DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM AND SYLLABI

B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATION 2022 (BATCH: 2023 – 2027)

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ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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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
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	Python for Data Science	3/0/0	3	3	60/40	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.	23AD302	Data Warehousing and Data Mining	3/0/2	5	4	50/50	PC
7.	23AD303	Python for Data Science Laboratory	0/0/3	3	1.5	40/60	PC
8.	23MCXXX	Mandatory Course III	1/0/0	1	0	0/100	MC
			Total	29	21.5	800	

SEMESTER IV

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23AD401	Data Engineering	3/1/0	4	4	60/40	PC
2.	23AD402	Design and Analysis of Algorithms	1/0/4	5	3	50/50	PC
3.	23AD403	Managing Cloud and Containerization	1/0/4	5	3	50/50	PC
4.	23CY101	Networking and Communication	3/0/2	5	4	50/50	ESC
5.	23CY202	Operating Systems	3/0/2	5	4	50/50	PC
6.	23IT402	Web Frameworks using REST API	0/0/4	4	2	40/60	PC
7.	23XXXXX	Design Thinking and Idea Lab	0/0/2	2	1	40/60	HSMC
			Total	30	21	700	

SEMESTER V

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	23XXXXX	Entrepreneurships and Startups	3/0/0	3	3	60/40	HSMC

2.	23AD501	Machine Learning Models	3/0/2	5	4	50/50	PC
3.	23XXXXX	Open Elective – I	3/0/0	3	3	60/40	OEC
4.	23AD502	Data Science Using R	3/0/2	5	4	50/50	PC
5.	23AD9XX	Professional Elective – I	3/0/0 or 0/0/6	3/6	3	60/40 or 40/60	PEC
6.	23AD9XX	Professional Elective – II	3/0/0	3	3	40/60	PEC
7.	23AD503	Mini Project - I	0/0/4	4	2	40/60	PW
			Total	**26/29**	**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.	23AD9XX	Professional Elective – III	3/0/0	3	3	60/40	PEC
3.	23AD9XX	Professional Elective – IV	3/0/0	3	3	60/40	PEC
4.	23ADXXX	Emerging Elective – I	3/0/0	3	3	60/40	EEC
5.	23AD602	Deep Learning and its Applications	3/0/2	5	4	50/50	PC
6.	23AD603	Natural Language Processing	3/0/2	5	4	50/50	PC
7.	23AD604	Mini Project - II	0/0/4	4	2	40/60	PW
			Total	**27**	**23**	**700**	

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	3	3	60/40	PEC
2.	23AD9XX	Professional Elective – VI	3/0/0	3	3	60/40	PEC
3.	23XXXXX	Open Elective – II	3/0/0	3	3	60/40	OEC
4.	23ADXXX	Emerging Elective – II	3/0/0	3	3	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.	23IT503	Internet of Things Laboratory	0/0/3	3	1.5	40/60	ESC
8.	23EES01	Employability Enhancement Skills (Summer Internship / Summer Training – 4 weeks)			2	0/100	EES
			Total	21	21.5	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 (15 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/ தமிழர் மரபு	1/0/0	1	1	HSMC
3	23TA201	Tamils and Technology/ தமிழரும் தொழில்நுட்பமும்	1/0/0	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
6	23XXXXX	Design Thinking and Idea Lab	0/0/2	2	1	HSMC
7	23XXXXX	Entrepreneurships and Startups	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 (18.5 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.	23IT101	Application Development Practices	1/0/4	5	3	ESC
3.	23CS101	Problem Solving using C++	1/0/4	5	3	ESC
4.	23CY101	Networking and Communication	3/0/2	5	4	ESC
5.	23IT501	Internet of Things	3/0/0	3	3	ESC
6.	23IT503	Internet of Things Laboratory	0/0/3	3	1.5	ESC

PROFESSIONAL CORE (63.5 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	Python for Data Science	3/0/0	3	3	PC
6.	23AD303	Python for Data Science Laboratory	0/0/3	3	1.5	PC
7.	23IT301	Web Technology using React	1/0/4	5	3	PC
8.	23CS301	Advanced Java Programming	1/0/4	5	3	PC
9.	23AD302	Data Warehousing and Data Mining	3/0/2	5	4	PC
10.	23AD401	Data Engineering	3/1/0	4	4	PC

11.	23AD402	Design and Analysis of Algorithms	1/0/4	5	3	PC
12.	23AD403	Managing Cloud and Containerization	1/0/4	5	3	PC
13.	23IT402	Web Frameworks using REST API	0/0/4	4	2	PC
14.	23CY202	Operating Systems	3/0/2	5	4	PC
15.	23AD501	Machine Learning Models	3/0/2	5	4	PC
16.	23AD502	Data Science Using R	3/0/2	5	4	PC
17.	23AD601	Virtual Reality and Augmented Reality	3/1/0	4	4	PC
18.	23AD602	Deep Learning and its Applications	3/0/2	5	4	PC
19.	23AD603	Natural Language Processing	3/0/2	5	4	PC

PROFESSIONAL ELECTIVES (18 CREDITS)

VERTICAL - I CLOUD COMPUTING AND DATA STORAGE TECHNOLOGIES

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23CD901	Data Virtualization	0/0/6	3	3	PEC
2.	23IT901	Cloud Services and Integration	3/0/0	3	3	PEC
3.	23CY901	Security and Privacy in Cloud	3/0/0	3	3	PEC
4.	23AD901	Storage Technologies	3/0/0	3	3	PEC
5.	23CS901	Software Defined Networks	3/0/0	3	3	PEC
6.	23CB901	Stream Processing	3/0/0	3	3	PEC

VERTICAL - II APPLIED AI

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23IT911	Intelligent Multiagent and Expert Systems	3/0/0	3	3	PEC
2.	23AD911	App Development	0/0/6	6	3	PEC
3.	23CY911	ETL Tools	3/0/0	3	3	PEC

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
4.	23CS911	Statistical Pattern Recognition	3/0/0	3	3	PEC
5.	23CD911	Stochastic and Network Control	3/0/0	3	3	PEC
6.	23AD912	Bayesian Data Analysis	3/0/0	3	3	PEC

VERTICAL - III INFORMATION SECURITY

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23IT921	Cyber Threats and Vulnerabilities	3/0/0	3	3	PEC
2.	23IT922	Cyber Physical Systems	3/0/0	3	3	PEC
3.	23IT923	Ethical Hacking and Auditing Frameworks	3/0/0	3	3	PEC
4.	23CY921	Data Privacy and Security	3/0/0	3	3	PEC
5.	23CY922	Cyber Crime and Forensics	3/0/0	3	3	PEC
6.	23CY923	Digital and Mobile Forensics	3/0/0	3	3	PEC

VERTICAL – IV NEXT GENERATION AI

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23AD931	Generative AI	3/0/0	3	3	PEC
2.	23AD932	Quantum Artificial Intelligence	3/0/0	3	3	PEC
3.	23AD933	Prompt Engineering	3/0/0	3	3	PEC
4.	23AD934	Intelligent Robotic Automation	3/0/0	3	3	PEC
5.	23AD935	Advanced Machine Learning	3/0/0	3	3	PEC
6.	23AD936	Explainable AI	3/0/0	3	3	PEC
7.	23AD937	AI for Humanity	3/0/0	3	3	PEC
8.	23AD938	Autonomous Vehicles and Drones	3/0/0	3	3	PEC
9.	23AD939	AI for Remote Sensing	3/0/0	3	3	PEC

