Sri Krishna College of Engineering and Technology

An Autonomous Institution, Affiliated to Anna University

Coimbatore – 641 008

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM AND SYLLABI

B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATION 2022

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATION 2022

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

SEMESTER I

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22AD101	Introduction to Artificial Intelligence	3/0/0	3	3	60/40	PC
2.	22MA102	Mathematics I	3/1/0	4	4	60/40	BSC
3.	22IT101	Application Development Practices	3/0/2	5	4	50/50	PC
4.	22CS101	Problem Solving using C++	3/0/2	5	4	50/50	PC
5.	22EN101	Technical Communication Skills	2/0/2	4	3	50/50	HSMC
6.	22CH101	Engineering Chemistry	3/0/2	5	4	50/50	BSC
7.	22MC101	Mandatory Course-I (Induction Programme)	3 weeks				MC
Total				**26**	**22**	**700**	

SEMESTER II

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22MA202	Mathematics II	3/1/0	4	4	60/40	BSC
2.	22EE111	Basics of Electrical and Electronics Engineering	2/1/0	3	3	60/40	ESC
3.	22TA101	Heritage of Tamils	1/0/0	1	1	60/40	HSMC
4.	22CS201	Data Structures and Algorithms	3/0/2	5	4	50/50	PC
5.	22IT201	Data Base Management Systems	3/0/2	5	4	50/50	PC
6.	22AD201	Java Programming	3/0/2	5	4	50/50	PC
7.	22PH201	Physics	3/0/2	5	4	50/50	BSC
8.	22EE114	Basics of Electrical and Electronics Engineering Laboratory	0/0/2	2	1	40/60	ESC
9.	22MC102	Mandatory Course-II (Environmental Sciences)	2/0/0	2	0	0/100	MC
			Total	**32**	**25**	**900**	

SEMESTER III

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22GE201	Universal Human Values	3/0/0	3	3	60/40	HSMC
2.	22MA302	Random Variables and Statistics	3/1/0	4	4	60/40	BSC
3.	22TA201	Tamils and Technology	1/0/0	1	1	60/40	HSMC
4.	22AD301	Design and Analysis of Algorithms	1/0/4	5	3	50/50	PC
5.	22IT302	Web Technology	1/0/4	5	3	50/50	PC
6.	22CS301	Advanced Java Programming	1/0/4	5	3	50/50	PC
7.	22AD302	Python Essentials	2/0/2	4	3	50/50	PC
8.	22MCXXX	Mandatory Course-III	2/0/0	2	0	0/100	MC
Total				**29**	**20**	**800**	

SEMESTER IV

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22MA401	Optimization and Project Management	3/1/0	4	4	60/40	BSC
2.	22IT402	Software Testing	1/0/4	5	3	50/50	PC
3.	22AD401	Cloud Computing	1/0/4	5	3	50/50	PC
4.	22CS402	Web Frameworks	1/0/4	5	3	50/50	PC
5.	22AD402	Data Warehousing and Data Mining	2/0/2	4	3	50/50	PC
6.	22CS403	Operating Systems	3/0/2	5	4	50/50	PC
7.	22MCXXX	Mandatory Course-IV	2/0/0	2	0	0/100	MC
Total				**30**	**20**	**700**	

SEMESTER V

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22AD501	Signals, Systems and Networks	3/0/0	3	3	60/40	ESC

2.	22AD502	Machine Learning	3/0/0	3	3	60/40	PC
3.	22AD9XX	Professional Elective –I	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
4.	22XXXXX	Open Elective –I	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	OEC
5.	22AD503	Data Science using R	2/0/2	4	3	50/50	PC
6.	22AD504	Machine Learning Laboratory	0/0/3	3	1.5	40/60	PC
7.	22AD9XX	Professional Elective –II	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
8.	22AD505	Mini Project –I	0/0/2	2	1	40/60	PW
Total				**24**	**20.5**	**800**	

SEMESTER VI

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22CS701	Internet of Everything	3/0/0	3	3	60/40	ESC
2.	22AD9XX	Professional Elective –III	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
3.	22ADXXX	Emerging Elective –I	3/0/0	3	3	60/40	EEC
4.	22AD601	Deep Learning and its Applications	3/0/2	5	4	50/50	PC
5.	22AD602	Natural Language Processing	3/0/2	5	4	50/50	PC
6.	22CS702	Internet of Everything Laboratory	0/0/3	3	1.5	40/60	ESC
7.	22AD9XX	Professional Elective –IV	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
Total				**25**	**21.5**	**700**	

SEMESTER VII

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22AD701	Data Analytics	3/0/0	3	3	60/40	PC
2.	22AD702	Data visualization using Tableau	3/0/0	3	3	60/40	PC

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
3.	22AD9XX	Professional Elective –V	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
4.	22AD9XX	Professional Elective –VI	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	PEC
5.	22XXXXX	Open Elective –II	3/0/0 or 1/0/4 or 0/0/6	3/5/6	3	60/40 or 50/50 or 40/60	OEC
6.	22ADXXX	Emerging Elective –II	3/0/0	3	3	60/40	EEC
7.	22AD703	Data Analytics Laboratory	0/0/2	2	1	40/60	PC
8.	22AD704	Data Visualization Laboratory	0/0/2	2	1	40/60	PC
9.	22EES01	Employability Enhancement Skills (Summer Internship / Summer Training – 4 weeks)			2	0/100	EES
Total				**22**	**22**	**900**	

SEMESTER VIII							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	22AD801	Project	0/0/24	24	12	40/60	PW
Total				**24**	**12**	**100**	

HUMANITIES (8 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1	22GE201	Universal Human Values	2/0/0	2	3	HSMC
2	22EN101	Technical Communication Skills	2/0/2	4	3	HSMC
3	22TA101	Heritage of Tamils	1/0/1	1	1	HSMC
4	22TA201	Tamils and Technology	1/0/1	1	1	HSMC

BASIC SCIENCES (24 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1	22MA102	Mathematics I	3/1/0	4	4	BSC
2	22CH101	Engineering Chemistry	3/0/2	4	4	BSC

3	22PH201	Physics	3/0/2	4	4	BSC
4	22MA202	Mathematics II	3/1/0	4	4	BSC
5	22MA302	Random Variables and Statistics	3/1/0	4	4	BSC
6	22MA401	Optimization and Project Management	3/1/0	4	4	BSC

ENGINEERING SCIENCE (11.5 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	22EE111	Basics of Electrical and Electronics Engineering	2/1/0	3	3	ESC
2.	22EE114	Basics of Electrical and Electronics Engineering Laboratory	0/0/2	2	1	ESC
3.	22AD501	Signals, Systems and Networks	3/0/0	3	3	ESC
4.	22CS701	Internet of Everything	3/0/0	3	3	ESC
5.	22CS702	Internet of Everything Laboratory	0/0/3	3	1.5	ESC

PROFESSIONAL CORE (74.5 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	22AD101	Introduction to Artificial Intelligence	3/0/0	3	3	PC
2.	22IT101	Application Development Practices	3/0/2	5	4	PC
3.	22CS101	Problem Solving using C++	3/0/2	5	4	PC
4.	22CS201	Data Structures and Algorithms	3/0/2	5	4	PC
5.	22IT201	Data Base Management Systems	3/0/2	5	4	PC
6.	22AD201	Java Programming	3/0/2	5	4	PC
7.	22AD301	Design and Analysis of Algorithms	1/0/4	5	3	PC
8.	22IT302	Web Technology	1/0/4	5	3	PC
9.	22AD302	Python Essentials	2/0/2	4	3	PC

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
10.	22CS301	Advanced Java Programming	1/0/4	5	3	PC
11.	22AD402	Data Warehousing and Data Mining	2/0/2	4	3	PC
12.	22IT402	Software Testing	1/0/4	5	3	PC
13.	22AD401	Cloud Computing	1/0/4	5	3	PC
14.	22CS402	Web Frameworks	1/0/4	5	3	PC
15.	22CS403	Operating Systems	3/0/2	5	4	PC
16.	22AD502	Machine Learning	3/0/0	3	3	PC
17.	22AD503	Data Science using R	2/0/2	4	3	PC
18.	22AD504	Machine Learning Laboratory	0/0/3	3	1.5	PC
19.	22AD601	Deep Learning and its Applications	3/0/2	5	4	PC
20.	22AD603	Natural Language Processing	3/0/2	5	4	PC
21.	22AD702	Data visualization using Tableau	3/0/0	3	3	PC
22.	22AD704	Data Visualization Laboratory	0/0/2	3	1	PC
23.	22AD701	Data Analytics	3/0/0	3	3	PC
24.	22AD703	Data Analytics Laboratory	0/0/2	2	1	PC

PROFESSIONAL ELECTIVES (18 CREDITS)

PROFESSIONAL ELECTIVE STREAM I

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	22AD901	APP Development	0/0/6	6	3	PEC
2.	22IT901	UI / UX Application Development	3/0/0	3	3	PEC
3.	22CS902	Cloud services and Integration	3/0/0	3	3	PEC
4.	22AD902	Project Management and Finance	3/0/0	3	3	PEC

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
5.	22AD903	IPR and Design Thinking	3/0/0	3	3	PEC
6.	22AD904	Software Agents	3/0/0	3	3	PEC
7.	22AD905	Virtual Reality and Augmented Reality	3/0/0	3	3	PEC

PROFESSIONAL ELECTIVE STREAM II

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	22AD911	Statistics and Machine Learning	3/0/0	5	3	PEC
2.	22IT911	NLP with Predictive Analysis	3/0/0	3	3	PEC
3.	22AD912	Data Engineering	0/0/6	6	3	PEC
4.	22IT902	Cloud Architecture	0/0/6	6	3	PEC
5.	22AD913	Artificial Neural Networks	3/0/0	3	3	PEC
6.	22AD914	Soft Computing	3/0/0	3	3	PEC
7.	22AD915	Bayesian Data Analysis	3/0/0	3	3	PEC
8.	22AD916	Information Extraction and Retrieval	3/0/0	3	3	PEC
9.	22AD917	Biology for Engineers	2/0/2	3	3	PEC
10.	22AD918	Web and Social media Mining	3/0/0	3	3	PEC
11.	22AD919	Brain and Neuroscience	3/0/0	3	3	PEC

PROFESSIONAL ELECTIVE STREAM III

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	22AD921	Ethical Hacking	3/0/0	3	3	PEC
2.	22AD922	Ethical Hacking and Auditing Frameworks	3/0/0	3	3	PEC
3.	22IT921	Cyber Security	3/0/0	3	3	PEC

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
4.	22CS921	Cyber Threats and Vulnerabilities	3/0/0	3	3	PEC
5.	22AD923	Semantic Web	3/0/0	3	3	PEC
6.	22AD924	Computational Statistics for Data Science	3/0/0	3	3	PEC
7.	22AD925	Ethics in Data Science	3/0/0	3	3	PEC
8.	22AD926	Intelligent Multi Agent and Expert 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.	22AD001	Fundamentals of Database Systems	1/0/4	5	3	OEC
2.	22AD002	Information Retrieval Techniques	3/0/0	3	3	OEC
3.	22AD003	Machine Learning Algorithms in Python	3/0/0	3	3	OEC
4.	22AD004	Data Visualization using R	3/0/0	3	3	OEC
5.	22AD005	Introduction to Data Analytics	3/0/0	3	3	OEC
6.	22AD006	Introduction to Deep Learning	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.	22AD007	Autonomous Systems and Drones	3/0/0	3	3	EEC
2.	22AD008	Crypto currencies	3/0/0	3	3	EEC
3.	22AD009	AI in Healthcare Applications	3/0/0	3	3	EEC
4.	22AD010	Scalable System for Data Science	3/0/0	3	3	EEC
5.	22AD011	Computer Vision	3/0/0	3	3	EEC

EMPLOYABILITY ENHANCEMENT SKILLS (2 CREDITS)

S.No	Course Code	Course	Duration	Credit	Category
1.	22EES01	Employability Enhancement Skills (Summer Internship / Summer Training)	4 WEEKS	2	EES

MANDATORY COURSES (NON-CREDIT)

S.No	Course Code	Course	Category
1.	22MC101	Induction Programme	MC
2.	22MC102	Environmental Sciences	MC
3.	22MC103	Soft Skills	MC
4.	22MC104	Management Organizational Behaviour	MC
5.	22MC105	General Aptitude	MC
6.	22MC106	Life Skills and Ethics	MC
7.	22MC107	Stress Management	MC
8.	22MC108	Constitution of India	MC
9.	22MC109	Essence of Indian Traditional Knowledge	MC
10.	22MC110	Biology	MC

VALUE ADDED COURSES

S.No	Course Code	Course	Category
1.	22VA701	Data Representation and Interpretation using Python	VAC
2.	22VA702	Android Enterprise	VAC
3.	22VA703	Chatbot Development	VAC
4.	22VA704	Hardware and Troubleshooting	VAC
5.	22VA705	Rapid Development for AI	VAC
6.	22VA706	Robotic Process Automation	VAC
7.	22VA707	Spark and Scala	VAC
8.	22VA130	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)	3	1	4						8	12
2.	Basic Sciences(BSC)	8	8	4	4					24	24
3.	Engineering Sciences(ESC)		4			3	4.5			11.5	29
4.	Professional Core (PC)	11	12	12	16	7.5	8	8		74.5	49
5.	Professional Electives(PEC)					6	6	6		18	18
6.	Open Elective(OEC)					3		3		6	12
7.	Emerging Electives(EEC)						3	3		6	
8.	Project work (PW)					1			12	13	15
9.	Employability Skills							2		2	
10.	Mandatory Course (MC)									-	
	Total	22	25	20	20	20.5	21.5	22	12	163	
	AICTE(CSE)	17.5	20.5	23	22	21	22	20	15		159

22AD101	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	3 / 0 / 0 / 3
Nature of Course:	H (Theory technology)	
Pre requisites:	NIL	

Course Objectives:

1	To learn the basic concepts of Artificial intelligence.
2	To explore areas of application based on knowledge representation.
3	To develop abilities to apply, build and modify decision models to solve real world problems.
4	To familiarize the artificial intelligence techniques for building well-engineered and efficient intelligent systems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Understand the concepts of AI and the agent environment.	[U]
C101.2	Imparting the basic principles of AI in solutions that require problem solving, inference, perception and learning.	[A]
C101.3	Acquire knowledge to solve constraint satisfaction problems, make optimal decisions and strategies in games using adversarial search.	[A]
C101.4	Recognize the knowledge representation and learning methods of artificial intelligence.	[U]
C101.5	Apply AI techniques to real-world problems to develop intelligent systems.	[A]
C101.6	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, searching for solutions.Case Study:State space search.

