, Docker Compose, Development Workflow, AWS EC Services. **Case study:** Microservices Architecture for a Social Media Application using Docker and AWS.

MODULE III DEVOPS   **15 Hours**

Introduction, Test Driven Development, Continuous Integration, Code coverage, Best Practices, Virtual Machines vs Containers, Rolling Deployments, Continuous Deployment, Auto Scaling. **Case Study:** Open Stack, Cloud based ML Solutions in Healthcare. **Case study:** Cloud-Based Machine Learning Solutions in Healthcare.

	Total Hours:	**45**

List of Experiments:	
1	Study of Hosted Hypervisor and Bare Metal Hypervisor.
2	Install a Virtualbox / VMware Workstation with different flavours of linux or windows S
3	Implementation of Virtual Machine(S) and create a Virtual Datacenter.
4	Configuration of Virtual Internetworking Components.
5	Configuration of Virtual Internetworking Components.
6	Install a docker engine and docker client on windows.
7	Creation and removal of container, container images.
8	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim
9	Find a procedure to transfer the files from one virtual machine to another virtual machine Using VMWare
10	Install Google App Engine. Create a hello world app and other simple web applications using python / java

Total Hours : 30

Text Books:	
1	Mark Wilkins, "Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud", 2019.
2	Sean P. Kane, Karl Matthias,"Docker: Up & Running: Shipping Reliable Containers in Production", O'Reilly Media Inc, 2015.
3	Jennifer Davis and Ryn Daniels, "Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale", 2016, O'Reilly Media Inc.

Reference Books:	
1	Ardian, "Using Docker: Developing and Deploying Software with Containers", O'Reilly Media Inc, 2015.

Web References:	
1	https://cloudacademy.com/course/introduction-to-devops/intro-3/
2	https://awscloud.in/

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+ B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C403.1	Apply	Quiz & Assignment	20
C403.2 & C403.5	Understand	Assignment	20
C403.3	Apply	Case study	20

C403.4 & C403.6	Analyze	Assignment		20

Assessment based on Summative Assessment - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]	
	CIA1: (60 Marks)	CIA2: (60 Marks)
Remember	10	10
Understand	40	40
Apply	40	40
Analyse	10	10
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Practical Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Practical Examination

Continuous Assessment (50%)							End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)	
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)		

Mapping of Course Outcomes (CO) with Programme Outcomes(PO) and Programme Specific Outcomes(PSO)

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C403.1	3	3	3					3	3	3		3			3
C403.2	3	3	3					3	2	3		3			3
C403.3	3	3	3					3	3	3		3			3
C403.4	3	3	3					3	3	3		3			3
C403.5	3	3	3					2	3	3		3			3
C403.6	2	3	3					2	3	2		3			2

23CS402	**SOFTWARE TESTING**	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

1.	To provide students with an understanding of Core Testing concept.
2.	To learn the functional and non-functional testing.
3.	To understand the different types of User Acceptance testing and end-to-end testing.
4.	To get familiarize with the best practices of Testing.

Course Outcomes

Upon completion of the course, students shall have ability to

C402.1	Plan and apply the appropriate level of testing within the context of a software development application to the satisfaction of its beneficiaries.	[AP]
C402.2	Analyze specific and measurable test cases to ensure coverage and traceability to requirements	[A]
C402.3	Understand the problem of reporting techniques, metrics, and testing status reports and communicate testing results to colleagues, managers, and end users.	[U]
C402.4	Apply testing models, processes and practices appropriate for the software development lifecycle model of a project	[AP]
C402.5	Apply principles and practices of test-driven development to improve testing quality and reduce delivery times	[AP]
C402.6	Inspect the various testing processes towards the continuous delivery of a software product.	[A]

Course Contents:

Introduction to Automation Testing with Selenium: **15 Hours**
What is Software Testing, Why Software Testing, Benefits of Software Testing, Software Test Levels, Unit Testing, Integration Testing, System Testing, Acceptance Testing, Software Test Types, Functional testing, Non-functional testing, Change Related Testing.
Test Scenario Design - Functional and non-functional test scenarios, identify and write business critical scenarios.
Test Case Design - pre-requisites, test steps and expected results for test cases, Positive and negative testcases for each scenario, Test case prioritization, Test case optimization technique. RTM, DSR.
Classes and Objects, Inheritance, and Polymorphism, Exception Handling, Collections, and, Collections(List), JDBC Connectivity, Creating CURD OPERATION JDBC Connectivity