VERTICAL - V DATA SCIENCE

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23AD941	Predictive Analytics	3/0/0	3	3	PEC
2.	23AD942	Information Extraction and Retrieval	3/0/0	3	3	PEC
3.	23AD943	Computational Statistics for Data Science	3/0/0	3	3	PEC
4.	23AD944	Ethics in Data Science	3/0/0	3	3	PEC
5.	23AD945	Video Analytics	3/0/0	3	3	PEC
6.	23AD946	Web and Social Media Mining	3/0/0	3	3	PEC
7.	23AD947	Business Analytics	3/0/0	3	3	PEC
8.	23AD948	Speech Processing	3/0/0	3	3	PEC
9.	23AD949	Risk Analytics	3/0/0	3	3	PEC

VERTICAL - VI EXTENDED REALITY

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	23AD951	Virtual Reality in Game Development	3/0/0	3	3	PEC
2.	23AD952	Augmented Reality and Video Streaming	3/0/0	3	3	PEC
3.	23AD953	APP Development using VRAR	3/0/0	3	3	PEC
4.	23AD954	Extended Reality for UX/UI Design	3/0/0	3	3	PEC
5.	23AD955	Metaverse Technologies	3/0/0	3	3	PEC
6.	23AD956	Virtual Reality Design and Communication	3/0/0	3	3	PEC
7.	23AD957	3D Modeling using VR	3/0/0	3	3	PEC
8.	23AD958	Sensors and Actuators in AR/VR	3/0/0	3	3	PEC
9.	23AD959	Mixed Reality and Advanced Systems	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 (6 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	23AD007	Edge AI	3/0/0	3	3	EEC
2.	23AD008	Geospatial Data Science and Location Intelligence	3/0/0	3	3	EEC
3.	23AD009	Healthcare Analytics	3/0/0	3	3	EEC
4.	23AD010	Genomics Data Science	3/0/0	3	3	EEC
5.	23AD011	Responsible AI	3/0/0	3	3	EEC
6.	23AD012	Brain and Neuroscience	3/0/0	3	3	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	1	3		3		15	15
2.	Basic Sciences(BSC)	4	10	4						18	23
3.	Engineering Sciences(ESC)	10			4			4.5		18.5	22
4.	Professional Core (PC)		13	14.5	16	8	12			63.5	54
5.	Professional Electives(PEC)					6	6	6		18	18
6.	Open Elective(OEC)					3		3		6	15
7.	Emerging Electives(EEC)						3	3		6	
8.	Project work (PW)					2	2		12	16	16
9.	Employability Skills							2		2	
10.	Mandatory Course (MC)									-	
	Total	18	24	21.5	21	22	23	21.5	12	163	
	AICTE(AI&DS)	18.5	23.5	27.5	20.5	22	17	18	16		163

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**		
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				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	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%) [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
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: **5 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: **5 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: **5 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	**15**

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								Total (A+B)	Total Continuous Assessment	End Semester Practical Examination	Total
Theory				Practical							
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 Examination (50%)
CA 1 (100 Marks)		CA 2 (100 Marks)		Practical Exam (100 Marks)		
SA 1	FA 1	SA 2	FA 2	FA	SA	

(60M)	Component-I (20 Marks)	Component-II (20 Marks)	(60M)	Component-I (20 Marks)	Component-II (20 Marks)	(75M)	(25M)	

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   **5 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   **5 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   **5 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(15+30)	**45 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	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	Continuous Assessment (25%) [100 Marks]		End Semester Practical Examination (50%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
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.
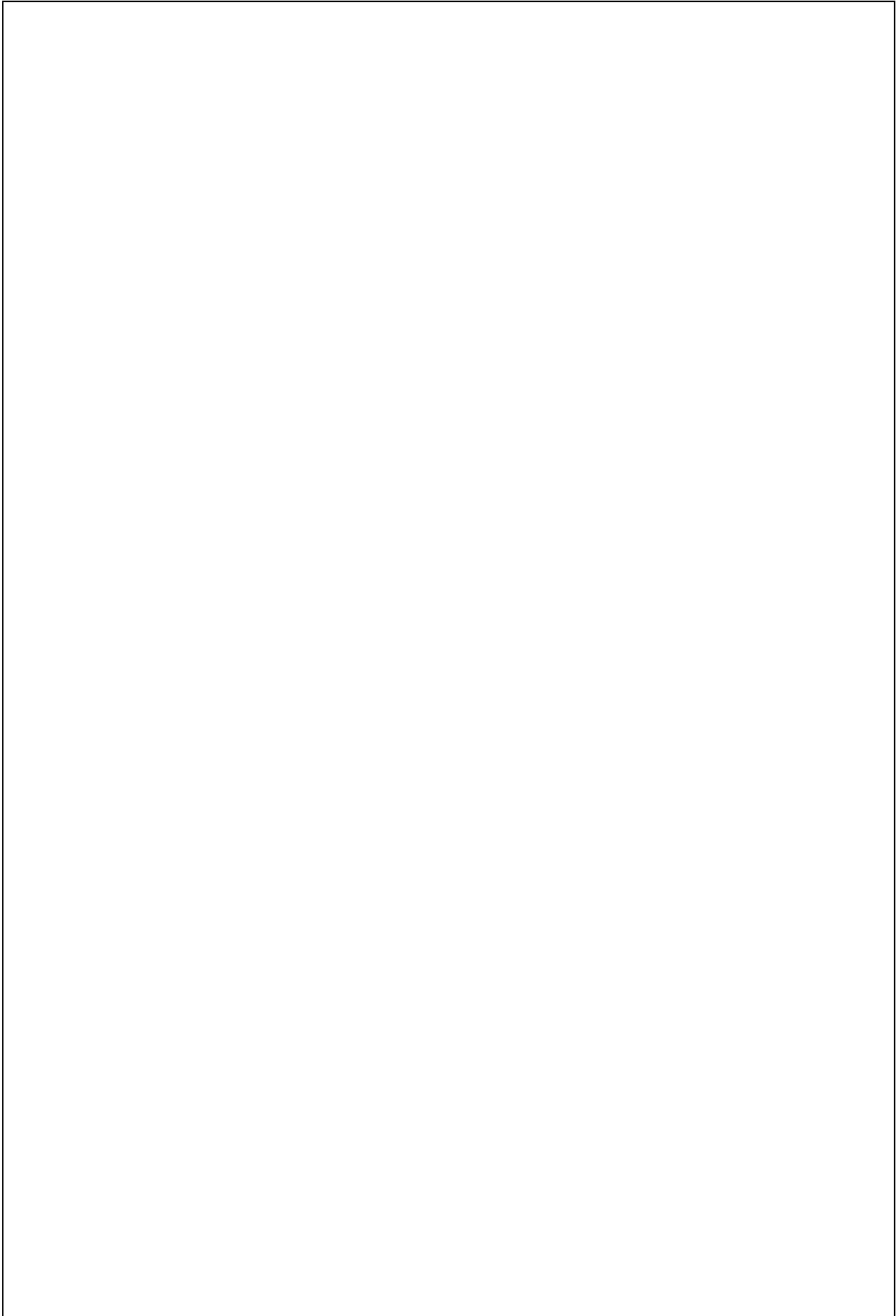
Lab Components		
1	Conversational listening	[U]
2	Speaking - Pictography	[AP]
3	Listening about an experience	[U]
4	Listening to short extracts	[U]
5	Writing - Resume Writing, Job application letter	[AP]
6	Mock interview	[AP]
	Total Hours:	60

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	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 (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	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 (H_2-O_2). 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					
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 (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			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]
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 **5 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 **5 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 **5 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):	**15 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: (15+30)	**45 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",2nd edition, Tata McGrawHill, 2013.
2	NarasimhaKarumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles",5th Edition, CareerMonk, 2016.
3	DebasisSamanta,"Classic data structures",Prentice Hall of India, 2nd edition,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	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)		
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									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   **5 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   **5 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   **5 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

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 5 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 5 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 5 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	**15**

