



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 2021



**SRI KRISHNA COLLEGE OF
ENGINEERING AND TECHNOLOGY**



**DEPARTMENT OF
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

REGULATION 2021

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 the limitations.

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 clear instructions.

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
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Sem	Course Code	Course	Programme Outcomes											
			1	2	3	4	5	6	7	8	9	10	11	12
Semester 1	21AD101	Python for Data Science	3	3	3	3	3	3	1	1			1	1
	21MA101	Engineering Mathematics I	2	2	2						2			
	21CH101	Engineering Chemistry	2	2	3				2		1			
	21AD102	Computer Organization and Digital Logic	3	3	3					2				
	21AD103	Python Laboratory	3	3	3		2			2	2	2	2	3
	21ME103	Engineering Practices laboratory	3	3	3		3		3		3	2		
	21MC101	Mandatory Course-I (Induction Programme)						3	3	3	3	3	3	3
Semester 2	21GE201	Universal Human Values	2	2	2			3	3	3	2	2		2
	21MA201	Engineering Mathematics II	3	3	2						2			
	21EN101	Technical Communication Skills								1	3	3		2
	21PH104	Physics	2	1	2						1			
	21AD201	Data Structures using C	3	3	3	3	3							2
	21ME111	Engineering Graphics	2	2	1				2	2	3			2

	21MC102	Mandatory Course-II (Environmental Sciences)						2	3					
Semester 3	21AD301	Artificial Intelligence Principles and Techniques	2	2	3	3	2				2	1		2
	21MA302	Mathematical Structures	3	3	3	3	2				2	3		2
	21AD302	Analysis of Algorithms	2	2	3	3	2				3	2		3
	21IT301	Web Development using React	3	3	3	3	3	2			3	1		3
	21CS302	Java Programming	3	3	3	3	2				1			2
	21CS303	Managing Data using RDBMS	2	2	3	3	3		2		3	2	2	3
	21MCXXX	Mandatory Course-III	2	2	3	2	1				1	1		2
Semester 4	21AD401	Fundamentals of Operating Systems	2	2	3	3	2				2	3		3
	21AD402	Data Warehousing and Mining	2	2	3	3	2				2	3		3
	21MA404	Random Variables and Statistics	2	2	2	3	2				2	2		2
	21IT402	Software Testing using Selenium	2	2	3	3	2	2	2		3	3		3
	21AD403	Cloud Computing	1	2	3	2	3				3	3	3	3
	21CS402	Web Frameworks	3	3	3	1	2				1	1		2
	21AD404	Fundamentals of Operating Systems Laboratory	2	2	2	3	2				2	2		2
	21MCXXX	Mandatory Course-IV	2	2	3	3	1	2			1	1	1	2

B. TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATION 2021 (Batch : 2021 – 2025)

SEMESTER I							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY							
1	21AD101	Python for Data Science	3/0/0	3	3	60/40	PC
THEORY CUM PRACTICAL							
2.	21MA101	Engineering Mathematics I	2/1/2	5	4	50/50	BSC
3.	21CH101	Engineering Chemistry	3/0/3	6	4.5	50/50	BSC
4.	21AD102	Computer Organization and Digital Logic	3/0/2	5	4	50/50	ESC
PRACTICAL							
5.	21AD103	Python Laboratory	0/0/3	3	1.5	40/60	PC
6	21ME103	Engineering Practices laboratory	0/0/3	3	1.5	40/60	ESC
MANDATORY COURSE							
7.	21MC101	Mandatory Course-I (Induction Programme)	3 weeks				MC
Total				25	18.5	600	

SEMESTER II							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY							
1	21GE201	Universal Human Values	3/0/0	3	3	60/40	HSMC
THEORY CUM PRACTICAL							
2.	21MA201	Engineering Mathematics II	2/1/2	5	4	50/50	BSC
3.	21EN101	Technical Communication Skills	2/0/2	4	3	50/50	HSMC
4.	21PH104	Physics	3/0/3	6	4.5	50/50	BSC
5.	21AD201	Data Structures using C	3/0/2	5	4	50/50	PC

PRACTICAL							
6.	21ME111	Engineering Graphics	1/0/3	4	2.5	40/60	ESC
MANDATORY COURSE							
7.	21MC102	Mandatory Course-II (Environmental Sciences)	2/0/0	2	0	0/100	MC
Total				29	21	700	