Working with Selenium: **15 Hours**
Selenium webdriver - Maven Configuration, WebDriver Commands, Navigation Command, Selenium locators - Selenium Locators Basics (id, name),Xpath and css locators, Selenium WebElement - Handling of Form Elements, Synchronization Methods, Selenium Exceptions, Keyboard and mouse handling, Alert handling, Iframe Handling in Selenium, Java Script Execution, Handling WebTable and calendar.
Introduction to TestNG - TestNg Introduction, Advantage of testNg , testNG Annotations, Test data preparation, Generation of TestNG Reports, Implicit wait and Explicit wait.

Testing Framework **15 Hours**
Testing Frameworks - Data driven testing using Apache POI, POM. Extent Reports - HTML Report Generation using Extent Reports, Attaching Screenshot in HTML Report.

Log4j - configuring log4j Property files, Log4j - parameters for Properties file, Log levels and logging using log4j, Hybrid framework implementation., Creating the POM with a Hybrid framework folder structure, Implementing the Hybrid framework in POM.	
Total Hours	**45**

Lab Component:	
1.	Develop a program to automate the login process for a specified webpage using Selenium.
2.	Write an automation script using Selenium to handle form elements on a given website.
3.	Create an automation script with Selenium to interact with specific web elements on a designated webpage.
4.	Implement automation scripts using TestNG, prioritizing different test cases for efficient testing on a given website.
5.	Develop automation scripts with TestNG, incorporating seven levels of logging for detailed analysis while testing a specified website.
6.	Execute application tests using designed test cases and generate an HTML report for a comprehensive overview.
7.	Design and implement a hybrid framework for a ticket booking system, along with associated test cases.
8.	Develop a hybrid framework and associated test cases for a hotel room booking system.
9.	Design and develop a hybrid framework and relevant test cases for a hospital appointment application.
10.	Implement a hybrid framework and associated test cases for an e-commerce application.
11.	Develop a hybrid framework and design test cases for comprehensive testing of an insurance website.
Text Books:	
1.	Rex Allen Jones II, "Absolute Beginner, Part 1 Selenium Webdriver for Functional Automation Testing", 1st Edition, Createspace Independent Pub, 2016
2.	S Basu, "Selenium with Python Simplified for Beginners", 1st Edition, 2020
3.	Paul Watson, "Selenium webdriver with Node.js: Beginner's Guide", 1st Edition, CreateSpace Independent Publishing Platform, 2016.
Reference Books:	
1.	Satya Avasarala, "Selenium Web Driver Practical Guide", 1stEdition, Packt Publishing Limited, 2014
2.	Sujay Raghavendra, "Python Testing with Selenium: Learn to Implement Different Testing Techniques Using the Selenium WebDriver", Apress, 2020.
3.	Pinakin Ashok Chaubal, "Selenium Framework Design in Keyword-Driven Testing: Automate Your Test Using Selenium", BPB Publications, 2020.
Web References:	
1.	https://www.coursera.org/projects/building-test-automation-framework-using-selenium-and-testng
2.	https://www.edx.org/professional-certificate/delftx-automated-software-testing
3.	https://onlinecourses.nptel.ac.in/noc22_cs12/preview

4.	https://www.nextgenerationautomation.com/post/selenium-coding-exercises
5.	https://www.studytonight.com/maven/build-and-test-maven-project
Online Resources:	
1.	https://www.tutorialspoint.com/selenium-for-software-testing-getting-started/index.asp
2.	https://www.softwaretestingmaterial.com/selenium-tutorial/
3.	https://www.leapwork.com/discover/selenium-automation

Continuous Assessment									End Semester Practical Examination	Total
Theory				**Practical**			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C402.3	Understand	Assignment	**20**
C402.5	Apply	Quiz	**20**
C402.1, C402.4	Apply	Case Study	**20**
C402.2, C402.6	Analyse	Group Assignment	**20**

Assessment based on Summative Assessment - Theory		
Bloom's Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	10	-
Understand	20	20
Apply	60	50
Analyse	10	30
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (50%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	-	10
Understand	20	20	20
Apply	60	50	60
Analyse	10	30	10

Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C402.1	2	2	2	2	2						2	2	2	2	2
C402.2	2	2		1	2						2	2	2	2	2
C402.3	2		1	1	3						2	2	2	2	2
C402.4	2	2	1	2	1						3	3	2	3	2
C402.5	1	2	2	1	2						2	3	3	2	2
C402.6	1	3	2	1	2						2	2	2	3	2

23IT402	WEB FRAMEWORKS USING REST API	1/0/4/3

Nature of Course:	D (Theory Application)
Pre requisites:	Java Programming

Course Objectives:

1	To impart the knowledge of REST API and HTTP methods used in Spring Boot Framework.
2	To discuss LIKE queries using JPA and handle CRUD operations with JPQL.
3	To explore the various relational mapping with JPA.
4	To deploy Spring AOP - Annotation Based applications.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C402.1	Create simple applications with REST API and handle HTTP methods.	[AP]
C402.2	Apply database connectivity with JPA using queries	[AP]
C402.3	Build application using Spring Boot and handle CRUD operations with JPQL.	[AP]
C402.4	Demonstrate various relational mapping with JPA.	[AP]
C402.5	Develop a real-time application using UI & Spring AOP	[AP]

Course Contents:

Module I :   APIs and JSON **15 Hours**
REST API, HTTP Methods in Rest, Overview of JSON, Controller and Service Layer, GET API with JSON & Spring Boot, @Value annotation, Runnable JAR Of Spring Boot App, @JsonIgnore Usage, @JsonProperty Usage, MySQL Database.

Module II : Spring JPA **15 Hours**
Spring Boot-MySQL Database Connection with JPA, @Repository Annotation, GET API with JPA, HTTP POST API, PUT API, DELETE API with @RequestParam, Path variable - @PathVariable, AND,OR,IN Query using JPA, Pagination & Sorting using JPA. @Transient Annotation, Queries using JPA, Starts and Ends with query using JPA, JPQL with @Query Annotation, Select, Update, Delete with JPQL.

Module III: JPA Mapping with Spring Boot **15 Hours**
OneToOne Relationship Mapping with JPA, Join Query, Lazy Loading in JPA, BiDirectionalOneToOne Relationship with JPA, OneToMany Relationship with JPA, Insert Record with OneToOne and OneToMany Relationship and JPA. SwaggerUI with Spring Boot, OpenUI with Spring Boot, Logging with Spring Boot, Changing Log Level,Logging Request and Response JSON, Logging properties with Spring Boot. AOP Terms, @BeforeAdvice with Method Parameter,@After Advice,@AfterReturning Advice, @Around Advice.

	Total Hours: 45

Laboratory Experiments:

1. Display the information about the current weather in a certain location using RESTful API use a weather forecast provider such as openweathermap.org.
2. Create your own app that embeds the information about flights, hotels and rental cars using Skyscanner API.
3. Create a simple Spring Application and inject the literal values by setter injection. So, create a simple class Employee having three attributes Id, Name, and Designation. Create setter methods for these attributes and a simple method to print the details of the student.
4. Create a simple payroll service that manages the employees of a company. Store employee objects in a database, and access them (via something called JPA).
5. Create a simple payroll service that manages the employees of a company. Perform the following LIKE queries using query methods with the keywords Containing, Contains, IsContaining, StartsWith and EndsWith.

	6. Create a simple payroll service that manages the employees of a company. Perform the following LIKE queries using query methods with the keywords NotContains, NotContaining and NotLike.
	7. Create a Spring Boot application with Student entity and Student JPA repository. Use Spring Rest Controller API to perform CRUD operations on Student data.
	8. Build a simple Rest API application called Donors. This application manages blood donors information and allows its users to Add a new donor, update existing donor information, view existing donors and delete a donor information from the application.

Total Hours: 45

Text Books:
1. Kirupa Chinnathambi, "A Hands-On Guide to Building Web Applications Using React and Redux", Addison-Wesley Professional, 2018.
2. Raja CSP Raman, Ludovic Dewailly, "Building RESTful Web Services with Spring 5", Packt Publishing, 2018.
3. Leonard Richardson, Sam Ruby "RESTful Web Services" O'Reilly Media, 2008.

Reference Books:
1. Ranga Karanam, "Master Java Web Services and REST API with Spring Boot", Packt Publishing, 2018.
2. Balaji Varanasi, Sudha Belida, "Spring REST", Apress, 2015.