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	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)			
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	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

C102.1	To determine the magnetic field around a current carrying conductor	[E]
C102.2	To determine the rate of growth or decay in a resistor -capacitor circuit and to estimate the resonant frequency and Q-factor.	[E]
C102.3	To determine the relationship between the magnetic flux density and the magnetizing field strength and to find the specific resistance of the wire.	[E]
C102.4	To determine the pH, single electrode potential using reference electrodes and Electroplating process based on electrolytic cell.	[E]
C102.5	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
C102.1	3	2	1	2					2			1	1		1
C102.2	2	1	1	2					2			1	1	1	1
C102.3	3	2	1	2					2			2	1	1	
C102.4	3	2	1	2					2			2	1		1
C102.5	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

C102.1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
C102.2	Illustrate the importance of natural resources and conservation of biodiversity.	[U]
C102.3	Interpret and analyze the impact of engineering solutions in a global and societal context.	[U]
C102.4	Apply the gained knowledge to overcome pollution problems.	[AP]
C102.5	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
C102.1	Remember	Quiz	10
C102.2	Understand	Case study based on environmental aspect	20
C102.3	Understand	Class presentation	10
C102.4& C102.5	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
C102.1							3								
C102.2							3								
C102.3						2	3								
C102.4							3								
C102.5							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	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]
C301.1	Understand & Apply	Online Quiz	20
C301.2	Understand & Apply	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	**PYTHON FOR DATA SCIENCE**	3/0/0/3
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

C301.1	Recognize the general principles and good algorithmic problem solving.	[U]
C301.2	Interpret the fundamental Python syntax and semantics and use of Python control flow statements.	[U]
C301.3	Understand variables, data types, control flow structures such as loops and conditionals, functions, and file handling.	[U]
C301.4	Design and implement modular and reusable code.	[AP]
C301.5	Examining compound data using Python lists, tuples and dictionaries.	[AP]
C301.6	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			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	FA (16%) [80 Marks]
C301.1, C301.2	Understand	Tutorial	20
C301.3	Understand	Assignment	20
C301.4, C301.5	Apply	Case Study	20
C301.6	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
C301.1	3	3	2	2	3	3	1		1	1	2	2	2	3	3
C301.2	3	3	3	3	2	2	1				2	3	3	3	2
C301.3	3	3	2	2	3	3	1		1	1	2	2	3	2	2
C301.4	3	3	3	3	2	2	1				2	3	2	2	3
C301.5	3	3	2	2	3	3	1				2	2	3	3	
C301.6	3	3	2	2	3	3	1				2	2	3	3	3

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   **5 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   **5 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   **5 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	15

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**			**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	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   5 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   5 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   5 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	15 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
C301.5	3	3	3	2	3				2	2		2	3	3	3
C301	**3**	**3**	**3**	**3**	**3**				**3**	**2**		**2**	**3**	**3**	**3**

23AD302	DATA WAREHOUSING AND DATA MINING	3/0/2/4

Nature of Course:	D (Theory application)

Pre requisites:	Database Management System

Course Objectives:

1	To learn the architecture of Data warehouse architecture and its Implementation.
2	To be familiar with the Data Mining system.
3	To explore various Mining techniques.
4	To understand various classification and clustering techniques.
5	To analyse the cluster-based methods.

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

C302.1	Understand the basics and evolutionary path of Data Warehouse and Data Mining techniques.	[U]
C302.2	Examine data warehouse architecture, data integration, data cleansing and data transformation techniques.	[AP]
C302.3	Apply classification and Clustering algorithm to extract knowledge from large datasets.	[AP]
C302.4	Comprehend the important role that Data Warehouse and Data Mining play in various fields.	[U]
C302.5	Integrate the gained practical experience in using data tools and technologies for implementation.	[AP]

Course Contents:
Introduction to Data Warehousing and Data Mining **15 Hours**
Data Warehousing Components- Data Warehouse Architecture, OLAP vs OLTP, OLAP operations - Data Warehouse v/s Data Mining, Data Mining Process, Data Mining Functionalities, Overview of weka tool and its feature -Installation and setup of weka- Data Pre-processing - Descriptive Data Summarization, Application of data pre-processing in health care - Data Cleaning, Integration and Transformation, Reduction - Case study - Financial and Market Analysis.

Data Mining Concepts: **15 Hours**
Classification, Issues in Classification, Statistical-Based Algorithms, Distance-Based Algorithms, Prediction techniques, Linear and Non-Linear Regression. Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods Mining Various Kinds of Association Rule- Apriori Algorithm - Association Mining to Correlation Analysis - Applications: Intrusion detection, Case study - A web data mining.

Clustering and its real time application: **15 Hours**
Categorization of Major Clustering Methods: Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Outlier Detection. Applications of clustering – Pattern recognition, Clustering Algorithm in Identifying Cancerous Data- Case Study: Finding similar users on Twitter, Analyzing the Stack Overflow data set.

	Total Hours:45

Lab component

1. Investigate Application interfaces of the WEKA tool.
2. Create a Weather table with a training data set which includes attributes like outlook, temperature, humidity, windy, play. Apply Pre-Processing techniques to the training data set of the Weather Table.
3. Interpret the house price prediction using a regression model in WEKA Tool.
4. With the help of a dataset that contains information about growth of a plant over time. The goal is to build a non-linear regression model to predict the plant's growth based on the time elapsed.
5. Demonstration of association rule mining using Apriori algorithm on supermarket data.
6. Create a dataset in ARFF (Attribute-Relation File Format) for any given dataset and perform Market-Basket Analysis.
7. Experiment on hierarchical Data Clustering algorithms.
8. Find all the neighbour points within eps and identify the core points or visited with more than MinPts neighbours using DBSCAN algorithm.
9. Implement grid-based clustering using weka tool.
10. Create multi-dimensional data as inputs and cluster them according to the model parameters and determine outlier using density-based outlier detection method.

Text Books:

| 1 | Mohammed J. Zaki, Wagner Meira, "Data Mining and Machine Learning Fundamental Concepts and Algorithms", Cambridge university press, 2020. |
| 2 | Parteek Bhatia, "Data Mining and Data Warehousing Principles and Practical Techniques", Cambridge University Press, 2019. |

Reference Books:

| 1 | Jiawel Han, MichelineKamber and Jian Pei," Data Mining Concepts and Techniques", Third Edition, Elsevier, 2018. |

Web References:

1	https://examupdates.in/data-mining-lecture-notes/
2	http://www.miet.edu/course/wp-content/uploads/2019/05/dwdm-completed-notes.compressed.pdf
3	https://livebook.manning.com/book/mahout-in-action/chapter-12/82

Online Resources:

1	https://www.classcentral.com/subject/data-mining
2	https://onlinecourses.nptel.ac.in/noc20_cs12/preview
3	https://www.coursera.org/specializations/data-mining

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment,Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C302.1	Understand	Quiz	20
C302.2	Apply	Tutorial	20
C302.3	Apply	Assignment	20
C302.4	Understand		20
C302.5	Apply	Presentation	20

Assessment based on Summative and End Semester Examination			
	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
Analyze	30	30	30
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	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 Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Theory Examination (25%)
SA 1 (60 M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	Practical Examination (25%)
	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
C302.1	1	2	1	2	2							2	2	2	1
C302.2	3	3	2	3	2							3	2	3	2
C302.3	3	3	2	3	2							2	3	3	3
C302.4	3	3	2	3	2							3	3	2	3
C302.5	3	3	2	3	2							3	3	2	3