MODULE II- Search techniques   (15 hrs)

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. Constraint satisfaction problems: Adversarial search, optimal decisions & strategies in games, alpha-beta pruning. Knowledge & reasoning:Knowledge representation issues, Baye's probabilistic interferences and dempstershafer theory**,** An Expert system Shell in LISP. Case Study:AI powered contextual

intelligence

MODULE III- Applications of AI (15 hrs)

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition –Facial Recognition- Healthcare -Robot – Hardware – Perception – Planning – Moving.

Case study: Text to speech.

	Total Hours: 45

Text Books:

1.	Utpal Chakraborty,"Artificial Intelligence for All: Transforming Every Aspect of Our Life", BPB Publications, February 2020.
2.	Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2018.
3.	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.	Luger George F, Artificial Intelligence: Structures and Strategies for Complex Problem solving, 6th edition, Pearson Education, 2015.
3.	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://nptel.ac.in/courses/106105077/

Online Resources:

1.	http://www.nptelvideos.in/2012/11/artificial-intelligence.html
2.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems.htm
3.	https://nptel.ac.in/courses/106105077/

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	Analyze	Tutorial	20
C101.3	Analyze		
C101.4	Understand	Group Assignment	20
C101.5	Analyze		
C101.6	Apply	Presentation	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**
C101.1	2	2	2	2	2	3				1		1	3	1	2
C101.2	2	3	2	2	2	3				1	1	1	2	2	2
C101.3	2	2	2	2	2	3				1	1	1	1	2	2
C101.4	2	2	2	2	2	3				2	2	2	2	1	2
C101.5	2	2	2	2	2	3				1	1	2	1	1	2
C101.6	2	2	2	2	2	3				1	1	2	1	1	2

22MA102		MATHEMATICS I	3/1/0/4

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

Course Objectives:

1	To develop the skill to use matrix techniques that are needed by engineers for practical applications.
2	To acquaint with the knowledge of vector space needed for problems in all engineering disciplines.
3	To acquire further skills in the techniques of linear algebra.
4	To gain knowledge in calculus, which are needed in engineering applications.
5	To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations.

Course Outcomes(Theory)

Upon completion of the course, students shall have ability to

C102.1	Recall the basic concepts of linear algebra and calculus.	[R]
C102.2	Understand the concepts of vectors to find the dimension and basic differentiation and integration to synthesise the function.	[U]
C102.3	Apply the concepts of linear algebra to solve linear systems of equations both numerically and analytically.	[AP]
C102.4	Apply the differential techniques to solve ordinary differential equations and numerical methods to solve the integral functions.	[AP]
C102.5	Apply Laplace transform methods for solving linear differential equations.	[AP]

Course Contents:

MODULE I - LINEAR ALGEBRA **(20 Hrs)**
VECTOR SPACE: Vector space: Dimension – Basis – Orthogonality – Projections - Gram-Schmidt orthogonalization and QR decomposition. **- MATRICES:** Definition – Types of matrices – Characteristic equation – Eigenvalues and Eigenvectors of a real matrices and their properties (excluding proof) – Eigenvalues of a matrix by power method - Solution of system of linear equations by Gauss Elimination and Gauss Jordan method - Iterative methods :Gauss Jacobi method and Gauss Seidel method- Inverse of a matrix by Gauss Jordan method.
Case study: Singular value decomposition and Principal component analysis in Machine Learning

MODULE II – CALCULUS **(20 Hrs)**
DIFFERENTIAL CALCULUS: Solution of First order ordinary differential equations: Taylor's series method – Rungekutta method of fourth order – Second and Higher order Linear differential equations with constant coefficients – Method of Variation of Parameters – Higher order Linear differential equations with variable coefficients: Euler Cauchy's equation.
INTEGRAL CALCULUS: Evaluation of definite integrals using Bernoulli's formula – Beta and Gamma functions – Evaluation of Integrals using Beta and Gamma Functions – Numerical integration: Trapezoidal rule and Simpson's rule for single and double integrals.
Case study: Prediction of population growth using Machine learning, Optimising functions using Machine learning algorithms.

MODULE III - LAPLACE TRANSFORM **(20 Hrs)**
Convergence of Laplace transform – Transform of some standard functions –Unit step function-Unit Impulse function – Properties –Shifting theorem- transforms of derivatives and integrals - Initial and final value theorem – Laplace Transform of periodic functions – Inverse Laplace transform – Partial fraction method – Convolution theorem (Excluding Proof) – Solving second order ordinary differential equations using Laplace Transform.
Case Study: Laplace Transform in Deep convolutional Neural network modelling and optimal neural network for Sparse Recovery.

	Total Hours:	**60**

Text Books:

1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14thEdition, Pearson, Reprint,2018.
2	Howard Anton and Chris Rorrs, "Elementary Linear Algebra", 9th Edition, John Wiley & Sons, 2000.
3	Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publications, Delhi, 2014.

Reference Books:

1	Veerarajan. T, "Engineering Mathematics II",Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
2	Glyn James, — Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012.
3	N.P.Bali and Dr.ManishGoyal,"A Textbook of Engineering Mathematics", 9th edition, Laxmi publications ltd, 2014.
4	Gilbert Strang, "Linear Algebra and its Applications", Third Edition, Harcourt College Publishers, 1988.

Web References:

1	https://onlinecourses.nptel.ac.in/noc21_ma16/preview
2	https://onlinecourses.nptel.ac.in/noc22_ma72/preview
3	https://archive.nptel.ac.in/courses/111/106/111106139/
4	http://nptel.ac.in/video.php?subjectId=117102060/

Online Resources:

1	https://www.coursera.org/learn/ordinary-differential-equations
2	https://www.coursera.org/learn/linearalgebra1/
3	https://www.classcentral.com/course/swayam-laplace-transform-19925
4	https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x/

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]
C102.1	Remember	Quiz	20
C102.2	Understand	Case study	20
C102.3 – C102.5	Apply	Tutorial	20
C102.3 – C102.5	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
C102.1	1	1											1		
C102.2	2	2											1		
C102.3	3	3													
C102.4	3	3											1		
C102.5	3	3													

	3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22IT101	**APPLICATION DEVELOPMENT PRACTICES**	3/0/2/4
Nature of Course	F (Theory programming)	
Pre requisites	Nil	

Course Objectives:

1.	To discuss the essence of agile developmentmethods.
2.	Ability to understand and applyScrumframework.
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	Make use of the concept of agile software engineering and its advantages in software development.	[AP]
C101.2	Demonstrate the values and practices of Scrum and how to setup the GitHub repository.	[U]
C101.3	Find the working model and learn basic web concepts to develop Static and Dynamic websites.	[R]
C101.4	Utilize the knowledge of HTML, CSS and Bootstrap to build modern interactive web applications.	[AP]
C101.5	Develop dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.	[AP]

Course Contents:
Module - I: **15 Hours**

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

Module - II:	**15 Hours**

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

Module - III:	**15 Hours**

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

	Total Hours	**45**

Lab Component:		

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

	Total Hours	**30**

Text Books:	
1.	Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1stEdition, 2010.
2.	Jeff Sutherland, "Scrum the Art of Doing Twice the Work in Half the Time", Random House Publisher, 1stEdition, 2014.

3.	Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
4.	Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley India Pvt. Limited, 5th Edition, 2008.
5.	Jennifer Niederst Robbins., "Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics",O'Reilly Media, 5th Edition,2018.
6.	Jennifer Smith and the AGI Creative Team, "Web Design with HTML and CSS",Wiley Publisher,1st Edition, 2011.
7.	Stephen Blumenthal, "JavaScript: JavaScript for Beginners - Learn JavaScript Programming with ease",1st Edition, 2017.

Reference Books:

1.	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2nd Edition, 2014.
2.	Mike Cohn, "User Stories Applied: For Agile Software", Addison Wesley, 2nd Edition, 2016.
3.	Thomas a Powell, "HTML & CSS: The Complete Reference", 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
4.	Russ Ferguson, "Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development", Apress Publishers, 3rd Edition, 2019.
5.	Deitel, Deitel, Goldberg, "Internet and World Wide Web – How to program", 5th Edition, Prentice Hall Publishers, 2012.

Web References:

1.	https://www.coursera.org/specializations/agile-development
2.	https://www.edx.org/learn/agile
3.	https://nptel.ac.in/courses/106/105/106105182/
4.	https://developer.mozilla.org/en-US/docs/Web/HTML
5.	https://developer.mozilla.org/en-US/docs/Web/CSS
6.	https://developer.mozilla.org/en-US/docs/Web/JavaScript

Online Resources:

1.	http://www.agilenutshell.com/
2.	https://www.atlassian.com/agile/scrum
3.	https://www.youtube.com/user/AgileMikeCohn
4.	https://www.coursera.org/learn/html-css-javascript-for-web-developers
5.	https://online-learning.harvard.edu/subject/javascript

Continuous Assessment									End Semester Examination	Total
Theory				Practical						
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)	Total (A+B)	Total Continuous Assessment		

80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory

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

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	10	10	10
Understand	40	40	40
Apply	40	40	40
Analyse	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	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

| SA 1 (60M) | FA 1 | | SA 2 (60M) | FA 2 | | FA (75M) | SA (25M) | (35%) Practical Examination (15%) |
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

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

22CS101	**PROBLEM SOLVING USING C++**	3/0/2/4
Nature of Course	C(Theory Concept), 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	Solve problems using operators and control Statements.	[AP]
C101.2	Write C++ programs for processing strings and arrays.	[AP]
C101.3	Apply the concepts of pointers and functions in programs.	[AP]
C101.4	Develop C++ programs using various object-oriented concepts to solve real world problems.	[A]
C101.5	Implement the concepts on file streams and operations.	[AP]

Course Contents:

Module – I: C++ Programming Fundamentals   **15 Hours**

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

Module – II: Object Oriented Concepts   **15 Hours**

Classes and Objects, public, private, protected. **Constructors and destructors**: Overloaded Constructor, Copy Constructor, Shallow Copying DeepCopying.**Overloading:** this' Pointer, structs vs Classes, Friends of a class, Operator OverloadingInheritance, Overloading vs overriding, Polymorphism, Virtual Functions, Pure Virtual Functionsand Abstract Classes.

Module – III: Files and Generic Programming   **15 Hours**

Abstract Classes as Interfaces, Exception, Files, Streams and I/O, STL, Generic Programming, Lambda Expression.

	Total Hours	**45**

Lab Component

1. Practice of C Programming using Branching and Iterative constructs.
2. Programs using Functions
3. Programs using arrays and strings.
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 Files.
12. Programs using exception handling concept
13. Mini project

Total Hours	**(45+30)=75**

Text Books:

1.	E Balagurusamy ,"Object Oriented Programming With C++", 4th Edition, Tata McGraw-Hill Education, 2008.
2.	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 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	Apply	Quiz & Assignment	20
C101.2	Apply	Assignment	20
C101.3	Apply	Case study	20
C101.4	Analyze	Group Assignment	20
C101.5	Apply		

Assessment based on Summative and End Semester Examination - Theory		
Bloom's Level	**Summative Assessment (15%) [120 Marks]**	**End Semester Examination (35%)**

	CIA1: (60 Marks)	CIA2: (60 Marks)	[100 Marks]
Remember	10	10	10
Understand	40	40	40
Apply	40	40	40
Analyse	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	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 (35%) Practical Examination (15%)**
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
C101.1	3	3											3	2	
C101.2	3	3	3	3	3				2	1		3	3	2	1
C101.3	3	3	3	3	3				2	1		3	3	2	1
C101.4	3	3	3	3	3				2	1		3	3	2	1
C101.5	3	3	3	3	3				2	1		2	3	2	1

22EN101	**TECHNICAL COMMUNICATION SKILLS**	**2/0/2/3**

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

Course Objectives:

1	To enhance learners' LSRW skills.
2	To develop students' ability to understand the process of communicating and interpreting ideas and human experiences.
3	To facilitate learners to acquire effective technical writing skills.
4	To prepare learners for placement and competitive exams.
5	To facilitate effective language skills for academic purposes and real-life situations.