Web References:
1. https://www.freecodecamp.org/news/how-to-build-a-rest-api-with-spring-boot-using-mysql-and-jpa-f931e348734b/
2. https://github.com/scbushan05/book-api-spring-boot
3. https://www.geeksforgeeks.org/spring-value-annotation-with-example/
4. https://www.baeldung.com/spring-jpa-like-queries
5. https://medium.com/thecodefountain/design-a-rest-api-with-spring-boot-and-mysql-a5572d94ccc7

Online Resources:
1. https://www.udemy.com/course/rest-api-with-java-spring-boot-spring-data-jpa-jparepository-swagger/
2. https://spring.io/guides/tutorials/rest/
3. https://www.javaguides.net/2018/10/spring-boot-2-restful-api-documentation-with-swagger2-tutorial.html

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]

C402.1, C402.2 & C402.3	Apply	Mini Project	**40**
C402.4	Understand	Quiz	**20**
C402.5	Apply	Case Study	**20**

Assessment based on Summative Assessment - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]	
	CIA1: (60 Marks)	**CIA2: (60 Marks)**
Remember	20	20
Understand	40	40
Apply	40	40
Analyse	-	-
Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (50%) [100 Marks]
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C402.1	2	2	2									1	2		1
C402.2	3	3	3	2	2				2	1		3	3	1	2

C402.3	3	3	3	3	3				2	1		3	3	2	2
C402.4	3	3	3	3	3				2	1		3	3	2	2
C402.5	3	3	3						1	1		3	3		1
C402	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**3**	**3**	**2**	**2**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

23AD404	No SQL DB	3/0/2/4
Nature of Course	F (Theory Programming)	
Prerequisites	Database Management Systems	

Course Objectives:

1	To differentiate and delineate various types of NoSQL databases based on their unique characteristics and functionalities.
2	To comprehend the impact of clustering on database design, considering scalability and fault tolerance as essential factors.
3	To elucidate the CAP theorem, outlining its core tenets and implications in distributed system design and operation.
4	To classify NoSQL databases - HBase, MongoDB, Cassandra, Neo4j, and Redis - based on CAP theorem trade-offs in consistency, availability, and partition tolerance.
5	To use Hadoop's HDFS, Apache Hive for data warehousing, and Apache Spark-SQL/Pig for effective data mining and analysis.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C404.1	Distinguish functionalities of NoSQL databases for varied data management.	[U]
C404.2	Implement fault-tolerant design principles in distributed systems.	[AP]
C404.3	Critically evaluate CAP theorem's trade-offs in NoSQL databases.	[A]
C404.4	Utilize Hadoop's HDFS as a base for NoSQL technologies and Apache Hive for data warehousing.	[AP]
C404.5	Proficiently mine data using HDFS-based tools for insightful decision-making.	[A]

Course Contents:

MODULE I An Overview of NoSQL   **15 Hours**

An Overview of NoSQL: Review of the Relational Model - ACID Properties - Distributed Databases: Sharding and Replication – Consistency - The CAP Theorem - NoSQL Data Models, HDFS: Overview of HDFS - HDFS Deployment - Core HDFS Services - Check Pointing - Federated and High Availability HDFS - Multi-node Cluster with Docker, Apache Hive as an HDFS Data Warehouse: Hive Meta store and HiveServer2 - The Beeline Command-Line Interface - Creating Hive Internal and External Tables - Data Serialization and Deserialization (SerDes) - Hive Storage Formats including Avro, Sequence File, and Parquet - Hive Query Language (HQL) - Built-in and User-Defined Functions - Hive and Map Reduce - Partitions and Buckets - Mining Hive Data with Apache Pig and Apache Spark-SQL. **CASE STUDY:** Comparative Analysis of Relational and NoSQL Databases in E-commerce Applications.

MODULE II Advanced NoSQL Database Management   **15 Hours**

Configuring HBase - Data Model: Conceptual and Physical Views - Data Model Operations - Schema Creation - Row Key Design - Architecture Overview - HBase Shell, MongoDB: The Document Data Model - Documents and Collections - MongoDB Use Cases - Embedded Data Models - Normalized Data - Replication via Replica Sets - MongoDB Design - MongoDB and the CAP Theorem - The MongoDB Data Manipulation Language - Transactions, Atomicity, and Documents - Durability and Journaling - Batch Processing and Aggregation – Indexing - Auto-Sharding, Shard Keys, and Horizontal Scalability - Writing to Shards - MongoDB as a File System. **CASE STUDY:** HBase vs. MongoDB.