23AD303	PYTHON FOR DATA SCIENCE LABORATORY	0/0/3/1.5

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

C303.1	Recognize and apply the general principles and good Algorithmic problem solving.	[AP]
C303.2	Design and implement modular and reusable code.	[AP]
C303.3	Represent and create compound data using Python lists, tuples and dictionaries.	[AP]
C303.4	Read and write data from data sheets and Analyse data.	[AP]
C303.5	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
C303.1	3	3	2	2	3	3	3	3	1	1	2	2	2	3	3
C303.2	3	3	3	3	2	2	2	3			2	3	3	3	2
C303.3	3	3	2	2	3	3	3	3	1	1	2	2	3	2	2
C303.4	3	3	3	3	2	2	2	3			2	3	2	2	3
C303.5	3	3	2	2	3	3	3	3			2	2	3	3	

23AD401	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:

C401.1	Identify and understand the basic concept of Data Engineering.	[U]
C401.2	Summarize cloud computing capabilities and compare cloud computing with on-site implementations.	[U]
C401.3	Understand Linux command and the command line to perform computing tasks.	[U]
C401.4	Classify Hadoop's and Spark's role in big data and explain batch versus in memory processing of big data.	[AP]
C401.5	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
C401.1	3	3	3	2	3	2						2	2	2	2
C401.2	3	3	3	2	3	2						2	2	2	2
C401.3	3	3	3	3	3	2						2	2	2	2
C401.4	3	3	3	2	3	2						2	2	3	3
C401.5	3	3	3	3	3	3						3	3	2	2

23AD402	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

C402.1	Illustrate the searching and sorting algorithms.	[U]
C402.2	Interpret the design principles of greedy and pattern searching algorithms with examples.	[AP]
C402.3	Explore problem-solving methodology used in Backtracking.	[A]
C402.4	Analyse the time and space complexities of dynamic programming strategy in solving complex problems.	[A]
C402.5	Employ range query and graph algorithms in real world problems.	[AP]

Course Contents:

Sorting, Searching and String Algorithms:	**[5 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:	**[5 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:	**[5 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:	**15**

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]
C402.1	Understand	Quiz & Assignment	20

C402.2	Apply	Assignment	20
C4023 & C402.4	Analyze	Case study	20
C402.5	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)	
	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)

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
C402.1	3	3	3	1	3	2	1	2			2	1	3	2	2
C402.2	3	3	3	1	3	2	1	2				1	3	2	2
C402.3	3	3	3	1	3	2	1	2			1	1	3	2	2
C402.4	3	3	3	1	3	2	1	2				2	3	2	2
C402.5	3	3	3	1	3	2	1	2				2	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   **5 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   **5 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   **5 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:	**15**

	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 Data center.
4	Configuration of Virtual Internetworking Components.
5	Configure and test Docker bridge networking to enable communication between multiple containers on a single Linux host.
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

23IT402	WEB FRAMEWORKS USING REST API	0/0/4/2

Nature of Course:	L (Programming)
Pre requisites:	Java Programming

Course Objectives:

1	To impart the knowledge of REST API and HTTP methods used in Spring Boot Framework.
2	To implement LIKE queries using JPA and handle CRUD operations with JPQL.
3	To develop the various relational mapping with JPA Repository.
4	To deploy Spring Rest controller API.

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	Create a simple Spring Application and inject the literal values by setter injection methods.	[AP]
C402.3	Apply LIKE queries using JPA to Various applications.	[AP]
C402.4	Build application using Spring Boot with JPA repository.	[A]
C402.5	Analyze and create applications with Spring Rest Controller API to perform CRUD operations.	[A]

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: 60

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 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	-	-	-
Apply	60	60	60
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

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

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

23CY101		NETWORKING AND COMMUNICATION	3/0/2/4
Nature of Course		C (Theory Practical)	
Prerequisites		Nil	

Course Objectives:

1.	To study different layers of ISO/OSI reference architecture.
2.	To understand the networks topology.
3.	To study the concepts of data link layer and Network layer Protocols
4.	To understand the types of protocols in Transport layer.
5.	To study advanced application layer protocols.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Summarize the functionality and protocols operating in each layer of OSI model.	[U]
C101.2	Compare network topology, devices and transmission medium.	[U]
C101.3	Analyze error control, flow control and routing protocols.	[A]
C101.4	Analyze IP, TCP and UDP header formats.	[A]
C101.5	Analyze Network traffic characteristics and congestion control mechanism.	[A]

Course Contents:

Module I : Fundamentals of Networking   **15 Hours**

Data Communication – The OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media – Networking devices – Network Topologies. Networking Devices: Hubs, Bridges, Switches, Routers and Gateways, Network Security Fundamentals. Case study: A comparative analysis of TCP/IP and OSI models in real-world network implementations.

Module II : Network Layer   **15 Hours**

Encoding - Error Detection – Reliable Transmission – MAC protocols – CSMA/CD – CSMA/CA. Circuit Switching – Packet Switching – Bridges and LAN Switches: Spanning Tree algorithm – Internetworking – IPv4 - Subnetting – IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) —— Interdomain Routing (BGP). Case study: IP address planning and subnetting for a geographically dispersed organization.

Module III : Transport layer and Application Layer: **15 Hours**

UDP – TCP – Congestion Control and Resource Allocation: TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service: Integrated Services – Differentiated Services – Network Traffic Analysis. Domain Name System – Electronic Mail (SMTP, MIME, IMAP) – File Transfer (FTP) – WWW (HTTP). Emerging Technologies in Networking (5G, edge computing, etc.), Securing web applications, Mobile Phone security, Data Tracking. Case study: Evaluating the impact of 5G and edge computing on the future of network communication.

Total Hours	45

Lab Component

S. No.	Lab Exercises
1	Develop client server based TCP applications using UNIX socket programming functions.
2	Develop client server based UDP applications using UNIX socket programming functions.
3	Simulation of data link and network layer protocols.
4	Performance analysis of TCP and UDP protocol using simulation tool.
5	Performance analysis of routing protocols using simulation tool.
6	Demonstrate the working of network tools such as Ping, TCPDump, Traceroute, Netstat.
7	Analyze the network traffic using Wireshark tool/Packet tracer tool.

Text Books:

1.	A S Tanenbaum, DJ Wetherall, "Computer Networks", 6th Edition, Prentice-Hall, 2021.
2.	Behrouz A. Forouzan, "Data communication and Networking", 5th Edition, Tata McGraw- Hill, 2013.
3.	Andrei Gurtov, Madhusanka Liyanage, Mika Ylianttila, Software Defined Mobile Networks (SDMN) Beyond LTE Network Architecture, Wiley, 2021

Reference Books:

1.	Peterson & Davie, "Computer Networks, A Systems Approach", 6th Edition, Elsevier, 2021.
2.	William Stallings, "Data and Computer Communications", 10th Edition, PHI, 2013.
3.	Xingqin Lin, Namyoon Lee 5G and Beyond Fundamentals and Standards, Springer, 2021
4.	JF Kurose, KW Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Addison-Wesley, 2021.
5.	Dariusz Gasior Resource Allocation for Software Defined Networks, 1st edition, Springer, 2020

Web References:

1.	https://www.geeksforgeeks.org/network-and-communication/
2.	https://www.britannica.com/science/computer-science/Networking-and-communication
3.	https://www.ibm.com/docs/en/aix/7.2?topic=management-network-communication-concepts

Online Resources:

1.	https://onlinecourses.nptel.ac.in/noc22_ee61/preview
2.	https://www.iit.edu/academics/programs/networking-and-communications-certificate
3.	https://www.shiksha.com/online-courses/network-security-associate-course-nsel13