SEMESTER III							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY							
1.	21AD301	Artificial Intelligence Principles and Techniques	3/0/0	3	3	60/40	PC
THEORY CUM PRACTICAL							
2.	21MA302	Mathematical Structures	2/1/2	5	4	50/50	BSC
3.	21AD302	Analysis of Algorithms	3/0/2	5	4	50/50	PC
4.	21IT301	Web Development using React	3/0/2	5	4	50/50	PC
5.	21CS302	Java Programming	3/0/2	5	4	50/50	PC
6.	21CS303	Managing Data using RDBMS	3/0/2	5	4	50/50	PC
MANDATORY COURSE							
7.	21MCXXX	Mandatory Course-III	2/0/0	2	0	0/100	MC
Total				30	23	700	

SEMESTER IV							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY							
1.	21AD401	Fundamentals of Operating Systems	3/0/0	3	3	60/40	PC
2.	21AD402	Data Warehousing and Mining	3/0/0	3	3	60/40	PC
THEORY CUM PRACTICAL							
3.	21MA404	Random Variables and Statistics	2/1/2	5	4	50/50	BSC

4.	21IT402	Software Testing using Selenium	3/0/2	5	4	50/50	PC
5.	21AD403	Cloud Computing	3/0/2	5	4	50/50	PC
6.	21CS402	Web Frameworks	3/0/2	5	4	50/50	PC
PRACTICAL							
7.	21AD404	Fundamentals of Operating Systems Laboratory	0/0/3	3	1.5	40/60	PC
MANDATORY COURSE							
8.	21MCXXX	Mandatory Course-IV	2/0/0	2	0	0/100	MC
Total				31	23.5	800	

SEMESTER V							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY							
1.	21AD9XX	Professional Elective –I	3/0/0	3	3	60/40	PEC
2.	21AD9XX	Professional Elective –II	3/0/0	3	3	60/40	PEC
3.	21XXXXX	Open Elective –I	2/0/2	4	3	60/40	OEC
4.	21AD501	Fundamentals of Signals and Systems	3/0/0	3	3	60/40	ESC
5.	21AD502	Machine Learning	3/0/0	3	3	60/40	PC
THEORY CUM PRACTICAL							
6.	21AD503	Data Science Using R	3/0/2	6	4	50/50	PC
7.	21AD504	Machine Learning Laboratory	0/0/3	3	1.5	50/50	PC
MANDATORY COURSE							
8.	21MCXXX	Mandatory Course-V	2/0/0	2	0	0/100	MC
PROJECT WORK							
9.	21AD505	Mini Project –I	0/0/2	2	1	40/60	PW
Total				29	21.5	900	

SEMESTER VI							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY							
1.	21AD601	AI in Natural Language Processing	3/0/0	3	3	60/40	PC
2.	21AD602	Introduction to Computer Networks	3/0/0	3	3	60/40	ESC
3.	21AD9XX	Professional Elective –III	3/0/0	3	3	60/40	PEC
4.	21AD9XX	Professional Elective –IV	3/0/0	3	3	60/40	PEC
5.	21ADXXX	Emerging Elective –I	3/0/0	3	3	60/40	EEC
THEORY CUM PRACTICAL							
6.	21AD603	Data visualization using Tableau	3/0/3	6	4.5	50/50	PC
PRACTICAL							
7.	21AD604	NLP Laboratory	0/0/3	3	1.5	40/60	PC
8.	21AD605	Networks Laboratory	0/0/3	3	1.5	40/60	ESC
PROJECT WORK							
9.	21AD605	Mini Project –II	0/0/2	2	1	40/60	PW
Total				29	23.5	900	

SEMESTER VII							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
THEORY							
1.	21AD9XX	Professional Elective –V	3/0/0	3	3	60/40	PEC
2.	21AD9XX	Professional Elective –VI	3/0/0	3	3	60/40	PEC
3.	21XXXXX	Open Elective –II	2/0/2	4	3	60/40	OEC
4.	21ADXXX	Emerging Elective –II	3/0/0	3	3	60/40	EEC
THEORY CUM PRACTICAL							
5.	21AD701	Data Analytics	3/0/2	5	4	50/50	PC