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

C101.1	Remember language skills for technical communication.	[R]
C101.2	Apply communication skills in a corporate environment.	[AP]
C101.3	Understand and communicate effectively in personal and professional situations.	[AP]
C101.4	Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text.	[U]
C101.5	Apply technical writing skills to write letters, emails and prepare technical documents.	[AP]

Course Contents:
Module I   **10 Hours**

Introduction-Listening: - Listening to News in NDTV and Times Now Channels. **Speaking**: Introduction to Effective Communication - Barriers to Effective Communication- Tips to develop Communication Skills - Self Introduction - Overview of Business Communication-Short Talk on Business Topics -Impromptu Speaking (Public Speaking) - Non-Verbal Communication-SATORI-Sharing Personal Information-**Reading**: Reading Comprehension- Values and its Importance. **Writing**: SWOT Analysis -Book Review - Movie Review-Vocabulary Building.
Suggested Activities:
- Listening to Elon Musk speech on TESLA and brainstorm on their thoughts and ideas.
- Introduce themselves and discuss what they knew about the course and why did they choose this course.
- Observe TEDs talk and prepare a TALK on "Digital Tools".
- Speaking on latest technologies.
- A short talk on Valuable Moments in their life.
- Worksheet on Technical Terms, Digital vocabulary, Sci - Fiction and Technology.

Module II   **10 Hours**
Listening: Listening to Specific Information. **Speaking**: Speaking on Specific Information. **Reading**: Skimming and Scanning-Reading Short Texts - Comparing Facts and Figures - Short Stories and Scientific Articles. **Writing**: Good and Bad Writing- Note Making - Writing Formal Letters (Inviting, Accepting and Declining Invitations)- Writing Business Letters (Calling for Quotations, Seeking Clarifications, Placing an Order and Complaint Letter)- Transcoding (Bar chart, Flowchart. Pie chart and Table)-Job Application Letter- Resume Writing.

Suggested Activities:
- Listening to Stephen Hawkings speech on APPLE and brainstorm on their thoughts and ideas.
- Listening to Stephen Hawkings speech on APPLE products and speak on the changes from previous product to latest product.
- Writing business letters.
- Worksheets on technical products.

Module III   **10 Hours**
Listening: Listening to Narrations and Persuasive speech and identifying narrative and persuasive techniques. **Speaking**: 21st Century Skills- Narrative Skills- Leadership- Conflict Resolution-Persuasive Speaking-How to Tell a Story with Charts and Graphs **Reading:**Product Description and Product Review. **Writing**: Email Writing –Advantages and Disadvantages- Circular – Agenda and Minutes of the Meeting - Proofreading- Subject Verb Agreement-Tenses- Active Voice- Passive Voice- Impersonal Passive Voice-Report Phrases – Report Writing.

Suggested Activities:
- Listening to Sunder Pitchai, Google COE on latest google technology and identify narrative and persuasive speech.
- Speak on Technology using the 21st Century Skills.
- Writing technical reports.
- Worksheets on grammar and technical products.

Hours: (30 Hours)

Lab Components		
1	Listening Comprehension 1.News in NDTV and Times Now Channels 2.Listening to Specific Information	[AP]
2	Impromptu Speaking	[AP]
3	Reading Comprehension related to Competitive Exams.	[U]
4	Immersion Activity and Presentation	[AP]
5	Group Discussion	[AP]
6	Group Assignment	[AP]
7	Verbal Ability and Logical Reasoning	[U]
8	Advertising and branding a product	[A]
9	Presenting a news on latest technology	[AP]
10	Create Blog and post content on social media	[A]
	Hours	30
	Total Hours:	(30+30) 60

Text Books:	
1	Basic Communication Skills for Technology, by Andrea J Rutherford, Pearson Publishers.2000
2	Remedial English Grammar. F.T. Wood. Macmillan.2007
3	Oxford Guide to Effective Writing & Speaking by John Seely, Oxford University Press.2005

4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.	
Reference Books:		
1	Touchstone Student's Book 1 by Michael McCarthy, Jeanne McCarten, Helen Sandiford, Cambridge University Press.2005	
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.	
3	Touchstone Student's Book 2 by Michael McCarthy, Jeanne McCarten, Helen Sandiford, Cambridge University Press.2015	
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									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]**
C101.1 C101.2	Remember	Quiz	**20**
C101.3	Apply	Technical Presentation	**20**
C101.4	Understand	Reading Comprehension	**20**
C101.5	Apply	Group 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		
C101.2								2		3					
C101.3								2		3	2		1		
C101.4										3					
C101.5										3		3	1		

22CH101	ENGINEERING CHEMISTRY	3 /0 /2 /4
Nature of Course	: E (Theory Skill based)	
Pre requisites	: NIL	

Course Objectives:

1	To understand the principles and applications of electrochemistry and to learn electroanalytical methods.
2	To learn the effect of corrosion in materials and the methods for prevention of corrosion.
3	To understand the basic concepts, synthesis, and applications of nanomaterials.
4	To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules.
5	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	Recall the principle and working of reference electrodes and conductivity meters as an analyzer.	[R]
C101.2	Apply the various corrosion control techniques in real time industrial environments.	[AP]
C101.3	Interpret the basic concepts and applications of Nano chemistry.	[U]
C101.4	Use the knowledge of various energy sources in storage devices and polymeric products in engineering field.	[AP]
C101.5	Interpret the principle and working of certain analytical techniques.	[U]

Course Contents

Electrochemistry and Corrosion: Electrochemistry-Introduction-single electrode potential-Electrochemical cells-EMF series. Reference electrodes-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Corrosion-types–mechanism of dry and wet corrosion-galvanic corrosion-differential aeration corrosion. Corrosion protection-electroplating of Chromium-electroless plating of Nickel.
Case Study: Electrochemical oxidation of effluents from sewage water treatment.

15 hours

Nano-Chemistry and Energy sources: Nano Chemistry-Basics-Comparison of molecules, nanomaterials and bulk materials. Preparation of nanomaterials-Electrochemical deposition and electro spinning. Applications of nanomaterials in medicine. Energy Sources-Fuel Cells-H_2-O_2 fuel cell. Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.
Case Study: Hydrogen fuel cell in agricultural-opportunities and challenges.

15 hours

Polymer Chemistry and Analytical Techniques
Introduction-monomers and polymers-classification of polymers-Degree of Polymerization Mechanism of addition polymerization (free radical mechanism). Plastics-classification-Thermoplastic-thermosetting plastics. Conducting polymers-Types-Mechanism-applications.Spectroscopy-Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible)-Vibrational and rotational spectroscopy (IR)-Flame emission spectroscopy (FES).
Case Study: To design new drug molecules using molecular docking software.

15 hours

Lab Components:		**20 hours**
1	Determination of total, temporary, calcium and magnesium hardness of water sample by EDTA method.	[E]
2	Estimation of alkalinity of water sample.	[E]

3	Estimation of dissolved oxygen in water.	
4	Potentiometry- determination of redox potentials and emf's.	[E]
5	Conductometric titration-mixture of acids vs NaOH..	[E]
6	Determination of strength of strong acid by pH-metry.	[E]
7	Determination of corrosion rate of mild steel in acid medium.	[E]
8	Electroplating of nickel over copper.	[E]
9	Spectrophotometry-Estimation of iron in water.	[E]
10	Determination of single electrode potential of Zinc and Copper by given solution.	[E]
11	Anodizing of Aluminium using Electrolysis process.	[E]
12	Synthesis of Nylon 6 6.	[E]
	Total Hours:	**65**

Understanding the concepts by simple Demonstrations/Experiments:

13	To detect the chlorine content in tap water using simple chemical method.
14	To know the presence of dissolved oxygen in given water sample using glucose by redox principle.
15	To illustrate the rate of corrosion in steel nails using acid medium.

Text Books:

1	Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015.
2	Jain P. C. & Monica Jain., "Engineering Chemistry", 16th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2015.
3	Fundamentals of Molecular Spectroscopy, 4th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994.
4	Nanochemistry, 2nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013.

Reference Books:

1	Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016.
2	Liliya.,Bazylak.I., Gennady.E.,Zaikov.,Haghvi.A.K.,"Polymers and Polymeric Composites" CRC Press,2014.
3	Lefrou., Christine., Fabry.,Pierre.,Poignet.,Jean-claude.,"Electrochemistry - The Basics, with examples" 2012 ., Springer.
4	Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012.
5	Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015.

Web References:

1	http://www.analyticalinstruments.in/home/index.html
2	www.springer.com › Home › Chemistry › Electrochemistry
3	https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry
4	www.edx.org/
5	https://www.ntnu.edu/studies/courses
6	www.corrosionsource.com/

Online Resources:

1	https://ocw.mit.edu/courses/chemistry
2	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf
3	https://alison.com - Spectroscopic technique, Colorimetry
4	https://ocw.mit.edu/courses/chemistry
5	nptel.ac.in/courses/113108051

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory

Formative Assessment based on Capstone Model (10%)

Course Outcome	Bloom's Level	Assessment Component	Marks
C101.1	Remember	Online Quiz-I	2
C101.2	Apply	Assignment-I	3
C101.3	Understand	Online Quiz-II	2
C101.4	Apply	Assignment-II	3
C101.5	Understand		

Summative Assessment based on Continuous and End Semester Examination - Theory

Bloom's Level	Continuous Internal Assessment (15%)		End Semester Examination (35%) [35 Marks]
	CIA 1 [7 Marks]	CIA 2 [8 Marks]	
Remember	20	15	20
Understand	30	35	30
Apply	50	50	50
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

Summative Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%)		End Semester Examination (15%) [15 Marks]
	FA (19 Marks)	SA (6 Marks)	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyze	-	-	
Evaluate	-	-	
Create	-	-	

Summative Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								End Semester Examination (50%)	
CA 1 (12 Marks)			CA 2 (13 Marks)			Practical Exam (25 Marks)		Theory (35)	Practical (15)
SA 1 (7)	FA 1		SA 2 (8)	FA 2		FA (19)	SA (6)		
	Comp - I (2)	Comp -II (3)		Comp - I (2)	Comp - II (3)				

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	K	l	1	2	3
C101.1	3	2										1	1		1
C101.2	3	2										1	1		1
C101.3	3											1	1		
C101.4	3	2										1			
C101.5	3	2										1	1		1

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

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22MA202	MATHEMATICS II	3/1/0/4

Nature of Course	J (Problem analytical)
Prerequisites	-

Course Objectives:

1	To use logical notation to define and reason mathematically about the fundamental data types and structures used in computer algorithm and systems.
2	To study the concepts needed to test the logic of a program.
3	To learn the working on class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
4	To use number theory in computer networks and security.
5	To acquire thorough knowledge of fundamental notions of recurrence relations and its application in Cryptography.

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

C202.1	Recall the basic concepts of sets, functions, truth table and number theory.	[R]
C202.2	Understand the formation of Truth table, equivalence relations, division algorithm.	[U]
C202.3	Apply the structure of sets, relations and functions in some of the discrete structures.	[AP]
C202.4	Demonstrate the fundamental concepts of a mathematical function and all of its properties.	[AP]
C202.5	Apply different algorithms in the relevant areas of computer science	[AP]

Course Contents
MODULE 1: Propositional and Predicate Calculus
Propositional Calculus: Basic concepts – Propositions – Connectives – Truth tables – Tautologies and Contradictions – Contrapositive – Logical equivalences and Implications – Normal forms – Principal conjunctive and Disjunctive normal forms– Rules of inference – Validity of arguments – **Predicate Calculus**: Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Theory of inference – The rules of universal specification and generalization – Validity of arguments.
Case Study: Boolean searches, Logic or computer circuits, Inference and Decision making, Fuzzy logic in Artificial Intelligence.

MODULE 2: Set Theory
Sets: Basic sets - Operations on Sets – Law on Sets - Cartesian product of sets – **Relations**: Types of relations and their properties – Relational matrix and graph of a relation – Equivalence relations – Partial ordering - **Functions:** Classification of functions–Composition of functions – Inverse function- Permutation functions- recursive function - Hashing function - Counting: Permutations and Combinations - Mathematical induction.
Case Study: Functions in Password storage, Cryptography, Database Indexing and Search Algorithms.