Continuous Assessment									End Semester Continuous 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, C101.2	Understand	Quiz	20
C101.3	Apply	Tutorial	20
C101.4, C101.5	Analyze	Tech Exploration Assignment	20
		Seminar	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	30
Apply	30	40	40
Analyze	10	10	10
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	10	10	10
Understand	20	20	20
Apply	50	40	40
Analyze	20	30	30
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				
SA1 (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	-	-	-	-	-	-	-	-	2	-	-	-	-	-
C101.2	3	3	2	3	-	-	-	-	-	2	-	2	-	-	-
C101.3	3	2	2	2	2	-	-	-	2	2	-	2	-	-	2
C101.4	3	3	-	3	2	-	-	-	-	2	-	2	-	2	-
C101.5	3	3	-	3	3			2	2	2	-	2	-	-	2

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

Bloom's Level			
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%)
	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 (75 M)	SA (25 M)	Practical Examination (15%)

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

23ME305	DESIGN THINKING & IDEA LAB	0/0/2/1

Nature of Course	Practical
Prerequisites	Nil

Course Objectives:

1	To Accelerate development of indigenous products to promote "Make in India" campaign
2	To encourage aspiring Engineers and Researchers to actualize their ideas under one roof.
3	To Impart multidisciplinary education and research among all stakeholders
4	To promote experiential learning and entrepreneur skills

Course Outcomes:

Upon completion of the course, students shall have ability to

C305.1	Describe all the skills associated with the tools and inventory associated with the IDEA Lab.	[R]
C305.2	Associate useful mechanical and electronic fabrication processes.	[U]
C305.3	Apply necessary skills to build useful and standalone system/ project with enclosures.	[Ap]
C305.4	Develop Innovative products which are useful for a student in preparing for an engineering career.	[C]
C305.5	Devise necessary skills to create print and electronic documentation for the system/project.	[E]

Course Contents:

An Insight to Learning : Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting **Remembering Memory :** Understanding the Memory process, Problems in retention, Memory enhancement techniques **Emotions: Experience & Expression** Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers **Basics of Design Thinking :** Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test

Being Ingenious & Fixing Problem : Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving **Process of Product Design :** Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design **Prototyping & Testing :** Rapid Prototype Development process, Testing, **Sample Example**, Test Group Marketing **Celebrating the Difference :** Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Design Thinking & Customer Centricity : Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design **Feedback, Re-Design & Re-Create :** Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – **"Solving Practical Engineering Problem through Innovative Product Design & Creative Solution"**

S.No	List of Experiments	CO Mapping	RBT
1	Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit	C305.1	[Ap]
2	Machining of 3D geometry on soft material such as soft wood or modelling wax.	C305.1	[Ap]
3	3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer	C305.2	[Ap]

4	2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/ cardboard, MDF (2 mm) board using laser cutter & engraver.	C305.3	[Ap]	
5	2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.	C305.3	[C]	
6	Familiarity and use of welding equipment.	C305.4	[C]	
7	Familiarity and use of normal and wood lathe.	C305.4	[C]	
8	Embedded programming using Arduino and/or Raspberry Pi.	C305.5	[C]	
9	Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure	C305.5	[E]	
		Total Hours:		**15**

Reference Books:

| 1 | AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), ISBN: 978-9391505332 |
| 2 | E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company. |

Web References:

| 1 | https://www.innovationtraining.org/how-to-use-design-thinking-to-design-an-innovation-lab/ |
| 2 | https://www.erdster.co.in/design-thinking-lab.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	10	10	10
Understand	10	10	10
Apply	40	40	40
Analyse	-	-	-
Evaluate	10	10	10
Create	30	30	30

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C305.1	3		3		3				1		1			1	
C305.2	3		3		2				1		2			3	
C305.3	3		3		2				3		2			3	
C305.4	3		2		3				2		3			1	
C305.5	3		2		2				2	3	3			1	
	3	Strongly agreed		2	Moderately agreed			1	Reasonably agreed						

23MC103	SOFT SKILLS	2/0/0/0
Nature of Course:	Theory Concept	
Pre requisites:	Technical Communication Skills	

Course Objectives:

1.	To develop the students competency level and their capabilities.
2.	To teach the students to be effective in workplace and social environments.
3.	To create self confidence among the students and to resolve stress and conflict within themselves.
4.	To help the students to enhance their career skills by increasing their productivity and performances.
5.	To concentrate more on conversation skills, presentation skills, verbal ability, critical and creative thinking.

Course Outcomes:

Upon completion of the course, students shall have ability to

C103.1	Remember the principles of soft skills required for their profession.	[R]
C103.2	Understand the importance of Interpersonal communication Skills among individuals, groups and cultures.	[U]
C103.3	Apply verbal and non-verbal communication skills in corporate environment.	[AP]
C103.4	Analyse and apply creativity skills, critical thinking skills and problem solving skills.	[AN]
C103.5	Articulate oral and written messages in an appropriate and persuasive manner to suit specific purposes, audiences and contexts at work place.	[AP]
C103.6	Apply good teamwork skills and Leadership Skills	[AP]

Module 1: Professional Communication Skills   **10 Hours**

Introduction to the Soft Skills, Performance Evaluation 1 –Significance of Soft Skills-Understanding the basic Communication Principles –Listening Skills- Listening Exercises-Speaking Skills- How to start and Sustain a Conversation- Speaking in Groups- Understanding self and Personal Branding, attitude, types of attitude, Positive Attitude, Self Confidence and Self-Motivation - Personal Application/Action Taken. Advanced Writing Skills-Principles of Business Writing- E mails- Writing Reports- Types of Reports- Strategies for Report Writing-Personal Application/Action Taken. Verbal Ability- Analogy- Classification- Odd One Out-

Idioms and Phrases- Sentence Correction- Empathy and its importance in career -Personal Application/Action Taken.

Module 2: Interpersonal Communication   **10 Hours**

Nonverbal Communication- Individual, Groups and Cultures- Body Language- Attire and Etiquettes- Interpersonal Skills- dealing with diverse People- Networking- Emotional Intelligence and its importance. Personal Application/Action Taken. Developing Creativity- Critical Thinking and Problem Solving Skills- Making the Right Choice- Never Give Up- Begin to Grow- Personal Application/Action Taken. Interviews- Facing Job Interviews - Planning and Preparing- Effective Resume along with Covering Letter- Planning and Preparing- Personal Application/Action Taken. Self-Discipline - Self Presentation - Personal Application/Action Taken.

Module 3: Teamwork and Leadership Skills   **10 Hours**

Industry Expectations- Universal Hiring Rule- Personal Application/Action Taken. Importance of Human Values-Importance of Team Work- Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player- Personal Application/Action Taken. Planning- Prioritization - Delegation- Conflict Management- Decision and its necessity in crucial situations- Group Discussion- Personal Application/Action Taken. Essential Skills in working Strategies- Presentation and Interaction Skills- What to Present and How- Being Assertive- Multimedia Presentation-Making Effective Presentations. Interview Skills- Do's and Don'ts - Body Language – Answering the Common Questions of Interview- Performance Evaluation 2- Mock Interview

	Total Hours:	**30**

Text Books:	
1.	Penrose, "Business Communication for managers: An advanced approach", Cengage learning.
2.	H.E. Sales, "Professional Communication in Engineering", Palgrave Macmillan 2009.
3.	W. P. Scott, Bertil Billing, "Communication for Professional Engineers", Thomas Telford, 1998.

Reference Books:	
1.	Peter Davson-Galle, "Reason and Professional Ethics", Ashgate Publishing, Ltd., 2009.