6.	21AD702	Deep Learning and its Applications	3/0/2	5	4	50/50	PC
EMPLOYABILITY ENHANCEMENT SKILLS							
7.	21EES01	Employability Enhancement Skills (Summer Internship / Summer Training – 4 weeks)			2	0/100	EES
Total				23	22	700	

SEMESTER VIII							
S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
Project Work							
1	21AD801	Project	0/0/24	24	12	40/60	PW
Total				24	12	100	

HUMANITIES (6 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1	21EN101	Technical Communication Skills	2/0/2	4	3	HSMC
2	21GE201	Universal Human Values	3/0/0	3	3	HSMC

BASIC SCIENCES (25 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1	21MA101	Engineering Mathematics I	2/1/2	5	4	BSC
2	21CH101	Engineering Chemistry	3/0/3	6	4.5	BSC
3	21MA201	Engineering Mathematics II	2/1/2	5	4	BSC
4	21PH104	Physics	3/0/3	6	4.5	BSC
5	21MA302	Mathematical Structures	2/1/2	5	4	BSC
6	21MA404	Random Variables and Statistics	2/1/2	5	4	BSC

ENGINEERING SCIENCE (15.5 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	21AD102	Computer Organization and Digital Logic	3/0/2	5	4	ESC
2.	21ME103	Engineering Practices laboratory	0/0/3	3	1.5	ESC
3.	21ME111	Engineering Graphics	1/0/3	4	2.5	ESC
4.	21AD501	Fundamentals of Signals and Systems	3/0/0	3	3	ESC
5.	21AD602	Introduction to Computer Networks	3/0/0	3	3	ESC
6.	21AD605	Networks Laboratory	0/0/3	3	1.5	ESC

PROFESSIONAL CORE (72.5 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	21AD101	Python for Data Science	3/0/0	3	3	PC
2.	21AD103	Python Laboratory	0/0/3	3	1.5	PC
3.	21AD201	Data Structures using C	3/0/2	5	4	PC
4.	21AD301	Artificial Intelligence Principles and Techniques	3/0/0	3	3	PC
5.	21AD302	Analysis of Algorithms	3/0/2	5	4	PC
6.	21IT301	Web Development using React	3/0/2	5	4	PC
7.	21CS303	Managing Data using RDBMS	3/0/2	5	4	PC
8.	21CS302	Java Programming	3/0/2	5	4	PC
9.	21AD401	Fundamentals of Operating Systems	3/0/0	3	3	PC
10.	21AD402	Data Warehousing and Mining	3/0/0	3	3	PC
11.	21AD404	Fundamentals of Operating Systems Laboratory	0/0/3	3	1.5	PC

12.	21IT402	Software Testing using Selenium	3/0/2	5	4	PC
13.	21AD403	Cloud Computing	3/0/2	5	4	PC
14.	21CS402	Web Frameworks	3/0/2	5	4	PC
15.	21AD502	Machine Learning	3/0/0	3	3	PC
16.	21AD503	Data Science Using R	3/0/2	6	4	PC
17.	21AD504	Machine Learning Laboratory	0/0/3	3	1.5	PC
18.	21AD601	AI in Natural Language Processing	3/0/0	3	3	PC
19.	21AD603	Data visualization using Tableau	3/0/3	6	4.5	PC
20.	21AD604	NLP Laboratory	0/0/3	3	1.5	PC
21.	21AD701	Data Analytics	3/0/0	3	4	PC
22.	21AD702	Deep Learning and its Applications	3/0/0	3	4	PC

PROFESSIONAL ELECTIVES (18 CREDITS)

PROFESSIONAL ELECTIVE STREAM I (SOFTWARE DEVELOPMENT)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	21AD901	Artificial Neural Networks	3/0/0	3	3	PEC
2.	21AD902	Semantic Web	3/0/0	3	3	PEC
3.	21AD903	Virtual Reality and Augmented Reality	3/0/0	3	3	PEC
4.	21AD904	Bio Informatics	3/0/0	3	3	PEC
5.	21AD905	Internet of Things	3/0/0	3	3	PEC
6.	21CS901	Dot Net Framework Essentials	2/0/2	3	3	PEC