MODULE 3:   Number Theory & Recurrence Relation
Number Theory: Division algorithm - Base-b representations - Number patterns - Prime and composite numbers - GCD- Euclidean algorithm - Fundamental theorem of arithmetic – LCM - Wilson's Theorem - Fermat's Theorem -Tau and Sigma Function.
Recurrence Relation: Recurrence relations -Formation of recurrence relation - Solving linear recurrence relations – Generating functions.
Case Study: Number theory - Compute mod of a big number, BigInteger Class in Java, To avoid overflow in modular multiplication, RSA algorithm in Cryptography.

	Total Hours:	**60 Hrs**

Text Books:		
	1	Kenneth H. Rosen, - Discrete Mathematics and its Applications, Eight Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Eight Edition, 2021.
	2	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
	3	Koshy. T-"Elementary Number Theory with Applications. Elsevier Publications, New Delhi, Second Edition, 2007.
Reference Books:		
	1	P. Grimaldi, - Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education sia, New Delhi, Fifth Edition, 2019.
	2	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, —Discrete Mathematical Structures, sixth edition, Pearson Education Pvt Ltd., New Delhi, 2017
	3	Thomas Koshy, —Discrete Mathematics with Applications, Elsevier Publications, 2004.
Web References:		
	1	https://nptel.ac.in/courses/111/107/111107058/
	2	https://nptel.ac.in/courses/106/106/106106094/
	3	https://nptel.ac.in/courses/106/106/106106183/
	4	https://nptel.ac.in/courses/111/101/111101137/
Online Resources:		
	1	http://discrete.openmathbooks.org/dmoi3.html
	2	https://www.csie.ntu.edu.tw/~sylee/courses/dm/resources.htm
	3	/youtu.be/qvw1GX93JSY
	4	https://www.geeksforgeeks.org/applications-of-hashing/

Summative assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%)						End Semester Examination (60 %)
CA 1 (20 Marks)			CA2 (20 Marks)			Theory Examination (60 Marks)
SA 1 (12 Marks)	FA 1		SA 2 (12 marks)	FA 2		
	Component -I (4 marks)	Component –II (4 marks)		Component -I (4 marks)	Component - II (4 marks)	

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model (16%)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C202.1	Remember	Quiz	4
C202.2	Understand	Assignment	4
C202.3	Apply	Case study	4
C202.4	Apply	Tutorial	4
C202.5	Apply		

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Continuous Assessment (24%)	End Semester Examination (60%)

	CIA1 [12 Marks]	CIA2 [12 Marks]	[60 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
C202.1	1	1	1										1		
C202.2	1	2	1										2		
C202.3	3	3	2										2		
C202.4	1	1	2										1		
C202.5	2	1	2										2		

22EE111	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	2/1/0/3

Nature of Course	G (Theory analytical)
Course Pre-requisites	Nil

Course Objectives:

1	To import the students with a basic understanding of Electrical circuits.
2	To learn the working principle of transformers.
3	To understand the Electrical Machines working principles and to have a knowledge on selection of machine for specific types of applications.
4	To equip the students with an ability to understand basics of electronics devices.

Course Outcomes:

Upon completion of the course, students shall have ability to

C111.1	Analyse the concepts in AC circuit and DC circuits.	[A]
C111.2	Examine the working principle of single-phase transformer.	[A]
C111.3	Realize the fundamental concepts of magnetic circuits	[U]
C111.4	Understand the working principle of DC and AC machines.	[AP]
C111.5	Interpret the basic devices in Electronics.	[U]

Course Contents:

Course Contents:

Module I: DC Circuits and AC Circuits   15 Hrs

DC Circuits - Electrical circuit elements (R, L and C) - Voltage and Current Sources - Kirchoff's current and voltage law - analysis of simple circuits with dc excitation - Mesh and Nodal Analysis.
AC Circuits - Representation of sinusoidal waveforms, Peak and RMS values, Phasor representation, Real power, Reactive power, Apparent power, Power factor. Analysis of single phase ac circuits consisting of R, L, C, RL and RC. Three phase balanced circuits - Voltage and Current relations in star and delta connections. Case Study: Computer Power Supply Unit.

Module II: Magnetic Circuits and Electrical Machines   15 Hrs

Magnetic Circuits - Definitions - MMF, Flux, Reluctance, Magnetic Field Intensity, Flux Density, Fringing, Self and Mutual Inductances, Static machines: BH characteristics, Construction and working principle of single-phase and three phase transformers. Rotating machines: Generation of rotating magnetic fields, Construction and working principle of DC machines, Three-phase induction motor and Synchronous motor. Case Study: Computer control system.

Module III: Basics of Electronics and Applications   15 Hrs

Semiconductor - PN junction diode - Zener diode - Rectifier - Half wave, Full wave and Bridge rectifier - Bipolar Junction Transistor Introduction - Common base, Common emitter and Common collector configuration - Field Effect Transistor Introduction - Construction and characteristics of JFETs - MOSFET - Depletion type MOSFET, Enhancement type MOSFET, Transfer characteristics. Case Study: Role of Electronics in miniaturization of computers.

	Total Hours	**45**

Text Books:

1	Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 7th edition, 2020.
2	Vincent. Del. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2nd edition, 2015.
3	E. Hughes, "Electrical and Electronics Technology", Pearson, 10th edition, 2011.
4	Donald .A. Neamen, Electronic Circuit Analysis and Design, 2nd Edition reprint, Tata Mc Graw Hill, 2013.

Reference Books:

1	Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of Electrical Engineering", CRC press, 2012.
2	D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, Revised 1st edition 2017.
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, 'Electronic Devices and Circuits', Pearson Education, 6th edition, 2013.
Web References:	
1	http://nptel.ac.in/course.php?disciplineId=108
2	https://ocw.mit.edu/courses/find-bytopic/#cat=engineering&subcat=electricalengineering&spec=electricpower
3	https://nptel.ac.in/video.php?subjectId=117103063
4	https://onionesquereality.wordpress.com/.../more-video- lectures-iit-open
5	https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf
Online Resources:	
1	http://www.electrical-knowhow.com/
2	https://www.edx.org/course/electricity-magnetism-part-1-ricex-phys102-1x-1
3	https://www.mooc-list.com/course/fundamentals-electrical-engineering-coursera
4	https://nptel.ac.in/course.php

Continuous Assessment				End Semester Examination	Total
Formative Assessment	**Summative Assessment**	t**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]**
C111.1	Analyze	Quiz	20
C111.2	Analyze	Tutorial	20
C111.3	Understand	Group Assignment	20
C111.4	Apply		
C111.5	Understand	Presentation	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)

No. of the 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
C111.1	3	3	3	3					2	2			3		3
C111.2	3	3	3	3					2	2			3		3
C111.3	3	3	3	3					2	2			3		3
C111.4	3	3	3	3					2	2			3		3
C111.5	3	3	3	3					2	2			3		3
1	Reasonably Agreed			2		Moderately Agreed				3		Strongly Agreed			

22TA101	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	-	-	-	-	-	-

22CS201	DATA STRUCTURES AND ALGORITHMS	3/0/2/4
Nature of Course:	F(Theory Programming)	
Pre requisites:	Problem Solving using C++	

Course Objectives:

1.	To introduce data structure concepts 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	Illustrate the applications of tree data structures.	[AP]
C201.4	Discuss the importance of hashing techniques in information storage	[AP]
C201.5	Employ graph algorithms for solving real time computing problems and analyze them.	[A]

Course Contents:
Module I LinkedList & Stack   15 Hours

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

Module II Queue and Trees 15 Hours
Queue: Queue Model, Array and Linked list implementation of Queue-Priority Queue - Applications of Queue. Trees: Binary Tree - Binary Search Tree - Insertion, Deletion, Traversal - Inorder, Preorder, Postorder, Level order traversal.

Module III Graphs and Hashing   15 Hours
Graphs: Weighted and Directed graphs - Adjacency matrix and list implementation - Traversal – Breadth First Search & Depth First Search. Hashing: Direct Address Table, Hash function, Collision resolution techniques, Linear Probing, quadratic probing, double hashing.

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

Lab Component

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

9	Implementation of Binary Search Tree.
10	Implementation of Graph Traversal algorithms
	Total Hours(Lab):30 hours
	Total Hours: (45+30) 75 Hours

Text Books:

1	Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.
2	AnanyLevitin, 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	Seymour Lipschutz,"Data Structures by Schaum Series",2nd edition, Tata McGraw Hill, 2013.
2	NarasimhaKarumanchi,"Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles",5th Edition, Career Monk,2016.
3	DebasisSamanta,"Classicdatastructures",PrenticeHallofIndia,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 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	Assignment	20
C201.3	Apply	Case study	20
C201.4	Apply	Group Assignment	20

C201.5	Analyse			

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	10	10
Understand	40	40	40
Apply	40	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 Examination (15%) [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 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%)
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

22IT201	DATABASE MANAGEMENT SYSTEMS	3/0/2/4
Nature of Course:	D (Theory Applications)	
Prerequisites :	Nil	

Course Objectives:

1	To describe information and data models and relational databases.
2	To explain an Entity Relationship Diagram and design a relational database for a specific use case.
3	To implement different relational model constraints.
4	To manage database using SQL commands

Course Outcomes:

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

C201.1	Understand the fundamental concepts and principles of DBMS.	[U]
C201.2	Understand the Normalization process to design and develop well-structured and normalized database schemas.	[U]
C201.3	Identify the basics of SQL and construct queries using SQL.	[AP]
C201.4	Analyze and design a real database application and develop database application using database management system.	[A]
C201.5	Examine the techniques for query optimization and infer the transactions management, concurrency control mechanism in a database environment.	[A]

Course Contents:

MODULE I INTRODUCTION   **15 Hours**

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

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

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

MODULE IIIQUERIES AND TRANSACTIONS   **15 Hours**

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

Lab Experiments:

1. Conceptual Database design using E-R DIAGRAM

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

3. Queries to demonstrate implementation of Integrity Constraints

4. Practice of Inbuilt functions

5. Implementation of Join and Nested Queries AND Set operators

6. Implementation of virtual tables using Views

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

8. Mini Project (Application Development)

i) IT Training Group Database

   ii) Blood Donation System

   iii) Salary Management System

   iv) Traffic Light Information System

	Total Hours:	**45+30**

Text Books:

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

Reference Books:

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

Web References:

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

Online Resources:

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

Continuous Assessment									**End Semester 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		Assignment	20
C201.3, C201.4	Apply	Group Assignment	20

C201.5	Analyse	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	10	10	20
Understand	40	30	30
Apply	50	40	40
Analyse	-	20	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	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 Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Theory Examination (35%) Practical Examination (15%)
	FA 1			FA 2				
SA 1 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	SA 2 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	FA (75M)	SA (25M)	

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

22AD201	JAVA PROGRAMMING	3/0/2/4
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

1	To understand the basic concepts of core java.
2	To employ different types of modifiers andControl 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 concepts and features of java.	[U]
C201.2	To examine key aspects of java Standard API library such as util, io, applets, swings, GUI based controls.	[AP]
C201.3	Apply Array and strings in real time environment.	[AP]
C201.4	Analyse and Interpret String Buffer and StringBuilder Classes.	[A]
C201.5	Utilize the functionalities of streams and java console class.	[AP]

Course Contents:

MODULE I Introduction to Java   **15 hours**

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

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

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

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

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

	Total Hours:	45

Laboratory Component:

S. No.	List of Experiments
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:	15

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 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	Understand	Quiz & Assignment	20
C201.2	Apply	Assignment	20
C201.3	Apply	Case study	20
C201.4	Analyze	Group Assignment	20
C201.5	Apply		

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	10	10	10
Understand	40	40	40
Apply	40	40	40
Analyse	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	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 (35%) Practical Examination (15%)
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

22PH201		PHYSICS	3/0/2/4

Nature of Course	: E (Theory skill based)
Prerequisites	: Nil

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 Laser, Optical fibers, Photonics, Superconductors and quantum mechanics of physics and apply the same in computing fields.