3.	Joep Cornelissen, "Corporate Communications: Theory and Practice", Sage Publications India Pvt Ltd, New Delhi, 2004.

Web References:

1	https://onlinecourses.nptel.ac.in/noc16_hs15/preview
2	https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication.
3	https://smude.edu.in/smude/programs/bca/soft-skills.html

Online Resources:

1	https://swayam.gov.in/course/4047-developing-soft-skills-and-personality
2	https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/
3	https://www.bizlibrary.com/soft-skills-training/

Assessment Methods & Levels (based on Revised Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:40)			
Course Outcome	**Revised Bloom's Level**	**Assessment Component**	**Marks**
C103.1	Remember	Group Discussion	10
C103.2 & C103.3	Understand	Listening Skills	10
C103.4	Apply	Interview	10
C103.5 & C103.6	Apply	Formal Presentation	10

Revised Bloom's Level	**Tentative End Assessment Examination (Theory) [60 marks]**
Remember	30
Understand	40
Apply	30
Analyse	-
Evaluate	-
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						1	1	2	2	3	2	2			1
C103.2							1	1	3	3	2	2			1
C103.3									2	3	2	2			1
C103.4						1	1	1	2	3	3	2			1
C103.5						1	1		2	3	2	2			1
C103.6							1	2	3	3	2	2			1

23MC105	GENERAL APTITUDE	2/0/0/0
Nature of Course	Problem analytical	
Pre requisites	Basic Mathematical calculations	

Course Objectives:

1	To ensure that students learn to think critically about mathematical models for relationships between different quantities and use those models effectively to solve problems and reach conclusions about them.
2	To impart skills that enable students to effectively use and interpret data, formulas, and graphs in the workplace.
3	To instills confidence in facing technical aptitude questions interviewed by recruiters.

Course Outcomes:

Upon completion of the course, students shall have ability to

C105.1	To teach the basics of Quantitative Techniques in a graded manner.	[R]
C105.2	Understand the verbal and non-verbal nature of problems in reality and know the shortcut methods of solving it.	[U]
C105.3	Solve problems using their general mental ability.	[AP]
C105.4	To give intense focus on improving and increasing the ability of solving real problems.	[AP]
C105.5	Think critically about mathematical models for relating different quantities to reach conclusion.	[AP]
C105.6	Enable effective use of data interpretation, formulas, graphs and assumptions.	[AP]

Module 1: Number Theory and Statistics   **14 Hours**

Number Systems– HCF and LCM of Numbers – Decimal Fractions – Simplification – Square Root and Cube Root of a number – Surds and Indices – Problems on numbers – Percentage – Ratio and Proportion – Divisibility – Mixtures – Averages- Polynomials – Solving Equations and Inequalities – Discard's rule of signs – Problems on ages – Chain rule – Time and Work – Time and Distance – Problems on Trains – Problems on Boats andStreams-Measures of central tendency – Mean, Median and Mode – Variance and Standard deviation Logarithms – Profit and Loss – Simple Interest – Compound Interest.

Module 2: Logic and Decision Making   **8 Hours**Analogy – Classification – Series completion – Coding and Decoding – Blood Relations – Puzzle Test – Direction Sense test – Logical Venn Diagrams - Number Ranking and Time

Sequence Test – Decision Making – Assertion and Reason– Inserting the missing one – Logical Sequence of words – Syllogisms.

Module 3: Reasoning **8 Hours**

Logic – Statement and Arguments – Statements and Assumptions – Statements and Course of Action – Statements and Conclusions – Deriving conclusions from passages – Functions – Different kinds of functions – Miscellaneous sets- Series – Analogy – Classifications – Analytical Reasoning – Problems on Cubes and Dice – Mirror Images – Water Images – Rule Detection.

	Total Hours:	**30**

Text Books:

1	Aggarwal R. S, "Quantitative Aptitude" Revised Edition, S. Chand Publication.
2	Abhijit Guha, "Quantitative Aptitude" 5th Edition, McGraw Hill Education.

Reference Books:

1	Edgar Thorpe "Mental Ability & Quantitative Aptitude" 3rd Edition, McGraw Hill Education.

Web References:

1	https://www.wiziq.com/tutorial/815468-quantitative-aptitude-reasoning-data-interpretation-video-lectures
2	https://learningpundits.com/contest?referrer=harsh.cse15@nituk.ac.in
3	https://nptel.ac.in/courses/114106041/8
4	https://nptel.ac.in/courses/111103020/2

Online Resources:

1	http://aptitudetraining.in/home/index.php
2	https://www.udemy.com/vedicmaths/
3	https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true

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

Formative assessment based on Capstone Model (Max. Marks:40)

Course Outcome	**Revised Bloom's Level**	**Assessment Component**	**Marks**
C105.1	Remember	Classroom or Online Quiz	10
C105.2 & C105.3	Understand	Formal presentation	10
C105.4, C105.5 & C105.6	Apply	Formal interview tests	20

Summative assessment based on Continuous and End Semester Examination	
Bloom's Level	**Term End Assessment Examination (Theory)** **[60 marks]**
Remember	20
Understand	40
Apply	40
Analyse	-
Evaluate	-
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**
C105.1	3	3	1												
C105.2	3	2	1												
C105.3	3	3	1												
C105.4	3	2	1										2		
C105.5	3	3	1										2		
C105.6	3	2	1										2		

23MC106	LIFE SKILLS AND ETHICS	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

1	To develop communication competence in prospective engineers.
2	To enable them to convey thoughts and ideas with clarity and focus.
3	To develop report writing skills.
4	To equip them to face interview & Group Discussion.
5	To inculcate critical thinking process.
6	To prepare them on problem solving skills.
7	To provide symbolic, verbal, and graphical interpretations of statements in a problem description.

Course Outcomes:

Upon completion of the course, students shall have ability to

C106.1	Define and identify different life skills required in personal and professional life.	[U]
C106.2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.	[AP]
C106.3	Explain the basic mechanics of effective communication and demonstrate these through presentations.	[AN]
C106.4	Use appropriate thinking and problem-solving techniques to solve new problems.	[AP]
C106.5	Understand the basics of teamwork and leadership	[U]

Course Contents:

Communication Skill:

Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Writing Skills, Technical Writing, Letter Writing, Job Application, Report Writing, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication.

Critical Thinking & Problem Solving:

Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats Mind Mapping & Analytical Thinking. Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

Ethics, Moral & Professional Values:			
Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE. **Leadership Skills:** Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation			

		Total Hours:	**30**

Reference Books:

1	Barun K. Mitra, "Personality Development & Soft Skills", First Edition, Oxford Publishers, 2011.
2	Kalyana, "Soft Skill for Managers", 1st Edition, Wiley Publishing Ltd, 2015.
3	Larry James, "The First Book of Life Skills", 1st Edition, Embassy Books, 2016
5	John C. Maxwell, "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc, 2014.

Web References:

1	https://www.coursera.org/courses?query=ethics

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

Formative assessment based on Capstone Model (Max. Marks:40)

Course Outcome	Bloom's Level	Assessment Component	Marks
C106.1	Remember	Quiz	**5**
C106.2	Understand	Assignment	**15**
C106.3	Understand	Presentation	**10**
C106.4 C106.5	Apply	Group Discussion	**10**

Summative assessment based on Continuous Assessment

Revised Bloom's Level	Term End Assessment [60 marks]
Remember	30
Understand	40
Apply	30
Analyse	-

Evaluate	-
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
C106.1								1	2	1		2	1		
C106.2								1	2	1		2	1		
C106.3								2	2	3		1	1		
C106.4								1	1	1		1	3		
C106.5								1	3	2		2	1		

23MC107	STRESS MANAGEMENT	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

1	Understand the basic principles of stress management
2	Recognize your stress triggers and how to manage them
3	Develop proactive responses to stressful situations
4	Use coping tips for managing stress both on and off the job
5	Learn to manage stress through diet, sleep and other lifestyle factors
6	Develop a long term action plan to minimize and better manage stress
7	Understand the basic principles of stress management

Course Outcomes:

Upon completion of the course, students shall have ability to

C107.1	Understand the basic principles of stress management	[U]
C107.2	Apply the concept of recognizing your stress triggers and find was to manage them.	[AP]
C107.3	Develop proactive responses to stressful situations	[AN]
C107.4	Develop a long term action plan to minimize and better manage stress	[AP]

Course Contents:

Scientific Foundations of Stress:

What is stress? – Sources of Stress – Types of Stress – Personality Factors and stress – Stress and the college student. Stress Psychophysiology: Stress and nervous system – Hypothalamic – Pituitary – Adrenal (HPA) Axis – Effect of Stress on Immune system – Health risk associated with chronic stress – Stress and Major Psychiatric disorders.