7.	21CS902	MEAN Full Stack Development	2/0/2	3	3	PEC
8.	21AD906	MERN Full Stack Development	2/0/2	3	3	PEC
9.	21AD907	Amazon Web Services	2/0/2	3	3	PEC
10.	21IT901	Microsoft Azure	2/0/2	3	3	PEC
11.	21IT902	DevOps	2/0/2	3	3	PEC

PROFESSIONAL ELECTIVE STREAM II (DATA SCIENCE AND COMPUTATIONAL INTELLIGENCE)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	21AD911	Bayesian Data Analysis	3/0/0	3	3	PEC
2.	21AD912	Sentiment Analysis	3/0/0	3	3	PEC
3.	21AD913	Information Extraction and Retrieval	3/0/0	3	3	PEC
4.	21AD914	Cognitive Systems	3/0/0	3	3	PEC
5.	21AD915	Advanced Database Technology and Design	3/0/0	3	3	PEC
6.	21AD916	Biology for Engineers	2/0/2	3	3	PEC
7.	21AD917	Web and Social media Mining	3/0/0	3	3	PEC
8.	21AD918	Introduction to Brain and Neuroscience	3/0/0	3	3	PEC
9.	21AD919	Reinforcement Learning	3/0/0	3	3	PEC
10.	21AD920	Data Science Applications of NLP	3/0/0	3	3	PEC
11.	21IT914	Predictive Analytics	2/0/2	3	3	PEC

PROFESSIONAL ELECTIVE STREAM III (NETWORKS AND SECURITY)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credits	Category
1.	21AD921	Image Signal processing	3/0/0	3	3	PEC
2.	21AD922	Computational Statistics for Data Science	3/0/0	3	3	PEC
3.	21AD923	Ethics in Data Science	3/0/0	3	3	PEC
4.	21AD924	Business Intelligence	3/0/0	3	3	PEC
5.	21AD925	Intelligent Multi Agent and Expert systems	3/0/0	3	3	PEC
6.	21IT921	Network Security	2/0/2	3	3	PEC
7.	21CS921	Cyber Security	2/0/2	3	3	PEC
8.	21AD926	Enterprise Network Security	2/0/2	3	3	PEC
9.	21AD927	Web Security using Burp Suite	2/0/2	3	3	PEC
10.	21IT922	GOAT – Security Intelligence	2/0/2	3	3	PEC
11.	21CS922	Open Vulnerability Assessment System	2/0/2	3	3	PEC

OPEN ELECTIVE COURSES (6 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	21AD001	Fundamentals of Database Systems	2/0/2	4	3	OEC
2.	21AD002	Information Retrieval Techniques	2/0/2	4	3	OEC
3.	21AD003	Machine Learning Algorithms in Python	2/0/2	4	3	OEC
4.	21AD004	Data Visualization using R	2/0/2	4	3	OEC
5.	21AD005	Introduction to Data Analytics	2/0/2	4	3	OEC
6.	21AD006	Introduction to Deep Learning	2/0/2	4	3	OEC

EMERGING ELECTIVE COURSES (6 CREDITS)

S.No	Course Code	Course	L/T/P	Contact hrs/week	Credit	Category
1.	21AD007	Autonomous Systems and Drones	3/0/0	3	3	EEC
2.	21AD008	Crypto currencies	3/0/0	3	3	EEC
3.	21AD009	AI in Healthcare Applications	3/0/0	3	3	EEC
4.	21AD010	Scalable System for Data Science	3/0/0	3	3	EEC
5.	21AD011	Computer Vision	3/0/0	3	3	EEC
6.	21AD012	Data Engineering on Google Cloud Platform	3/0/0	3	3	EEC

EMPLOYABILITY ENHANCEMENT SKILLS (2 CREDITS)

S.No	Course Code	Course	Duration	Credit	Category
1.	21EES01	Employability Enhancement Skills (Summer Internship / Summer Training)	4 WEEKS	2	EES

MANDATORY COURSES (NON-CREDIT)

S.No	Course Code	Course	Category
1.	21MC101	Induction Programme	MC
2.	21MC102	Environmental Sciences	MC
3.	21MC103	Soft Skills	MC
4.	21MC104	Management Organizational Behaviour	MC
5.	21MC105	General Aptitude	MC
6.	21MC106	Life Skills and Ethics	MC
7.	21MC107	Stress Management	MC
8.	21MC108	Constitution of India	MC
9.	21MC109	Essence of Indian Traditional Knowledge	MC
10.	21MC110	Biology	MC