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

C201.1	Understand the basic concepts of lasers and its application in Engineering field.	[U]
C201.2	Recall the various types of optical fibers and its applications.	[R]
C201.3	Describe and conduct experiments in photonic materials and fundamental concepts of superconductors.	[U]
C201.4	Discuss the basic concepts of Quantum Mechanics and quantum ideas at the nanoscale.	[U]
C201.5	Apply the gained knowledge to solve the problems related to their field of study.	[AP]

Course Contents:

Laser and Fiber optics 15 Hours

*Laser:*Characteristics of laser – Principle of spontaneous emission and stimulated emission – Einstein's theory of matter radiation interaction and A and B coefficients (derivation) – Population inversion – Pumping – Nd-YAG and CO_2 laser **– Case Study - Applications**: **Laser printer, Data storage and Bar code scanner.**

Fiber optics: Light propagation through fibers, acceptance angle, numerical aperture – Types of fibers: step index, graded index, single mode and multimode – V – number – **Case Study - Optical fibers for computing applications – PC to PC communication and fiber optics in computer networking.**

Photonics and Superconductors 15 Hours

Photonics: Introduction to photonic materials – Photonic crystals – Liquid crystal display (LCD) Light sources: Light emitting diode (LED) – Photo dependence resistor – Photo detectors: PIN, avalanche – Photo voltaic effect, Solar cell – **Case Study -Applications of photonic materials in computing – optical computing.**

*Superconductors:*Properties of Superconductors: effect of magnetic field, Meissner effect, effect of current, thermal properties, isotope effect, Josephson effects and its applications – Type–I and Type–II Superconductors – BCS theory –High T_C superconductors – Application of Superconductors: magnetic levitation, SQUID and cryotron. **Case Study – Superconducting Microprocessor.**

Quantum Mechanics and Quantum computing 15 Hours

Quantum Mechanics: Planck's quantum theory (derivation) – Matter waves, de-Broglie wavelength, Heisenberg's uncertainty principle – Schrödinger's wave equation: time independent and time dependent – Physical significance of wave function – Particle in a one-dimensional potential box – Electron microscope: SEM and TEM–Postulates of quantum mechanics. *Quantum computing*: Introduction to quantum computing – qubits, entanglement, decoherence and quantum supermacy, differences in quantum and classical computation. **Case Study** – **Real – world applications of Quantum Computing.**

	45 Hours

Lab Component		**30 Hours**
1	nination of Particle size and measurement of d-spacing in CD using Laser.	[E]
2	Determination of wavelength, angle of divergence and coherence length	[E]

	of laser source.	
3	Determination of numerical aperture and acceptance angle parameter of optical fiber using Laser source.	[E]
4	Determination of Characteristics curves of solar cell.	[E]
5	Determination of Characteristics curve of light dependence resistor (LDR).	[E]
6	Determination and verification of Stefan law.	[E]
7	Determination of Planck's constant using electroluminescence.	[E]
8	Determination of wavelength of mercury spectrum Spectrometer	[E]
9	Determination of bandgap of semiconductor.	[E]
10	Determination of entangled photons using spectrometer.	[E]
	Life Skills Experiments	
11	Determination of pressure required to shut off the fuel pump nozzle.	[E]
12	Determination of capacitance required to shut off the circuit in a circuit breaker.	[E]
13	Determination of earth, neutral and phase line in a circuit.	[E]
	Total Hours:	**75**

Text Books:

1	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11th edition, Wiley, 2018.
2	FedorMitschke "Fiber Optics physics and Technology", 2nd edition, Springer, 2017.
3	Kasap, Safa, Capper, "Handbook of Electronic and Photonic Materials" 2nd edition, Springer, 2017.
4	Trager, Springer "Handbook of Lasers and Optics" 2nd edition, Springer, 2012.
5	Eleanor Rleffel and Wolfgang Polak, "Quantum computing a gentle introduction", 1st edition, The MIT press, 2012.
6	D. K. Bhattacharya and Poonam Tandon, "Engineering Physics", Oxford University press, 2014

Reference Books:

1	William T. Silfvast "Laser Fundamentals" Cambridge University Press, 2012
2	P. Chakrabarti, "Optical Fiber Communication", McGraw Hill Education, 2015.
3	Balkan, Naci, Erol, Ayşe, "Semiconductors for Optoelectronics", 1st edition Springer, 2020.
4	David J. Griffiths, "Introduction to Quantum Mechanics", 2nd edition , Cambridge university press, 2017.
5	Chris Bernhardt, "Quantum Computing for Everyone" The MIT press, 2019

Web References:

1	https://www.studocu.com/in/document/mahatma-gandhi-university/engineering-physics/lasers-engineering-physics-lecture-notes-module-i/23900829
2	https://www.nitsri.ac.in/Department/PHYSICS/Unit_IV__Laser.pdf
3	https://www.lifewire.com/fiber-optic-cable-817874
4	https://www.nap.edu/read/5954/chapter/4
5	/www.sciencedirect.com/science/article/pii/S2211379718314268
6	/lecturenotes.in/notes/13602-note-for-optical-fibre-communication-ofc-by-sunil-s-harakannanavar
7	/ocw.mit.edu/courses/materials-science-and-engineering/3-46-photonic-materials-and-devices-spring-2006/lecture-notes/

8	vcchew.ece.illinois.edu/chew/course/QMALL20121005.pdf
9	/www.technologyreview.com/2019/01/29/66141/what-is-quantum-computing/
10	/www.quantum-inspire.com/kbase/what-is-a-qubit/
11	/www.cl.cam.ac.uk/teaching/0910/QuantComp/notes.pdf

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]
C201.1	Understand	Online Quiz – I	20
C201.2	Remember	Assignment – I	20
C201.3	Understand	Online Quiz – II	20
C201.4	Understand	Assignment – II	20
C201.5	Apply		

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	50	50	50
Apply	30	30	30
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	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	25	25	25
Evaluate	25	25	25
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%)
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
C201.1	3	2	1	1								1			
C201.2	3	2	1	1								1			
C201.3	3	2	1	1								1			
C201.4	3	2	1	1								1			
C201.5	3	2	1	1								1			

22EE114	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	0/0/2/1
Nature of Course	: M(Practicalapplication)	
Pre-requisites	: Nil	

Course Objectives:

1	Toimplement the basic Electric Circuits.
2	To estimate the current flow and voltage across the circuit elements under different loading conditions.
3	To understand the basic electronic devices.

Course Outcomes:

Upon completion of the course, students shall have ability to

C114.1	Illustrate the Electrical Elements and Sources in an Electric Circuit.	[U]
C114.2	Verify the current flow and voltage across the circuit elements using different analysis method.	[A]
C114.3	Measure three phase power and power factor in a single and three phase AC circuits.	[AP]
C114.4	Illustrate the working principle of residential house wiring, DC and AC machines.	[U]
C114.5	Interpret the basic devices in Electronics.	[AP]

Course Contents:

S.No	Listof Experiments	CO Mapping	RBT
1	Familiarization of Electrical Elements, Sources, Measuring Devices and Verification of ohm's law.	C114.1	[U]
2	Estimation of voltage and current by KVL and KCL in Electric Circuits.	C114.1	[A]
3	Determination of mesh current by Mesh Analysis.	C114.1	[A]
4	Determination of node voltage by Nodal Analysis.	C114.1	[A]
5	Estimation of Voltage and Current in star and delta connections.	C114.1	[A]
6	Measurement of three phase power and Power factor.	C114.2	[AP]
7	Residential house wiring and demonstration of cut-out sections of DC Motor and Induction Motor.	C114.3	[U]
8	Determination of characteristics of MOSFET.	C114.5	[U]
9	Construction of bridge rectifier with and without filters.	C114.5	[AP]
10	Draw the characteristics of Bipolar Junction Transistor.	C114.5	[U]
	Total Hours	**30**	

Text Books:

1	Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 7th edition, 2020.
2	Vincent. Del. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2nd edition, 2015.
3	E. Hughes, "Electrical and Electronics Technology", Pearson, 10th edition, 2011.
4	Donald .A. Neamen, Electronic Circuit Analysis and Design, 2nd Edition reprint, Tata Mc Graw Hill, 2013.

Reference Books:

1	Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of Electrical Engineering", CRC

	press, 2012.
2	D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, Revised 1st edition 2017.
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, 'Electronic Devices and Circuits', Pearson Education, 6th edition, 2013.
Web References:	
1	http://nptel.ac.in/course.php?disciplineId=108
2	https://ocw.mit.edu/courses/find-bytopic/#cat=engineering&subcat=electricalengineering&spec=electricpower
3	https://nptel.ac.in/video.php?subjectId=117103063

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	0	0	0
Understand	30	30	30
Apply	30	30	30
Analyse	40	40	40
Evaluate	0	0	0
Create	0	0	0

No. of the 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
C114.1	3	2	1	1			1	2	2	2			3		3
C114.2	3	3	2	2			1	2	2	2			3		3
C114.3	2	1			3								3	2	
C114.4	3	2	1	1			1	2	2	2			3		3
C114.5	2	1			3								3	2	
1	Reasonably Agreed		2		Moderately Agreed			3		Strongly Agreed					

22GE201	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

C201.1	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
C201.2	Apply responsibilities towards their commitments (human values, human relationship and human society).	[AP]
C201.3	Apply what they have learnt to their own self indifferent day-to-day settings in real life, at least a beginning would be made in this direction.	[AP]
C201.4	Analyze ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[AN]
C201.5	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in nature.	[U]

CourseContents:

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 the harmony 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.

		TotalHours:	45

TextBooks:

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.

ReferenceBooks:

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	IndiaWins Freedom-MaulanaAbdulKalamAzad.

WebReferences:

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

OnlineResources:

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 (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]

C201.1	Understand & Apply	Online Quiz	20
C201.2	Understand & Apply	Group Assignment	20
C201.3	Understand	Presentation	20
C201.4	Apply		
C201.5	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
C201.1						3						1	1		1
C201.2						3			3			1		1	
C201.3						3		3				1	1		1
C201.4						3	3	3			2	1			
C201.5						3	3					1	1		

22MA302	RANDOM VARIABLES & STATISTICS	3/1/0/4

Nature of Course	J (Problem analytical)
Pre requisites	Concepts of basic differentiation and Integration

Course Objectives:

1	To study the basic probability concepts
2	To understand and have a well – founded knowledge of standard distributions which can be used to describe real life phenomena
3	To acquire skills in handling situations involving more than one random variable
4	To learn the concept of testing hypothesis using statistical analysis
5	To apply the Analysis of variance classifications in one way and two way

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

C302.1	Recall the concepts of basic probability	[R]
C302.2	Understand how to handle situations involving random variable	[U]
C302.3	Applying different standard distribution methods in real life problems.	[AP]
C302.4	Derive the logic and attain the knowledge of hypothesis testing.	[AP]
C302.5	Apply the analytical comparisons using ANOVA.	[AP]

Course Contents:

Module 1: Probability and Standard distributions **20 hrs**
Probability: Probability concepts – Addition and Multiplication law of probability – Conditional probability – Total probability theorem –Bayes theorem. **Standard distributions**: Discrete distributions – Binomial, Poisson, Geometric – Continuous distributions – Uniform, Exponential, Normal distributions.
Case study: Bayes theorem in Data Science, Binomial, Poisson and Normal distributions in Data Analytics.

Module 2: Random Variables **20 hrs**
One dimensional random Variables: Discrete random variables – Probability mass function – Continuous random variables – Probability density function – Moment generating Function. **Two dimensional random variables**: Joint distributions – Marginal and conditional distributions – Covariance – Correlation – Regression – Central limit theorem (statement only).
Case Study: Joint distribution in Machine Learning, Correlation and regression in Big Data Analytics.

Module 3: Statistics **20 hrs**
Mean, median, mode and standard deviation for raw, discrete and continuous data – Testing of Hypothesis: Large sample – Z test – Test of significance – Proportions – Small sample test – t test and F test for single mean – difference of means and variance – Chi -square test for goodness of fit and independence of attributes. **Analysis of variance** :One way and two way classifications.
Case Study: ANOVA based analysis for water quality monitoring through Internet of Things, Chi-square test in Data Analysis and Algorithm.

	Total Hours:	**60 Hrs**

Web References:

1	http://nptel.ac.in/courses/111104079/
2	http://nptel.ac.in/video.php?subjectId=117105085
3	http://nptel.ac.in/syllabus/111105041/
4	http://freevideolectures.com/Course/3028/Econometric-Modelling/22#
5	http://nptel.ac.in/courses/111104079/

Online Resources:

1	www.edx.org/Probability
2	https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/
3	https://onlinecourses.nptel.ac.in/noc15_ec07/

Summative assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%)						**End Semester Examination (60 %)**
CA 1 (20 Marks)			**CA 2 (20 Marks)**			**Theory Examination (60 Marks)**
SA 1 (12 Marks)	**FA 1**		**SA 2 (12 marks)**	**FA 2**		
	Component -I (4 marks)	**Component –II (4 marks)**		**Component -I (4 marks)**	**Component -II (4 marks)**	

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (16%)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
C302.1	Remember	Quiz	**4**
C302.2	Understand	Group Assignment	**4**
C302.3	Apply	Case Study	**4**
C302.4 & C302.5	Apply	Group Activities / Tutorial	**4**

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Internal Assessment (24%)**		**End Semester Examination (60%)[60 Marks]**
	CIA 1 [12 Marks]	**CIA 2 [12 Marks]**	
Remember	20	15	20
Understand	30	35	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**
C302.1	2	1	1	1									1		
C302.2	1	2	2	1									2		
C302.3	2	2	2	3									2		
C302.4	1	1	2	2									2		
C302.5	2	3	2	3									3		

22TA201		TAMILS AND TECHNOLOGY	1/0/0/1

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

Course Objectives:

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

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

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

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

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

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

	Total Hours:	**15**

Text-cum-Reference Books:

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

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

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

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

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

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

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

22AD301	DESIGN AND ANALYSIS OF ALGORITHMS	1 / 0/ 4 / 3

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

Course Objectives:

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

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

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

Course Contents:

Sorting, Searching and String Algorithms: [15 Hours]

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

Greedy and Dynamic Programming: [15 Hours]

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

Tree and Graph Algorithms: [15 Hours]