Developing Resilience to Stress:

Understanding you stress level – Role of personality pattern, Self-esteem, Locus of control – Role of Thoughts Beliefs and Emotions – I & II – Life situation Intrapersonal: (Assertiveness, Time Management).

Strategies for Relieving Stress:
Developing cognitive coping skills – Autogenic training, imagery and progressive relaxation – Other relaxation techniques – Exercise and Health – DIY strategies stress management.

	Total Hours:	30

Reference Books:	
1	Jonathan C. Smith, "Stress Management: A Comprehensive Handbook of Techniques and Strategies", 1st Edition, Springer Publishing Company, 2011.
2	Bob Stahl, Elisha Goldstein, Jon Kabat-Zinn, "A Mindfulness–based Stress Reduction Workbook", 2nd Edition, New Harbinger Publications, 2019.
3	Ryan M. Niemiec, "The Strengths-based Workbook for Stress Relief", 1st Edition, New Harbinger Publications, 2019.

Web References:	
1	https://thiswayup.org.au/courses/coping-with-stress-course/
2	https://www.classcentral.com/course/swayam-stress-management-14309

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

Formative assessment based on Capstone Model (Max. Marks:40)

Course Outcome	Bloom's Level	Assessment Component	Marks
C107.1	Remember	Quiz	**10**
C107.2	Understand	Group Discussion	**10**
C107.3	Understand	Class Presentation	**10**
C107.4	Apply	Assignment	**10**

Summative assessment based on Continuous Assessment	
Revised Bloom's Level	**Term End Assessment [60 marks]**
Remember	30
Understand	40
Apply	30
Analyse	-
Evaluate	-
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
C107.1								1	3			1	1		
C107.2								1	2	1		1	1		
C107.3								1	3	1		2	2		
C107.4								1	3	1		3	2		

23MC108	CONSTITUTION OF INDIA	2/0/0/0

Nature of Course : Theory

Pre Requisites   : Nil

Course Objectives:

1	To familiarize with basic information about Indian constitution
2	To understand the fundamental rights and duties as citizens of India

Course Outcomes:

Upon completion of the course, students shall have ability to

C108.1	Explain the objectives of the Constitution of India and its formation	[U]
C108.2	Recall state and central policies (Union and State Executive), fundamental Rights and their duties.	[R]
C108.3	Make use of legal directions in developing solutions to societal issues	[AP]
C108.4	Utilized for competitive exams that requires knowledge of Indian Constitution	[AP]

Course Contents:

Module 1   **10 Hours**

Historical perspective, The making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights, Directive Principles of State Policy, Fundamental Duties, Citizenship Article 5-11.

Module 2   **10 Hours**

Federal structure, Powers of the Union and the states, Centre-State Relations, Union Executive – President, Prime Minister, Union Cabinet, Parliament, Supreme Court of India, State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Elections, Electoral Process, and Election Commission of India, Election Laws. Powers and Functions of Municipalities and Panchayat

Module 3   **10 Hours**

Amendments - Methods, Emergency Provisions, National Emergency, President Rule, Financial Emergency, Provisions for SC & ST, OBC, women, children and backward classes, Right to Property, Freedom of Trade and Commerce. Agricultural Law

	Total Hours:	**30**

Text Books:

1	Dr. D. D. Basu, "Introduction to the Constitution of India", LexisNexis, New Delhi, 22nd Edition, 2016.
2	"Bare act-constitution of India", The universal Publications, LexisNexis 2020, New Delhi, India.

Reference Books:	
1	Subhash. C. Kashyap, "Our Constitution: An Introduction to India's Constitution and Constitutional Law", National Book Trust, India, 5th Edition, 2019.
2	M. Laxmikanth, "Constitution of India", Cengage Learning India, 1st Edition 2018.
Web References:	
1	https://unacademy.com/course/the-indian-constitution/NSKQ8XXQ
2	https://unacademy.com/goal/upsc-civil-services-examination-ias-preparation/KSCGY
Assessment Methods & Levels (based on Blooms' Taxonomy)	
Formative assessment based on Capstone Model (Max. Marks:20)	

Course Outcome	Bloom's Level	Assessment Component	Marks
C108.1	Remember	Test	10
C108.4	Understand	Quiz	10
C108.3	Apply	Presentation	10
C108.2	Apply	Group Assignment	10

Summative assessment based on Continuous Assessment	
Revised Bloom's Level	**Term End Assessment [60 marks]**
Remember	30
Understand	40
Apply	30
Analyse	-
Evaluate	-
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
C108.1						3	1	1	1			1	1	1	
C108.2						3	1	1	1			1	1	2	
C108.3						3	2	2	1			1	1	2	
C108.4						3	1	1	1			2	1	1	

23MC109	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2/0/0/0
Nature of Course : Theory		
Pre Requisites : Nil		

Course Objectives:

1	To make understand the contribution of Indian mind in various fields.
2	To cultivate critical appreciation of the thought content and provide insights relevant for promoting cognitive ability, health, good governance, aesthetic appreciation and right values.

Course Outcomes:

Upon completion of the course, students shall have ability to

C109.1	Relate classical Indian traditions with contemporary traditions and culture.	[R]
C109.2	Outline the thoughts of Indians in different disciplines.	[U]
C109.3	Apply the knowledge to the present context.	[AP]
C109.4	Develop a better appreciation and understanding of Indian traditions.	[C]

Course Contents:

Indian Ethics: Individual and Social – Society state and Polity (Survey) - Education systems – Agriculture (Survey) – Early & Classical Architecture – Medieval & Colonial Architecture.

Astronomy in India – Martial Arts Traditions (Survey) - Indian Literatures - Indian Philosophical Systems - Indian Traditional Knowledge on Environmental Conservation

Ayurveda for Life, Health and Well-being - The Historical Evolution of Medical Tradition in Ancient India- Music in India - Classical & Folk

	Total hours:	30

Text Books:

1	Kapil Kapoor and Michel Danino, "Knowledge Traditions and Practices of India", Central Board of Secondary Education, 2017.
2	Yogesh Atal, "Indian Society: Continuity and Change", Pearson Education India, 2016.

Reference Books:	
1	Douglas Osto, "An Indian Tantric Tradition and Its Modern Global Revival", Routledge publications, 2020.
2	Rao C.N. Shankar, "Sociology: Principles of Sociology with an Introduction to Social Thoughts", S Chand Publisher, 2019.
Web References:	
1	http://nopr.niscair.res.in/handle/123456789/43
2	https://nptel.ac.in/courses/109/104/109104102/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:100)

Course Outcome	Bloom's Level	Assessment Component	Marks
C109.1	Remember	Quiz	10
C109.2	Understand	Group Assignment	10
C109.3	Apply	Presentation	10
C109.4	Create	Survey	10

Summative assessment based on Continuous Assessment	
Revised Bloom's Level	**Term End Assessment [60 marks]**
Remember	30
Understand	40
Apply	30
Analyse	-
Evaluate	-
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
C109.1						2	1	1	1			2	3	1	
C109.2						2	1	1	2			1	2	1	
C109.3						1	1	1	1			1	1	1	
C109.4						2	1	1	2			2	1	1	

23VA701	DATA REPRESENTATION AND INTERPRETATION USING PYTHON	1/0/0/1

Nature of Course	

Course Objectives:

1	To develop the student's competency level and their capabilities.
2	To help the students to enhance their career skills by increasing their productivity and performances.
3	To use latest python libraries for data science in real time paradigms.