Scheme of Distribution

S.NO	Stream	Credits/Semester								Credits	AICTE Norms
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities (HSMC)		6							6	12
2.	Basic Sciences (BSC)	8.5	8.5	4	4					25	24
3.	Engineering Sciences (ESC)	5.5	2.5			3	4.5			15.5	29
4.	Professional Core (PC)	4.5	4	19	19.5	8.5	9	8		72.5	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	1		12	14	15
9.	Employability Skills							2		2	
10.	Mandatory Course (MC)									-	
Total		18.5	21	23	23.5	21.5	23.5	22	12	165	
AICTE(CSE)		17.5	20.5	23	22	21	22	20	15		159

21AD101	PYTHON FOR DATA SCIENCE		3/0/0/3
Nature of Course		F (Theory and Programming)	
Course Objectives:			
1	To understand and execute Python script using types and expressions		
2	To understand the difference between expressions & statements and to understand the concept of assignment semantics.		
3	To utilize high level data types such as lists and dictionaries.		
4	To import and utilize a module and to perform read & write operations on files.		
5	To use latest python libraries for data science in real time paradigms.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Recognize the general principles and good Algorithmic problem solving.		[U]
C101.2	Read, write, execute by hand simple Python programs.		[U]
C101.3	Structure simple Python programs for solving problems.		[U]
C101.4	Decompose a Python program into functions.		[AP]
C101.5	Represent compound data using Python lists, tuples and dictionaries.		[AP]
C101.6	Read and write data from data sheets and Analyse data.		[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.			
Control Flow, Functions, Lists, Dictionaries:			(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; Tuples: Tuple Assignment, Tuple As Return Value; Dictionaries: Operations And Methods, Exception handling, Files-reading and writing

Python Libraries for Data Science:

(15 Hrs)

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: Analyze the academic performance of students and plot a graph.

Total Hours: 45

Text Books:

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

Reference Books:

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

Web References:

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

Online Resources:

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

Assessment Methods & Levels (based on Blooms' Taxonomy)
Formative assessment based on Capstone Model (16%)

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)	Marks
C101.1, C101.2	Understand	Quiz	4
C101.3	Understand	Assignment	4
C101.4	Apply	Idea Presentation	4
C101.5	Analyze	Case Study	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (24%)		End Semester Examination (60%) [60 Marks]
	CIA1 [12 Marks]	CIA2 [12 Marks]	
Remember	10	10	10
Understand	30	30	30
Apply	30	30	30
Analyse	30	30	30
Evaluate			
Create			

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)	

* SA 1 & SA 2 are continuous internal examination conducted each for 100 marks

* FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.

* ES exams conducted and evaluated for 100 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
C101.1	3	3	2	2	3	3	3	3	1	1	2	2	2	3	3

C101.2	3	3	3	3	2	2	2	3			2	3	3	3	2
C101.3	3	3	2	2	3	3	3	3	1	1	2	2	3	2	2
C101.4	3	3	3	3	2	2	2	3			2	3	2	2	3
C101.5	3	3	2	2	3	3	3	3			2	2	3	3	
C101.6	3	3	2	2	3	3	3	3			2	2	3	3	3

21MA101	ENGINEERING MATHEMATICS I		2/1/2/4
Nature of Course		J (Problem analytical)	
Pre requisites		Concept of Differentiation and Matrices	
Course Objectives:			
1	To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.		
2	To know about system of linear equations and its solution set and how to write down the coefficient matrix and augmented matrix of a linear system		
3	To familiarize with functions of several variables applicable in many branches of engineering.		
4	To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Recall the concepts of matrices, ordinary and partial derivatives.		[R]
C101.2	Express square matrix in the diagonal form.		[U]
C101.3	Solve systems of linear equations numerically and to find inverse matrices.		[AP]
C101.4	Apply numerical techniques effectively to analyse and visualize data to solve basic engineering-related problems.		[AP]
C101.5	Find the extreme values of the given functions to solve the engineering problems.		[AP]
C101.6	Find the solution of second and higher order differential equations connected with electric circuits and simple harmonic motion.		[AP]
Course Contents:			
MATRICES:		(14 Hrs)	
Definition – Types of matrices – Characteristic equation – Eigenvalues and eigenvectors of a real matrices and their properties (statement only) – Cayley-Hamilton theorem (statement only) – Verification and application to find inverse and powers of real matrices – Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by Orthogonal transformation.			
SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS:		(16 Hrs)	
Newton-Raphson method – Fixed point iteration method– Gauss-Elimination method – Gauss-Jordan method –Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigenvalue of a matrix by Power method and Jacobi method.			