MODULE III Diverse NoSQL and Graph Database Architectures   **15 Hours**

The Column-Family Data Model - Databases and Tables - Columns, Types, and Keys - The Data Manipulation Language - Cassandra's Architecture - Key Spaces, Replication, and Column-Families - The CAP Theorem - Consistent Hashing - Managing Cluster Nodes - Neo4j: Overview of Graph Theory - The Graph Data Model - Relationships as First-Class Citizens - Graph Database Use Cases - Neo4j

Design: Standalone and Cluster - ACID Properties and the CAP Theorem - Transaction Management with JTA - CRUD Operations with the Neo4j Core API - Navigating Graphs with the Traversal API - The Neo4j REST API - The Cypher Data Manipulation Language - Querying as Graph Traversal, Redis: The Key-Value Data Model - Redis as a Cache - Commands and Pipelining - Durability/Persistence Mechanisms - Partitioning with Redis Cluster - Publish/Subscribe Messaging - Key Space Notifications - Automatic Deletion with Key Expiration - Bulk Data Loading – Transactions.

CASE STUDY: Optimizing Real-Time Recommendation Engine, Cassandra, Neo4j, and Redis in a Social Media Platform

	Total Hours:	**45**

Laboratory Component:

S.No.	List of Experiments
1	Implement a Program to Compare Relational and NoSQL Models.
2	Develop a program to deploy and configure Hadoop's HDFS, focusing on its core services and implementing data checkpointing.
3	Develop scripts to create internal/external tables in Apache Hive, perform data serialization, and execute HQL queries.
4	Create a program to configure HBase, explore dynamic schema creation, and experiment with diverse row key designs.
5	Develop a script demonstrating MongoDB's document data model, replication strategies, and transaction management practices.
6	Design a program to perform data manipulation operations in Cassandra and manage cluster nodes using consistent hashing.
7	Build a script to execute CRUD operations, traverse graphs, and perform queries in Neo4j using Cypher and traversal APIs.
8	Develop a program demonstrating Redis as a cache, executing commands, exploring persistence mechanisms, and implementing publish/subscribe messaging.
9	Develop a comparative study program analyzing various NoSQL databases, focusing on their architectures and scalability attributes.
10	Implement an end-to-end application using a combination of NoSQL databases covered in the course, showcasing their functionalities.

	Total Hours:	**30**

Text Books:

1	Michael Kaufmann, Andreas Meier "SQL and NoSQL Databases", Springer Nature Switzerland, 2023.
2	Kaushik Rana, Durga Prasad Mohapatra, Julia Sidorova, Lars Lundberg, Lars Skold "Advanced Data Management: For Sql, Nosql, Cloud and Distributed Databases", ARCLER Press, 2023.
3	Andreas Meier, Michael Kaufmann, SQL & NoSQL Databases, Springer Fachmedien Wiesbaden, 2019.
4	Jeff Carpenter, Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilly Media, 2016.
5	Mark Needham, Amy E. Hodler, "Graph Algorithms", O'Reilly Media, 2019.

Reference Books:

1	Sam Alapati, "Expert Hadoop 2 Administration", Pearson Education, 2016.
2	Dayong Du, "Apache Hive Essentials", Packt Publishing, Limited, 2015.
3	Ruchir Choudhry, "HBase High Performance Cookbook", 2017.
4	Manu Sharma, "MongoDB Complete Guide", BPB Publications, 2021.
5	Ian Robinson, Jim Webber, Emil Eifrem, "Graph Databases", O'Reilly Media, 2013.

Web References:

1	https://www.mongodb.com/docs/
2	https://cassandra.apache.org/doc/latest/
3	https://neo4j.com/docs/
4	https://redis.io/docs/
5	https://docs.aws.amazon.com/amazondynamodb/latest/developerguide/Introduction.html

6	https://hostingdata.co.uk/nosql-database/
7	https://db-engines.com/en/ranking
8	https://nptel.ac.in/courses/106104135