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

	Total Hours:	45

Lab Component	
1	Implementation of Linear, Binary Search and Tries.
2	Implementation of Sorting Algorithms - Bubble, Insertion, Selection, Merge Sort, Quick sort, Heap

	Sort.
3	Implementation of Greedy Algorithms.
4	Implementation of Pattern Searching Algorithms.
5	Implementation of Backtracking Algorithms.
6	Implementation of Dynamic Programming.
7	Implementation of Range Query Algorithms.
8	Implementation of Minimum Spanning Tree.
9	Implementation of Shortest path Algorithms.
10	Implementation of Maximum Flow Minimum cut Algorithm.
	Total Hours : 30

Text Books:

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

Reference Books:

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

Web References:

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

Online Resources:

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

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

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

C301.3 & C301.4	Analyze	Case study	20
C301.5	Apply	Assignment	20

Assessment based on Summative Assessment - Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

Assessment based on Continuous and End Semester Practical Examination

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

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

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

| C301.4 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 2 | | | | 2 | 3 | 2 | 2 |
| C301.5 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 2 | | | | 2 | 3 | 2 | 2 |

22IT302	WEB TECHNOLOGY	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

C302.1	Demonstrate the client-side JavaScript application development with React library.	[U]
C302.2	Construct the single page applications in React.	[AP]
C302.3	Apply the react features including components and forms.	[AP]
C302.4	Analyze the functionality of front-end UI applications using React.	[A]
C302.5	Examine the responsive react applications with CSS	[A]

Course Contents:

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

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

Deploying and Testing Web Applications   **15 Hours**
React Projects, Demo apps, HTTP Requests/Ajax Calls, HTTP Requests in React, Introduction of Axios package, HTTP GET Request, fetching & transforming data, HTTP POST, DELETE, UPDATE, Handing Errors, Adding/Removing Interceptors, Creating/Using Axios instances, Redux, React Thunk, Difference between Thunk & other, React hooks, Application Using React & Redux , React Routing, Routing and SPAs, Setting Up the Router Package, react-router vs react-router-dom, Preparing the Project For Routing, Switching Between Pages. Routing-Related Props, The "withRouter" HOC & Route Props, Passing & extracting route/query parameters, Using Switch to Load a Single Route, Navigating Programmatically. React Forms and Form Validation, Creating a Custom Dynamic Input Component, Setting Up a JS Config for the Form, Dynamically Create Inputs based on JS Config, Adding a Dropdown

Component. Handling User Input, Handling Form Submission, Adding Custom Form Validation, Fixing a Common Validation, Adding Validation Feedback, Showing Error Messages, Handling Overall Form Validity, Deploying React App to the Web, Testing React apps with Jasmine & implementing JEST.

	Total Hours	45

Lab Component:

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

	Total Hours:	30

Text Books:

1.	Robin Wieruch, "The Road to React", 2022 Kindle Edition.
2.	Alex Banks, Eve Porcello. "Learning React: Modern Patterns for Developing React Apps", O'Reilly Media,2020.

Reference Books:

1.	Adam Bouch, "React and React Native", Packt Publishing, 3rd Edition, 2020.
2.	Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Pearson Education, 2nd Edition, 2018
3.	Adam Boduch, Roy Derks "React and React Native: A Complete Hands-on Guide to Modern Web and Mobile Development with React.js", Packt Publishing, 2020.

Web References:

1.	https://www.coursera.org/learn/front-end-react
2.	https://www.geeksforgeeks.org/full-stack-development-with-react-node-js-live/
3.	https://www.edx.org/learn/front-end-web-development
4.	https://www.w3schools.com/REACT/DEFAULT.ASP

Online Resources:

1.	https://reactjs.org/
2.	https://www.youtube.com/watch?v=3HMtarQAt3A
3.	https://frontendmasters.com/guides/front-end-handbook/2018/what-is-a-FD.html
4.	https://www.youtube.com/watch?v=HT82p_re-EY

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			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]**
C302.1	Understand	Quiz	20
C302.2	Apply	Quiz	20
C302.3	Apply	Mini Project	20
C302.4	Analyze		
C302.5	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
C302.1	3	3	3	2	2				2	2	2	2	3	3	2
C302.2	3	3	3	2	2				2	2	2	2	3	2	3
C302.3	3	3	3	3	2				3	2	2	2	3	2	2
C302.4	3	3	3	2	3				2	2	2	2	3	3	3
C302.5	3	3	3	2	3				2	2	2	2	3	2	2

22CS301	ADVANCED JAVA PROGRAMMING	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	Java Programming	

Course Objectives:

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

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

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

Course Contents:

Module I   Introduction to OOPS   15 Hours

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

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

Module II   Abstraction, Exception Handling & Collections   15 Hours

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

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

Module III   Swings, Servlets & JDBC   15 Hours

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

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

	Total Hours	**45 Hours**

List of Experiments

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

	Total Hours	**30 Hours**

Text Books:

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

Reference Books:

1.	Paul Deitel, Harvey Deitel, "Java How To Program",10th Edition, Prentice Hall Publications,2014.
2.	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**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22AD302	PYTHON ESSENTIALS	2/0/2/3

Nature of Course	F (Theory and Programming)
Prerequisite	Nil

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

C302.1	Recognize the general principles and good algorithmic problem solving.	[U]
C302.2	Interpret the fundamental Python syntax and semantics and use of Python control flow statements.	[U]
C302.3	Understand variables, data types, control flow structures (such as loops and conditionals), functions, and file handling.	[U]
C303.4	Design and implement modular and reusable code.	[AP]
C304.5	Examining compound data using Python lists, tuples and dictionaries.	[AP]
C305.6	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 Hrs)**

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 Hrs)**

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; Case Study: Text Analysis.

Python Tuple, Dictionary and Libraries for Data Science: **(15 Hrs)**

Tuples: Tuple Assignment, Tuple As Return Value; Dictionaries: Operations And Methods, Exception handling, Files-reading and writing - Basics for Data Science: Loading the Data from CSV file, Cleaning the Data, Visualization, Numpy and Numpy Operations, Pandas and pandas operations, Matplotlib: types of plots. **Case study:** Analyse the academic performance of students and plot a graph.

Total Hours:	**45**

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.

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 (A+ B)	Total Continuous Assessment	End Semester 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

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]
C302.1	Understand	Quiz	20
C302.2	Understand	Tutorial	20
C302.3	Understand	Group Assignment	20
C302.4, C302.5	Apply		
C302.6	Analyze	Presentation	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (25%) [120 Marks]		End Semester Examination (25%) [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 - 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)			

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
C302.1	3	3	2	2	3	3	1		1	1	2	2	2	3	3
C302.2	3	3	3	3	2	2	1				2	3	3	3	2
C303.3	3	3	2	2	3	3	1		1	1	2	2	3	2	2
C304.4	3	3	3	3	2	2	1				2	3	2	2	3
C305.5	3	3	2	2	3	3	1				2	2	3	3	
C306.6	3	3	2	2	3	3	1				2	2	3	3	3

22MA401	OPTIMIZATION AND PROJECT MANAGEMENT	3/1/0/4

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

Course Objectives:

1	Students will develop problem modeling and solving skills and learn how to make intelligent decisions from the point of view of optimization.
2	Understand the meaning, purpose, and tools of Operations Research.
3	Critically analyze a problem, identify, formulate and solve problems in any engineering field using operations research principles, considering current and future trends.
4	Formulate Queuing models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Queuing problems.
5	The students will define the basics of simulation modeling and replicating the practical situations in organizations

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

C401.1	Recall the basic concepts of optimization, Queueing and simulation.	[R]
C401.2	Understand the concepts of linear programming problems.	[U]
C401.3	Apply operations research techniques for LPP in industrial optimization problems.	[AP]
C401.4	Apply the concepts of discrete time Markov chains to model computer systems.	[AP]
C401.5	Apply the concepts of simulation in different real life probabilistic situations using Monte Carlo simulation technique.	[AP]

Course Contents:

MODULE I - DEVELOPMENT OF OPERATIONS RESEARCHANDLINEAR PROGRAMMING
(20 Hrs)

Linear programming problem: Graphical method – Simplex method – Big M Method – Transportation problem: North west corner method – Least cost method – Vogel's approximation method – Optimal solution – MODI method – Balanced and unbalanced Transportation problem – Assignment problem – Hungarian method.
Case Study : Process optimization and real time analytics using linear programming.

MODULE II - QUEUEING MODELS **(20 Hrs)**
Introduction to Queuing Models – Characteristics –– Birth and death processes – Markovian queues – Single and multiple server queueing models – Little's formula – Non Markovian Queueing Model M/G/1.
Case Study :A Machine learning approach to waiting time prediction in Queueing Scenarios.

MODULE III - **SIMULATION** **(20 Hrs)**
Simulation: Introduction – Types of simulation models – Discrete Event Simulation – Monte - Carlo Simulation – Advantages and Disadvantages.
Case Study : Deep reinforcement learning using Simulation (ChatGPT, AlphaGo, etc….)

	Total hours:	**60**

Text Books:

1	KantiSwarup, P.K.Gupta, Manmohan, "Operations research", Sultan Chand and Sons,2nd Edition 2015
2	Taha H.A, "Operation Research", Pearson Education,10th Edition, 2017
3	Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M.,Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.

Reference Books:

1	D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014
2	S. Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 2013

3	S. D Sharma, Operation Research, Kedarnath Ram Nath Publishers,2020

Web References:

1	https://archive.nptel.ac.in/courses/112/106/112106134/
2	https://onlinecourses.nptel.ac.in/noc22_ma48/preview
3	https://nptel.ac.in/courses/110106062
4	https://www.aicte-india.org/flipbook/p&ap/Vol.%20II%20UG/UG_2.html#p=8
5	https://www.britannica.com/topic/operations-research

Online Resources:

1	https://www.edx.org/course/operations-research-an-active-approach
2	https://in.coursera.org/learn/operations-research-modeling
3	https://in.coursera.org/projects/simulation-call-centre-operations

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]
C401.1	Remember	Quiz	20
C401.2	Understand	Case Study	20
C401.3	Apply	Tutorial	20
C401.4 – C401.5	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	FA 1 (40 Marks)	SA 2	FA 2 (40 Marks)	

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

Course Outcomes (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	1	1	1										1		
C401.2	2	2	2										1		
C401.3	3	3	3										2		
C401.4	3	3	3										2		
C401.5	3	3	3										2		

22IT402	**SOFTWARE TESTING**	**1/0/4/3**

Nature of Course	F (Theory Programming)
Pre requisites	Nil

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

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

Course Contents:

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

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

Testing Framework   **15 Hours**
Testing Frameworks - Data driven testing using Apache POI, POM. Extent Reports - HTML Report Generation using Extent Reports, Attaching Screenshot in HTML Report.
Log4j - configuring log4j Property files, Log4j - parameters for Properties file, Log levels and logging using log4j, Hybrid framework implementation., Creating the POM with a Hybrid framework folder structure, Implementing the Hybrid framework in POM.

		Total Hours	45

Lab Component:	
1.	Develop a program to automate the login process for a specified webpage using Selenium.
2.	Write an automation script using Selenium to handle form elements on a given website.
3.	Create an automation script with Selenium to interact with specific web elements on a designated webpage.
4.	Implement automation scripts using TestNG, prioritizing different test cases for efficient testing on a given website.
5.	Develop automation scripts with TestNG, incorporating seven levels of logging for detailed analysis while testing a specified website.
6.	Execute application tests using designed test cases and generate an HTML report for a comprehensive overview.
7.	Design and implement a hybrid framework for a ticket booking system, along with associated test cases.
8.	Develop a hybrid framework and associated test cases for a hotel room booking system.
9.	Design and develop a hybrid framework and relevant test cases for a hospital appointment application.
10.	Implement a hybrid framework and associated test cases for an e-commerce application.
11.	Develop a hybrid framework and design test cases for comprehensive testing of an insurance website.

Text Books:	
1.	Rex Allen Jones II, "Absolute Beginner, Part 1 Selenium Webdriver for Functional Automation Testing", 1st Edition, Createspace Independent Pub, 2016
2.	S Basu, "Selenium with Python Simplified for Beginners", 1st Edition, 2020
3.	Paul Watson, "Selenium webdriver with Node.js: Beginner's Guide", 1st Edition, CreateSpace Independent Publishing Platform, 2016.

Reference Books:	
1.	Satya Avasarala, "Selenium Web Driver Practical Guide", 1stEdition, Packt Publishing Limited, 2014
2.	Sujay Raghavendra, "Python Testing with Selenium: Learn to Implement Different Testing Techniques Using the Selenium WebDriver", Apress, 2020.
3.	Pinakin Ashok Chaubal, "Selenium Framework Design in Keyword-Driven Testing: Automate Your Test Using Selenium", BPB Publications, 2020.