CALCULUS:		(18 Hrs)
Concepts of limits and continuity –Functions of several variables – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion – Maxima and Minima – Method of Lagrangian multipliers – Ordinary differential equations –Higher order linear differential equations with constant coefficients –Euler Cauchy’s equations – Applications of ODE: Solving electrical circuits and simple harmonic motion.		
Lab Component		
1. Entering row vector, column vector, accessing blocks of elements in MATLAB.		
2. Entering matrices, to locate matrix elements and correcting any entry through indexing in MATLAB.		
3. Sum, product, transpose, inverse, determinant and rank of a matrices using MATLAB.		
4. Eigenvalues and eigenvectors of a matrix using MATLAB.		
5. System of linear equations in MATLAB using Gaussian elimination.		
6. System of linear equations in MATLAB using matrix inverse method.		
7. System of linear equations in MATLAB using linsolve.		
8. First and second derivative of single variable functions using MATLAB.		
9. Maxima and Minima of a function using MATLAB.		
10. Higher Order Equations of constant coefficients using MATLAB.		
Total Hours:(48+12)		60
Text Books:		
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 th Edition,Pearson, Reprint,2018	
2	Kreyszig. E, “Advanced Engineering Mathematics” Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.	
3	Grewal. B.S, “Higher Engineering Mathematics”, 43 rd edition, Khanna Publications, Delhi, 2018.	
Reference Books:		
1	Veerarajan. T, “Engineering Mathematics I”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.	
2	Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4 th edition, 2012.	
3	N.P.Bali and Dr.ManishGoyal,”A Text book of Engineering Mathematics” 9 th edition, Laxmi publications Ltd, 2014.	
Web References:		

1	http://www.nptel.ac.in/courses/111105035
2	http://www.nptel.ac.in/courses/122104017
3	http://www.nptel.ac.in/courses/122102009
4	http://www.nptel.ac.in/courses/111107063
Online Resources:	
1	https://www.coursera.org/learn/linearalgebra2
2	https://www.coursera.org/learn/differentiation-calculus
3	https://www.coursera.org/learn/single-variable-calculus
4	https://alison.com/courses/Algebra-Functions-Expressions-and-Equations

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								End Semester Examination (50%)
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 marks)	
	Compon ent -I (2 marks)	Compon ent -II (2 marks)		Compon ent -III (2 marks)	Compon ent -IV (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcom e	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				Marks		
C101.1	Remember	Component – I		Quiz		2		
C101.2	Understand	Component - II		Assignment		2		
C101.3	Apply	Component - III		Seminar		2		
C101.4	Apply							
C101.5	Apply	Component - IV		Tutorial		2		
Summative assessment based on Continuous and End Semester Examination								
Bloom's Level	Continuous Assessment (12%)				End Semester Examination (50%) [50 Marks]			
	CIA1 [6 Marks]		CIA2 [6 Marks]					
Remember	30		30		20			
Understand	50		40		50			
Apply	20		30		30			
Analyse	-		-		-			
Evaluate	-		-		-			
Create	-		-		-			
Summative assessment based on Continuous and End Semester Examination – Practical								
Bloom's Level	Continuous Assessment (30%)					SA (8 Marks)		
	FA (22 Marks)							

Remember	20	20
Understand	30	30
Apply	50	50
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
C101.1	3	2	3						2				2		
C101.2	2	2	2						1				2		
C101.3	1	2	2										2	2	
C101.4	2	2	2						2				2	1	
C101.5	2	3	2						2				2	1	
C101.6	2	3	2						2				2	1	