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C404.1	Understand	Assignment - 1	20
C404.2, C404.3	Analyse	Quiz	20
C404.4	Apply	Case Study	20
C404.5	Analyse	Assignment - 2	20
Assessment based on Summative - Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	10	
Understand	30	30	
Apply	40	50	
Analyse	10	10	
Evaluate	-	-	
Create	-	-	
Assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	30	20	20
Understand	20	30	30
Apply	40	40	40
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								End Semester Practical Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C404.1	3	3	2	2								2	3	2	2
C404.2	3	3	2	2	2				2	2	2	3	3	2	3
C404.3	2	3	2	2	2				2	2	2	3	3	2	3
C404.4	3	3	2	2	2				2	2	2	3	3	2	3
C404.5	3	3	2	2								3	3	2	3

23AD405	PYTHON FOR DATA SCIENCE LABORATORY	0/0/4/2

Nature of Course	L (Programming)

Course Objectives:

1	To understand and execute Python script using types and expressions.
2	To understand the difference between expressions & statements and to understand the concept of assignment semantics.
3	To utilize high level data types such as lists and dictionaries.
4	To import and utilize a module and to perform read & write operations on files.
5	To work with Pandas, Matplot lib and turtle.

Course Outcomes:

Upon completion of the course, students shall have ability to

C405.1	Recognize and apply the general principles and good Algorithmic problem solving.	[AP]
C405.2	Design and implement modular and reusable code.	[AP]
C405.3	Represent and create compound data using Python lists, tuples and dictionaries.	[AP]
C405.4	Read and write data from data sheets and Analyse data.	[AP]
C405.5	Correlating how to leverage popular libraries such as NumPy, Pandas, and Matplotlib for data manipulation, analysis, and visualization.	[A]

Course Contents:

Laboratory Experiments:

Lab Exercise

1. Running instructions in Interactive interpreter a Python Script and Programs for Familiarizing with the syntax and basic concepts.
2. Create a Python program to find the XOR of two given strings interpreted as binary numbers.
3. The first pile has n stones. If n is even, then all piles have an even number of stones. If n is odd, all piles have an odd number of stones. Each pile must more stones than the previous pile but as few as possible. Write a Python program to find the number of stones in each pile.
4. Python program to generate and print the first n rows of Pascal's Triangle using function and recursive function.
5. Create a file where all letters of the English alphabet are listed by specified number of letters on each line.

6. Generate a random color hex, a random alphabetical string, random value between two integers (inclusive) and a random multiple of 7 between 0 and 70. Use random.randint().

7. There are two elements in this game – snake and food. The player has to move the snake such that it touches(eats) the food and grows in size. The snake dies if it touches its own body or the boundaries of the window. On an obvious note, the player needs to win and hence avoid dying. Build and Implement GUI using turtle.

8. Implement a Pandas program to get the day of month, day of year, week number and day of week from a given series of date strings.

9. Given a 2D Numpy array representing the grades of students in different subjects. Calculate the average grade for each student and overall class average.

10. Given a numpy array representing the sales data for different products, find the total sales, average sales and maximum sales value.

11. Creating and processing Data files using Pandas.

12. Visualizing the data using matplot lib.

	Total Hours: 30

Text Books:

1	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/think-python/)
2	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3	Fabio Nelli, "Python Data Analytics: Data Analysis and science using pandas, matplotlib and python programming language", Apress.

Reference Books:

1	Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
2	Timothy A. Budd, "Exploring Python", Mc Graw Hill Education (India) Private Ltd., 2015.
3	John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
4	Peter Morgan, "Data Analysis from scratch with python: Beginner guide using python, pandas, Numpy, SCIKIT-learn, IPython, TensorFlow and Matplotlib", AI Sciences, 2018.

Web References:

1	http://nptel.ac.in/courses/106106145/
2	https://www.codecademy.com/learn/learn-python
3	https://www.coursera.org/learn/python-data-analysis#syllabus

Online Resources:	
1	https://www.programiz.com/python-programming
2	https://www.fullstackpython.com/best-python-resources

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
75	25	100	60	40	100

Assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (60%) [100 Marks]		End Semester Practical Examination (40%) [100 Marks]
	FA (75 Marks)	SA (25 Marks)	
Remember	-	-	-
Understand	30	30	30
Apply	30	30	30
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C405.1	3	3	2	2	3	3	3	3	1	1	2	2	2	3	3
C405.2	3	3	3	3	2	2	2	3			2	3	3	3	2
C405.3	3	3	2	2	3	3	3	3	1	1	2	2	3	2	2
C405.4	3	3	3	3	2	2	2	3			2	3	2	2	3
C405.5	3	3	2	2	3	3	3	3			2	2	3	3	