Web References:	
1.	https://www.coursera.org/projects/building-test-automation-framework-using-selenium-and-testng
2.	https://www.edx.org/professional-certificate/delftx-automated-software-testing
3.	https://onlinecourses.nptel.ac.in/noc22_cs12/preview
4.	https://www.nextgenerationautomation.com/post/selenium-coding-exercises
5.	https://www.studytonight.com/maven/build-and-test-maven-project

Online Resources:	
1.	https://www.tutorialspoint.com/selenium-for-software-testing-getting-started/index.asp
2.	https://www.softwaretestingmaterial.com/selenium-tutorial/
3.	https://www.leapwork.com/discover/selenium-automation

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

Formative Assessment based on Capstone Model - Theory

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

Assessment based on Summative Assessment - Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)						End Semester Practical Examination (50%)
CA 1 (100 Marks)		CA 2 (100 Marks)		Practical Exam (100 Marks)		
SA 1	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
C402.1	2	2	2	2	2						2	2	2	2	2
C402.2	2	2		1	2						2	2	2	2	2
C402.3	2		1	1	3						2	2	2	2	2
C402.4	2	2	1	2	1						3	3	2	3	2
C402.5	1	2	2	1	2						2	3	3	2	2
C402.6	1	3	2	1	2						2	2	2	3	2

22AD401	CLOUD COMPUTING	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:

C401.1	Demonstrate the basic global infrastructure of the AWS Cloud.	[AP]
C401.2	Identify an appropriate solution using AWS Cloud services for various use cases.	[U]
C401.3	Interpret how the components of Docker containers support compute container implementations.	[AP]
C401.4	Examine common Infrastructure Servers, Availability and Scalability.	[A]
C401.5	Learn why automation, culture, and metrics are essential to a successful DevOps project.	[U]
C401.6	Analyze various cloud models and apply them to solve problems.	[A]

Course Contents:

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

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

MODULE II CONTAINERIZATION USING DOCKERS   **15 Hours**

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

MODULE III DEVOPS   **15 Hours**

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

	Total Hours:	**45**

List of Experiments:	
1	Study of Hosted Hypervisor and Bare Metal Hypervisor.
2	Install a Virtualbox / VMware Workstation with different flavours of linux or windows S
3	Implementation of Virtual Machine(S) and create a Virtual Datacenter.
4	Configuration of Virtual Internetworking Components.

5	Configuration of Virtual Internetworking Components.
6	Install a docker engine and docker client on windows.
7	Creation and removal of container, container images.
8	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim
9	Find a procedure to transfer the files from one virtual machine to another virtual machine Using VMWare
10	Install Google App Engine. Create a hello world app and other simple web applications using python / java
	Total Hours : 30

Text Books:

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

Reference Books:

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

Web References:

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

Continuous Assessment									Total Continuous Assessment	End Semester Practical Examination	Total
Theory				Practical			Total (A+B)				
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]**
C401.1	Apply	Quiz & Assignment		20
C401.2 & C401.5	Understand	Assignment		20
C401.3	Apply	Case study		20
C401.4 & C401.6	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	

Bloom's Level		
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		FA (75M)	SA (25M)	
SA 1 (60M)	Component-I (20 Marks)	Component-II (20 Marks)	SA 2 (60M)	Component-I (20 Marks)	Component-II (20 Marks)			

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

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C401.1	3	3	3					3	3	3		3			3
C401.2	3	3	3					3	2	3		3			3
C401.3	3	3	3					3	3	3		3			3
C401.4	3	3	3					3	3	3		3			3
C401.5	3	3	3					2	3	3		3			3
C401.6	2	3	3					2	3	2		3			2

22CS402	WEB FRAMEWORKS	1/0/4/3
Nature of Course:	D (Theory Application)	
Pre requisites:	Java Programming	

Course Objectives:

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

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

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

Course Contents:

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

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

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

	Total Hours: 45

Laboratory Experiments:

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

NotContains, NotContaining and NotLike.
7. Create a Spring Boot application with Student entity and Student JPA repository. Use Spring Rest Controller API to perform CRUD operations on Student data.
8. Build a simple Rest API application called Donors. This application manages blood donors information and allows its users to Add a new donor, update existing donor information, view existing donors and delete a donor information from the application.

	Total Hours: 45

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

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

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

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

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C402.1, C402.2 & C402.3	Apply	Mini Project	40
C402.4	Understand	Quiz	20

C402.5	Apply	Case Study		20

Assessment based on Summative Assessment - Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

Assessment based on Continuous and End Semester Examination

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

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

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22AD402	DATA WAREHOUSING AND DATA MINING	2/0/2/3

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 theData Mining system.
3	To explore various Mining techniques.
4	To understand various classification and clustering techniques.
5	To analyze the cluster-based methods.

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

C402.1	Understand the basics and evolutionary path of Data Warehouse and Data Mining techniques.	[U]
C402.2	Examine data warehouse architecture, data integration, data cleansing and data transformation techniques.	[AP]
C402.3	Apply classification and Clusteringalgorithm to extract knowledge from large datasets.	[AP]
C402.4	Comprehend the important role that Data Warehouse and Data Mining play in various fields.	[U]
C402.5	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 wekatool 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 - 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(WEKA Tool)

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 MinPtsneighbours 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 usingdensity-based outlier detection method.

Text Books:	
1	Mohammed J. Zaki, Wagner Meira, Jr,"Data Mining and Machine Learning Fundamental Concepts and Algorithms", cambrdge university press,2020.
2	ParteekBhatia ,"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]**
C402.1	Understand	Quiz	20
C402.2	Apply	Tutorial	20
C402.3	Apply	Group Assignment	20
C402.4	Understand		20
C402.5	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
C402.1	1	2	1	2	2							2	2	2	1
C402.2	3	3	2	3	2							3	2	3	2
C402.3	3	3	2	3	2							2	3	3	3
C402.4	3	3	2	3	2							3	3	2	3
C402.5	3	3	2	3	2							3	3	2	3

22CS403	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

C403.1	Review the basic concepts and functions of operating systems.	[U]
C403.2	Interpret the processes and threads in operating systems for real world problems.	[U]
C403.3	Examine CPU scheduling algorithms, process synchronization mechanisms and deadlock handling methods.	[AP]
C403.4	Practice memory management techniques including virtual memory and page replacement algorithms.	[AP]
C403.5	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 Hours**

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 Hours

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]**
C403.1	Understand	Quiz	20
C403.2	Understand	Assignment	20
C403.3 & C403.4	Apply	Tutorial	20
C403.5	Apply	Case Study	20

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

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

Assessment based on Continuous and End Semester Examination							
Continuous Assessment (50%)							**End Semester Examination (50%)**
CA 1 (100 Marks)			**CA 2 (100 Marks)**			**Practical Exam (100 Marks)**	**Theory Examination (35%) Practical Examination (15%)**
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
C403.1	2	2	2						2	1		2	2	2	2
C403.2	3	3	3	2	2				2	1		3	3	2	2
C403.3	3	3	3	3	3				2	1		3	3	2	2
C403.4	3	3	3	3	3				2	1		3	3	2	2
C403.5	3	3	3						2	1		3	2	2	2
C403	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**3**	**3**	**2**	**2**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22AD501	SIGNALS, SYSTEMS AND NETWORKS	3/0/0/3
Nature of Course	G (Theory Analytical)	
Pre requisites	NIL	

Course Objectives:		
1	Understand the basic properties of signals and systems.	
2	Understanding signals and systems in terms of both time and frequency domains.	
3	Utilize the Laplace transform method to solve continuous, linear, time-invariant systems and to obtain transfer functions.	
4	Developing Expertise in time domain and frequency domain approaches to the analysis of Discrete time signals and system in Z-transform domain	
5	To learn and familiarise the functions of OSI layers and its protocols in data communication networks	

Course Outcomes:		
Upon completion of the course, students shall have ability to		
C501.1	Acquire the knowledge of signal, system and its classifications	[R]
C501.2	Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier Transform and Laplace Transform	[AN]
C501.3	Analyze system properties based on impulse response and Frequency Response	[AN]
C501.4	Apply Z-transform for the analysis of discrete-time signals and systems	[AP
C501.5	Understand the basic layers and its functions in computer networks	[U]
C501.6	Analyze the protocols for various functions in the network and examine the common layers and its protocols	[AN]

Course Contents:

CLASSIFICATION OF SIGNALS AND SYSTEMS: **15 hours**
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids - Classification of signals - Continuous time (CT) and Discrete Time (DT) signals, Periodic & aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems - CT systems and DT systems - Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable - Applications of Biomedical signal.

ANALYSIS OF CONTINOUS TIME SIGNALS AND DISCRETE TIME SIGNALS   **15 hours**
Laplace Transforms and properties - System representation using differential equations - System Analysis using Laplace transform and Fourier transform - Impulse response and step response - System representation using difference equations - System Analysis using Z -transform - Impulse response and step response - Case study: Biological Signal Analysis

DATACOMMUNICATION NETWORKING AND TRANSMISSION   **15 hours**
Introduction: Data Communications - Networks - Protocols and standards - The OSI model - TCP/IP Protocol Suite - Physical layer: Ethernet and Wi-fi - Data link layer: Error detection and correction (Parity & CRC) - Network layer: Logical Addressing - IPv4, IPv6 Addresses and Packet Formats - Transport layer: Transport layer services, User datagram protocol, Transmission control protocol - Application layer: WWW, HTTP, FTP, Electronic Mail and Domain Name System (DNS) - Case study: Investigating the impact of AI-driven applications on network protocols and its services.

Total Hours:		**45**

Text Books:		
1	Allan V. Oppenheim etal," Signals and Systems", Prentice Hall of India, 2/E, 2015	
2	Ramakrishna Rao P, "Signals and Systems", McGraw Hill Education, New Delhi, 2/E, 2013.	
3	Behrouz A. Foruzan, "Data communication and Networking", 5th Edition Tata McGraw-Hill, 2013.	

Reference Books:	
1	J. Roberts, "Fundamentals of Signals and Systems", Tata McGraw Hill, 2007.
2	Simon Haykin and Barry Van Veen "Signals and Systems", 2nd edition, Wiley 2005.
3	AS Tanenbaum, DJ Wetherall, "Computer Networks", 6th Edition, Prentice-Hall, 2021.

Web References:	
1	http://www.nptelvideos.in/2012/12/signals-and-system.html
2	http://library.aceondo.net/ebooks/Computer_Science/Data_Communication_and_Networking_by_Behrouz.A.Forouzan_4th.edition.pdf

Online Resources:	
1	https://www.edx.org/course/signals-systems-part-1-iitbombayx-ee210-1x-2
2	https://cosmolearning.org/courses/data-communication-542/video-lectures/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C501.1	Remember	Quiz	2
C501.2	Analyze	Assignment	4
C501.3	Analyze	Problem Solving	2
C501.4	Analyze	Group Assignment	4
C501.5	Understand	Assignment	4
C501.6	Analyze	Case study	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50 Marks]
	CIA1 [10 Marks]	CIA2 [10 Marks]	CIA3 [10 Marks]	
Remember	20	10	10	10
Understand	40	10	40	40
Apply	20	40	30	30
Analyse	20	40	20	20
Evaluate	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

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
C501.1	2	2	3	3	1		1				1	2	2	1	2
C501.2	3	3	3	3	1		1				1	2	2	1	2
C501.3	3	3	3	3	1		1				1	2	2	1	2
C501.4	3	3	3	3	1		1				1	2	2	1	3
C501.5	3	3	3	3	1		1				1	3	2	1	2

22AD502	MACHINE LEARNING	3/0/0/3
Nature of Course	: G (Theory Analytical)	
Pre requisites	: Data Warehousing and Mining	

Course Objectives:

1.	To introduce applications of machine learning and case studies.
2.	To provide an insight to different supervised learning techniques, merits and demerits.
3.	To enable the students to understand Graphical models and their applicability to real world problems.
4.	To explore discovering clusters in the given data.
5.	To study and evaluate dimensionality reduction for the given data.

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

C502.1	Understanding the fundamental issues and challenges of machine learning.	[U]
C502.2	Explore the acquired knowledge on concept learning and hypothesis selection.	[AP]
C502.3	Understand the concepts behind different types of learning, algorithms and their appropriateness.	[U]
C502.4	Analyse the differentiation between feature selection and feature extraction techniques in dimensionality reduction.	[A]
C502.5	Apply appropriate machine learning technique for a given real world problem.	[AP]

Course Contents:

Module I Introduction to Machine Learning   **15 Hours**

Introduction – Data Preprocessing - Designing a learning system, Issues. Examples of Machine Learning Applications, Overview: Supervised Learning, Learning Associations, Classification, Regression, Unsupervised learning and Reinforcement Learning - Concept learning and general to specific ordering: A concept learning task, concept learning as search, FIND-S: Finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, Remarks, Inductive Bias. **Case Study:** Building a Machine Learning System for Customer Churn Prediction.

Module II Supervised Learning   **15 Hours**

Generative vs discriminative learning, Decision Tree learning, Neural Networks, Support vector machines, Instance based learning, Ensemble learning – Bagging and Boosting - Linear regression, Logistic regression, other types of Regression. Face recognition and Hand-writing Recognition. **Case Study:** Spam Filtering, Predicting Loan Default using Supervised Learning.