21CH101	ENGINEERING CHEMISTRY		3 /0 /3 /4.5
Nature of Course	: E (Theory skill based)		
Pre requisites	: NIL		
Course Objectives:			
1	To make the students conversant with water treatment, boiler feed water techniques.		
2	To learn the effect of corrosion in materials and the methods for prevention of corrosion.		
3	To understand the principles and applications of electrochemistry and to learn electro analytical methods.		
4	To understand the basic concepts, synthesis, and applications of nanomaterials.		
5	To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules.		
6	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 requirements of water treatment procedures and boiler feed water for industries.		[R]
C101.2	Apply the various corrosion control techniques in real time industrial environments.		[AP]
C101.3	Understand the principle and working of reference electrodes and conductivity meters as an analyzer.		[U]
C101.4	Understand the basic concepts and applications of Nanochemistry.		[U]
C101.5	Use the knowledge of polymers, various energy sources and storage devices in engineering field.		[AP]
C101.6	Understand the principle and working of certain analytical techniques, and synthesis of some common drug molecules.		[U]
Course Contents:			
Water chemistry and Corrosion:			15Hours
Water treatment-characteristics of water-hardness-types and estimation of hardness by EDTA method with numerical problems. Boiler feed water–requirements-disadvantages of hard water. Domestic water treatment-disinfection methods (chlorination, Ozonation, UV treatment)-demineralization process–desalination-reverse osmosis. Corrosion-types–mechanism of dry and			

wet corrosion-galvanic corrosion-differential aeration corrosion-protective coatings-electroplating of gold-electroless plating of nickel.

Electrochemistry and Energy sources:

15Hours

Electrochemical cells-electrolytic cell-reversible and irreversible cells – Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Nanochemistry-Basics- Comparison of molecules, nanomaterials and bulk materials; Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of nanomaterials in medicine. Energy Sources-Fuel cells (H_2-O_2). Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecules: 15Hours

Introduction-monomers and polymers-classification of polymers-Polymerization-types. Mechanism of addition polymerization (free radical mechanism). Plastics-classification-preparation, properties and uses of Nylon 6,6, Nylon 6, PVC, Bakelite and PET. Moulding methods- moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays (Compression moulding) and PET bottles (Blow moulding). Spectroscopy-Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and Flame emission spectroscopy (FES). Synthesis of a commonly used drug molecule-Asprin, p-nitroaniline from acetanilide.

Field work:

Industrial visit- Water treatment plant / Sewage treatment plant / Reverse osmosis plant

Lab Components:

1	Estimation of hardness of water by EDTA method	[E]
2	Estimation of alkalinity of water sample	[E]
3	Determination of chloride content in bleaching powder	[E]
4	Estimation of dissolved oxygen in water	[E]
5	Potentiometry- determination of redox potentials and emf's	[E]
6	Conductometric titration-mixture of acids vs NaOH	[E]
7	Determination of strength of strong acid by pH metry	[E]
8	Corrosion rate of mild steel in acid medium	[E]
9	Electroplating of nickel over copper	[E]
10	Spectrophotometry-Estimation of iron in water	[E]

11	Separation of mixture of amino acids by thin layer chromatography	[E]
12	Synthesis of Nylon 66	[E]
Total Hours:		75
Understanding the concepts by simple Demonstrations/Experiments:		
1	To observe the hardness of given water sample by soap solution test	
2	To view the colour of the different medium of given water sample using litmus paper test	
3	To detect the chlorine content in tap water using simple chemical method	
4	To know the presence of dissolved oxygen in given water sample using glucose by redox principle	
5	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", 16 th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.	
3	Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994.	
4	Physical Chemistry, 11 th Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018.	
5	Nanochemistry, 2 nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013.	
6	N.Krishna Murthy, Vallinayagam D., "Engineering Chemistry" 3 rd Edition by PHI Learning Pvt Ltd., 2014	
7	Sunita Rattan, A Text Book of Engineering Chemistry, Student Edition by SK Kataria Publishers, 2013.	
8	R.V.Gadag, A.Nithyananda Shetty "Engineering Chemistry" 3 rd Edition PHI Learning Pvt Ltd., 2014.	
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, 2 nd Edition 2012.
5	Perez, Nestor, "Electrochemistry and Corrosion Science", Springer, 2016.
6	Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015.
7	Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and Francis group, 2012.
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	nptel.ac.in/courses/105104102/hardness.htm
2	https://ocw.mit.edu/courses/chemistry
3	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf https://alison.com –
4	Spectroscopic technique, Colorimetry
5	https://ocw.mit.edu/courses/chemistry
6	nptel.ac.in/courses/113108051