Course Outcomes:

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

C701.1	Understand the programming skill required for their profession.	[U]
C701.2	Read and write data from data sheets and Analyze data.	[AP]
C701.3	Review, collect, transform and organize data to make future predictions, and make informed data-driven decisions.	[AP]

COURSE Contents:

Analyzing Numerical Data with NumPy

Arrays in NumPy - Creating NumPy Array - NumPy Array Indexing - NumPy Array Slicing - NumPy Array Broadcasting.

Working with Dataset

Pandas series - Pandas DataFramesPandas Read CSVPandas Read JSONPandas Analyzing Data.

Data visualization

Seaborn – Pandas – Plotly - Python Matplotlib - Matplotlib Pyplot - Matplotlib Plotting - Matplotlib Markers - Matplotlib Line - Matplotlib Labels - Matplotlib Grid - Matplotlib Subplot - Matplotlib Scatter - Matplotlib Bars - Matplotlib Histograms - Matplotlib Pie Charts.

	Total Hours:	30 Hours

Text Books:

1	Fabio Nelli, "Python Data Analytics: Data Analysis and science using pandas, matplotlib and python programming language", Apress.

Web References:

1	http://nptel.ac.in/courses/106106145/
2	https://www.codecademy.com/learn/learn-python

Course Outcome(s)	Programme Outcome(s)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C701.1		1	3	3	3							1	3	3	3
C701.2	1	2	3	3	3	1						1	3	3	3
C701.3	2	2	3	3	2							1	3	3	3

23VA702	ANDROID ENTERPRISE	1/0/0/1

Nature of Course	

Course Objectives:

1	To provide in-depth knowledge and hands-on experience in android application development, the latest trends and features.
2	To explore the intent and various functions of intent.
3	To construct user interface, layout and constraints.
4	Creating intuitive, reliable mobile apps using the android services and components.
5	To demonstrate the application with SQL lite.

Course Outcomes:

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

C702.1	Demonstrate and understanding of the fundamentals of Android operating systems.	[U]
C702.2	Interacting with the user, the user experience and debugging.	[AP]
C702.3	Design and develop user Interfaces for the Android platform.	[AP]
C702.4	Understand the basics of UI layout and UI control.	[U]
C702.5	Understand the purpose different development tools for Android.	[U]

COURSE Contents:

MODULE I: INTRODUCTION

Introduction to Android OS: Android Architecture.: Overview of the Stack, Linux Kernel, Native Libraries, Dalvik Virtual Machine, Android Virtual Machine (ADT), Dalvik Debug Monitor Server (DDMS), LogCat, Application Framework, Application Licensing, Gradle - Android Life cycle, working with App Inventor Designer and Blocks Editor.

MODULE II: ANDROID BASICS

Android Resources - Activities - Services - Broadcast Reviewers - Content Providers- Fragments - Intents/ Filters - UI Layout - UI Controls.

MODULE III: HANDLING DATA

Text controls, Button controls, Images Supporting Multiple Screen, Activities, application context, Web View File, shared Preferences, Database (SQLite database) Creation of .apk files.

	Total Hours:	**30 Hours**

Text Books:

1	Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.

Web References:

1	https://developer.android.com/index.html
2	https://in.udacity.com/course/new-android-fundamentals--ud851

Course Outcome(s)	Programme Outcome(s)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C702.1		1	3	3	3							1	3	3	3
C702.2	1	2	3	3	3	1						1	3	3	3
C702.3	2	2	3	3	2							1	3	3	3
C702.4	2	1	3	3	3							1	3	3	3
C702.5	2	1	2	3	2	1						1	3	3	3

23VA130	EFFECTIVE COMMUNICATION SKILLS	2/0/0/2
Nature of Course	E (Theory skill based)	
Pre-Requisites	Basics of English Language	

Course Objectives:

1	To become self-confident individuals by mastering interpersonal skills, team management skills, and leadership skills.
2	To develop effective communication skills.
3	To train students to use the language with confidence and without committing errors.
4	To improve the fluency of the students when speaking English.
5	To focus on pronunciation, dialect, intonation, interaction, practice and communication.

Course Outcomes:

Upon completion of the course, students shall have ability to

C130.1	Remember correct usage of English grammar in speaking.	[U]
C130.2	Apply and improve their speaking ability in English both in terms of fluency and comprehensibility	[AP]
C130.3	Understand and communicate effectively in personal and professional situations.	[U]
C130.4	Understand and analyze oral presentations and receive feedback on their performance.	[U]
C130.5	Apply reading fluency skills through extensive reading.	[AP]

Course Contents:

Module I	**10 Hours**

Pre-Test - Vocabulary Building- Connecting Phrases- Exercises and **Activities- Conversation Practices-** Greetings-exchanging ideas - Asking for information - questioning techniques / answering techniques - Getting people to do things - requesting/agreeing/refusing – **Activity Common Expressions** (Individual)- Talking about Favorites - Talk Show **Activity - Impromptu Speaking**- Personal Interest - Talking about Past Events and Future/Talking about Everyday Life (Family, Hobbies, Work, Travel and Current Events) – **Activity.**

Module II	**10 Hours**

Listening - Trials of a Good Listener- Listening to Texts, Listening for Specific Purpose- **Activity**- **21st Century Skills** – Communication with Critical Thinking and Creativity-Role Play- **Activity**- **Personality Development**- Manners and Etiquettes. Building Confidence and Developing Presentation Skills-**Activity**- **Singing a Song (Group)**- **Activity**.

Module III	**10 Hours**

Story Telling- Use of Charts and Graphs-**Activity -Persuasive Speech**- Handling Criticism-Justifying Opinions-Conflict-Resolution-Situational Role Play **Activity**- **- News reading and Pronunciation**- **Activity** -**Satori**- Intuitive Approach-**Activity**- **Post Test.**

30 Hours

	Total Hours:	**30**

Text Books:

1	English and Soft skills Orient Black Swan Publishers (S. P. Dhanavel)2010.

2	Remedial English Grammar. F.T. Wood. Macmillan.2007
3	On Writing Well. William Zinsser. Harper Resource Book. 2001
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.

Reference Books:

1	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
2	Busch, B., & Oakley, B. (2017). Emotional intelligence: why it matters and how to teach it. Retrieved from https://www.theguardian.com/teacher-network/2017/nov/03/emotional-intelligence-why-it-matters-and-how-to-teach-it.
3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Web References:

| 1 | https://www.udemy.com/course/english-speaking-complete/ |
| 2 | https://www.cambridgeenglish.org/exams-and-tests/linguaskill/ |

Online Resources:

| 1 | https://www.lingoda.com/en/linguaskill-from-cambridge/ |
| 2 | https://www.icd.org.pk/linguaskill/ |

Summative assessment based on Continuous and End Semester Examination

Internal Components - 10

S.No	Components	Marks
1.	Vocabulary Building	10 Marks
2.	Conversation Practices	10 Marks
3.	Common Expressions	10 Marks
4.	Impromptu Speaking	10 Marks
5.	Listening	10 Marks
6.	21st Century Skills	10 Marks
7.	Presentation Skills	10 Marks
8.	Singing a Song (Group)	10 Marks
9.	News Reading and Pronunciation	10 Marks
10.	Satori	10 Marks
	Total	100 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
C130.1									2	3		2			2
C130.2									3	3		1			1
C130.3								2	2	2		1			1
C130.4								1	1	2					1
C130.5								1	3	3		2			2