Module III Unsupervised Learning and Reinforcement Learning   **15 Hours**

Unsupervised learning Algorithms: Gaussian mixture models, Discovering clusters, Discovering latent factors, Dimensionality reduction – Principal Component Analysis. **Case Study**: You tube video Recommendation - Utilizing unsupervised learning techniques to perform customer segmentation for a retail company. Genetic programming, Reinforcement learning: the learning task, Q learning, non-deterministic rewards and actions. **Case Study:** Applying Reinforcement Learning for Autonomous Drone Navigation.

	Total Hours:	**45 Hours**

Text Books:	
1.	Harsh Bhasin, "Machine Learning for Beginners", BPB Publications, January 2020.
2.	Kevin P. Murphy, "Machine Learning A probabilistic Perspective", MIT press, 2018.
3.	Tom M. Mitchell , " Machine Learning", 3rd Edition, Tata McGrawHill, 2015.
4.	Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 3rd edition, Paperback, October 2022.
Reference Books:	
1.	Manuel Garcia-Piqueras,"Heuristic search of optimal machine teaching",Springer, 2023.
2.	Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2017.
3.	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
Web References:	
1.	https://onlinecourses.nptel.ac.in/noc16_cs18/
2.	http://freevideolectures.com/Course/2257/Machine-Learning
3.	https://towardsdatascience.com/machine-learning/

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]**
C502.1	Understand	Quiz	20
C502.2	Apply	Tutorial	20
C502.3	Understand	Group Assignment	20
C502.4	Analyze		
C502.5	Apply	Presentation	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%)**
CA 1 : 100 Marks	**CA 2 : 100 Marks**	

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

COs	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C502.1	2	3	3	3	2	2						2	2	3	2
C502.2	2	3	3	3	2	2						2	2	3	2
C502.3	3	3	2	3	2	2						2	3	2	3
C502.4	2	3	2	3	2	2						2	3	2	2
C502.5	2	3	3	2	3	2						2	3	3	3
	3	Strongly agreed		2	Moderately agreed		1	Weakly agreed							

22AD503	DATA SCIENCE USING R	2/0/2/3
Nature of Course	F (Theory Programming)	
Prerequisites	Python Essentials	

Course Objectives:

1	Apply quantitative modelling and data analysis techniques to the solution of real-world business problems.
2	To exercise the fundamentals of statistical analysis in the R environment.
3	To analyse data for the purpose of exploration using Descriptive and Inferential Statistics.
4	To use descriptive, predictive and prescriptive analytics to drive growth.
5	To extract valuable information for use in strategic decision making, product development, trend analysis, and forecasting.

Course Outcomes:

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

C503.1	Understand the core concepts likedata types, variables, control flow structures, functions and data structures.	[U]
C503.2	Apply R programming essentials to manipulate, clean and analyse data.	[AP]
C503.3	Implement and explore proficiency in using packages like dplyr and tidyr for data wrangling tasks such as filtering, transforming and summarizing data.	[AP]
C503.4	Examine skills in data visualization using R's powerful graphics capabilities.	[A]
C503.5	Analyse and explore regression analysis, hypothesis testing and other statistical modelling techniques.	[A]

Course Contents:

MODULE I: INTRODUCTION TO R   **15 Hours**

Overview of R Language - Data Types - Variable - Operators - Decision Making - Loop control - Array - String - Function - Vector - Lists - Matrices - **Factors - Data Frames –Merging Data Frames - Packages - Data and File Management - Charts & Graphs. Case study: Analyze the dataset and derive insights to make data-driven decisions.**

MODULE II: DATA ANALYSIS AND VISUALIZATION   **15 Hours**

Introduction to data science - Data visualization - A grammar for graphics - Data Pre-processing - Data wrangling on one table - Data wrangling on multiple tables - Tidy data – Iteration – Outlier Detection - Dimensionality reduction - Time series analysis - Model evaluation and validation - Ensemble methods. Case study: Perform data analysis and visualization to uncover patterns, trends, and insights related to customer satisfaction and feedback.

MODULE III: STATISTICS AND MODELING   **15 Hours**

Statistical foundations - Predictive modelling –Logistic Regression – Random Forest – Naïve Bayes – Hierarchical Clustering - Support Vector Machines - Decision Trees - Gradient Boosting - Time Series Forecasting - Anomaly Detection - Model Selection and Hyperparameter Tuning - Survival Analysis. Case study: Fit a series of supervised learning models to predict arrival delays for flights from New York to SFO using the nycflights13 package.

	Total Hours:	**45 Hours**

Lab Component

1. Getting Used to R: Describing Data – Calculate and summary statistics such as mean, median, and standard deviation based on student grade.

2. Creating and displaying Data - Create a dataset to store information about employees, including their names, ages, and salaries

3. Creating and manipulating a List and an Array - Manipulate the list to add or remove elements for a set of student list with their corresponding grades.

4. Creating a Data Frame and Matrix-like Operations on a Data Frame.

5. String Manipulations - Suppose you have a dataset containing customer names and email addresses. How would you use R to perform string manipulations, such as extracting the domain name from email addresses or converting names to uppercase.

6. Data transpose operations in R - Imagine you have a dataset with observations in rows and variables in columns. How would you use R to transpose the data, converting the rows into columns and vice versa.

7. Probability Distributions - Working on a project that requires modelling a random variable with a specific probability distribution, such as the normal distribution.

8. Basic Statistics in R – Consider a dataset containing the heights of individuals, calculate basic statistics such as mean, median, standard deviation, and correlation coefficients

9. Visualizing Data - Tables, charts and plots - create a line chart showing the monthly sales trends for each product category over the past year and a stacked bar chart comparing the sales distribution among different regions for the top-selling product category.

10. Creating models for prediction - Develop a predictive model using the dataset to identify customers who are at a high risk.

	Total Hours: 30 Hours

Text Books:

1	Vinod MotiramRathod, Harish SadashivMotekar, ReshmaRamakantKanse, "Data Science Using R", Book Rivers, August 2023.
2	Benjamin S. Baumer, Daniel T. Kaplan, and Nicholas J. Horton, "Modern Data Science with R", 2nd edition, CRC Press, July 28, 2021.
3	Hadley Wickham & Garrett Grolemund "R for Data Science - Import, Tidy, Transform, Visualize, and Model Data", O'Reilly , 1st edition, December 2016.

Reference Books:

1	Tilman M. Davies, "The Book of R", No Starch Press, 1st edition, July 16 2016.
2	Joel Grus, "Data Science from Scratch", O'Reilly, 1st edition, April 2015.
3	Norman Matloff, "The Art of R Programming", No Starch Press, 1st edition, 2011.
4	Garrett Grolemund, "Hands on programming with R", O'Reilly , 1st edition, July 22 2014.

Web References:

1	https://nptel.ac.in/courses/106/106/106106179/
2	https://www.atnyla.com/syllabus/r-programming-language/7

Online References:

1	https://www.knowledgehut.com/blog/data-science/r-for-data-science
2	https://www.coursera.org/specializations/data-science-foundations-r
3	https://www.mastersindatascience.org/learning/data-scientist-skills/r/

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	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C503.1	Understand	Quiz	20
C503.2	Apply	Tutorial	20
C503.3	Apply	Group Assignment	20
C503.4	Analyze		
C503.5	Understand	Presentation	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (25%) [120 Marks]		End Semester Examination (25%) [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 - 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%) Practical Examination (25%)
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) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C503.1	2	3	3	3	2							1	2	3	
C503.2	2	3	3	3	2							1	2	3	
C503.3	3	3	2	3	2							1	3	2	3
C503.4	2	3	2	3	2							1	3	2	
C503.5	2	3	3	2	3							1	3	2	3

	3	Strongly agreed	2	Moderately agreed	1	Weakly agreed

22AD504	**MACHINE LEARNING LABORATORY**	**0/0/3/1.5**
Nature of Course	: L (Programming)	
Pre requisites	: Python Essentials	

Course Objectives:		
1.	To understand the basic concepts and techniques of Machine Learning through python programming.	
2.	To enable the students to understand Graphical models and their applicability to real world problems.	
3.	To develop skills of using recent machine learning packages for solving practical problems.	
4.	To explore discovering clusters in the given data.	
5.	To study and evaluate dimensionality reduction for the given data.	

Course Outcomes:

Upon completion of the course, students shall have ability to

C504.1	Explore the hands-on experience in implementing and applying various machine learning algorithms.	[AP]
C504.2	Explorethe knowledge on how topreprocess and transform raw data to make it suitable for machine learning tasks.	[AP]
C504.3	Design and implement classifiers and clustering algorithms for machine learning applications.	[AP]
C504.4	Choose and implementappropriate algorithms based on the problem at hand and apply them effectively.	[A]
C504.5	Apply machine learning in various domains, such as healthcare, finance, marketing, and computer vision, etc.	[AP]

Course Contents:

1. Implementation of Gaussian Mixture Models - A marketing company wants to identify different customer segments based on their purchasing behaviour. They have collected data on customer transactions.
2. Implementation of Data Pre – Processing - A research team is working with a large dataset that contains missing values and outliers. Before proceeding with their analysis, they need to preprocess the data, handle the missing values and outliers effectively.
3. Implementation of Decision Tree Classifier - A credit card company wants to build a model that predicts whether a customer is likely to default on their payment. They have historical data on customer attributes and payment behaviour.
4. Implementation of Neural Networks Algorithm - An image recognition startup aims to develop a deep learning model that can accurately classify images into different categories.
5. Implementation of Support Vector Machines - A healthcare organization wants to predict the likelihood of a patient developing a particular disease based on their medical history. They have collected a large dataset with patient attributes and disease outcomes.
6. Implementation of K- nearest Neighbor Classifier - An e-commerce company wants to recommend products to customers based on their browsing history and previouspurchases.
7. Implementation of Regression Algorithm - A real estate agency wants to predict housing prices based on factors such as location, size, and amenities. They have collected data

on recently sold properties.

8. Implementation of Clustering Algorithm - A retail chain wants to group their customers into distinct segments based on their purchasing patterns. They have collected data on customer transactions.

9. Implementation of Dimensionality Reduction Algorithm - A data analysis team wants to reduce the dimensionality of a high-dimensional dataset to improve computational efficiency and remove noise.

10. Mini Project

Total Hours: 45

Text Books:

1.	AurélienGéron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 3rd edition, Paperback, October 2022.
2.	Oliver Theobald, "Machine Learning for Absolute Beginners", 3rd edition, Scatterplot Press, 2021
3	Tom M. Mitchell, "Machine Learning", 3rd Edition, Tata McGrawHill, 2015.
4	EthemAlpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", 3rd Edition, MIT Press, 2014.

Reference Books:

1.	Kevin P. Murphy, "Machine Learning A Probabilistic Perspective", MIT press, 2012.
2.	Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2014.
3.	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Web References:

1.	https://onlinecourses.nptel.ac.in/noc16_cs18/
2.	http://freevideolectures.com/Course/2257/Machine-Learning
3.	https://www.youtube.com/watch?v=8l6RPr17xac

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	30	30	30
Evaluate	10	10	10

Create	-	-	-

<table>
<tr><td colspan="16">Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)</td></tr>
<tr><td rowspan="2">COs</td><td colspan="12">POs</td><td colspan="3">PSOs</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>C504.1</td><td>2</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>2</td><td>2</td><td>3</td><td>2</td></tr>
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<tr><td>C504.4</td><td>2</td><td>3</td><td>2</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>2</td><td>2</td></tr>
<tr><td>C504.5</td><td>2</td><td>3</td><td>3</td><td>2</td><td>3</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>2</td><td>3</td></tr>
<tr><td></td><td colspan="15">3 Strongly agreed   2 Moderately agreed   1 Weakly agreed</td></tr>
</table>

22MC101		**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)

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
Course Articulation Matrix (Lab)															
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				

22MC201	**ENVIRONMENTAL SCIENCES**	**2 /0 /0 /0**

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

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

Natural Resources:

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

Environmental Pollutions:

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

Social issues and the Environment:

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

	Total Hours:	**30**

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

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

Web References:		
	1	http://nptel.ac.in/courses/104103020/20

2	http://nptel.ac.in/courses/120108002
3	http://nptel.ac.in/courses/122106030
4	http://nptel.ac.in/courses/120108004/
5	http://nptel.ac.in/courses/122102006/20

Online Resources:

1	https://www.edx.org/course/subject/environmental-studies
2	www.environmentalscience.org

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

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

Course Outcome	Bloom's Level	Assessment Component	Marks
C201.1	Remember	Quiz	**10**
C201.2	Understand	Mini project based on environmental aspect	**20**
C201.3	Understand	Class Presentation	**10**
C201.4	Apply	Group 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
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
C102.1						2	2						2		
C102.2						2	2						2		
C102.3						2	2							2	
C102.4						3	3						2		
C102.5						3	3						2		

22MC103		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

22MC105		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 and Streams- 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		

22MC106	**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		

22MC107	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		

22MC108	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	

22MC109	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	

22VA701	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

22VA702	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

22VA130		**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