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 Marks)	
	Component -I (2 marks)	Component -II (2 marks)		Component -III (2 marks)	Component -IV (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)					Marks	
C101.1	Apply	Component – I			Classroom or online Quiz		2	
C101.2	Remember	Component - II			Group Assignment		2	

C101.3	Understand	Component - III	Presentation	2
C101.4	Apply	Component – IV	Group Activities	2
C101.5	Understand			
Summative assessment based on Continuous and End Semester Examination				
Bloom’s Level	Continuous Assessment (12%)		End Semester Examination (50%) [50 Marks]	
	CIA1 [6 Marks]	CIA2 [6 Marks]		
Remember	30	30	20	
Understand	50	40	50	
Apply	20	30	30	
Analyse	-	-	-	
Evaluate	-	-	-	
Create	-	-	-	
Summative assessment based on Continuous and End Semester Examination – Practical				
Bloom’s Level	Continuous Assessment (30%)		SA (8 Marks)	
	FA (22 Marks)			
Remember	20		20	
Understand	30		30	
Apply	50		50	
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
C101.1	2	1	1				1						1		
C101.2	2	2	2				2						2		
C101.3	3	2	3				2						3		
C101.4	2	2	3				3		1				2		
C101.5	2	2	2				2						2		
C101.6	2	2	2				2						2		

21AD102	COMPUTER ORGANIZATION AND DIGITAL LOGIC		3/0/2/4
Nature of Course	: F (Theory Programming)		
Pre requisites	: NIL		
Course Objectives:			
1	To study the concepts of the basic structure and operation of a digital computer.		
2	To understand the concepts of algorithmic problem solving.		
3	To learn the working of different types of arithmetic operations.		
4	To understand the basics of sequential logic devices and the design of sequential circuits.		
5	To learn the working of different types of memories and advanced processor architecture.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C102.1	Encode information in binary and to manipulate Boolean functions using Boolean algebra.		[AP]
C102.2	Minimize Boolean functions and implement them using digital logic gates.		[A]
C102.3	Recognize the design of the various units of digital computers that store and process information via instructions.		[R]
C102.4	Review the functionality of all components and connectivity to the Central Processing Unit.		[U]
C102.5	Review and apply the importance and challenges of parallel processing.		[AP]
C102.6	Understand the different types of multiprocessors and functionalities.		[U]
Course Contents:			
Number Systems and Boolean Algebra:			(15 Hrs)
Introduction -Base Conversion-Binary codes- Complements. Boolean Algebra: Properties of boolean algebra-Boolean functions – Minimization of Boolean Functions using Karnaugh Maps Implementation of Logic Circuits using Gates – Code Conversion- Combinational Logic – Combinational circuits- Binary Adder - Subtractor - Decimal Adder - Binary Multiplier – Decoders - Encoders - Sequential Logic - Flip-flops, Triggering of Flip-flops, Analysis of clocked sequential circuits, Design Procedure.			
Architecture Fundamentals and Memory Organization:			(15 Hrs)
Organization of the Von Neumann Machine - Basic Operational Concepts of a Machine - Memory Locations and Addresses – Instruction Format - Instruction Sets, Addressing Modes and Assembly Language. Memory Organization: Basic Concepts, Semiconductor RAMs, ROMs, Cache memories, Performance Consideration, Virtual Memory and Memory Management requirements - Secondary storages.			

Advanced Architecture:		(15 Hrs)
Parallel processing challenges – Flynn’s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message - Passing Multiprocessors.		
Lab Experiments:		
<div>1. Realization of Boolean Functions Using Logic Gates</div> <div>2. Analysis and Synthesis of Combinational Logic Circuits</div> <div>3. Design and implement combinational circuits using MSI devices:<div><div>• 4 –bit binary adder / subtractor</div><div>• Parity generator / checker</div><div>• Magnitude Comparator</div><div>• Application using multiplexers</div></div></div> <div>4. Design and implementation of a simple digital system</div> <div>5. Design and Implementation of Shift Registers.</div> <div>6. Design and Implement synchronous counters.</div> <div>7. Memory unit design and perform memory operations.</div> <div>8. Interfacing of CPU and Memory</div>		
Total Hours:		60 Hours
Text Books:		
1	David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.	
2	Carl Hamachar, ZvoncoVranesic and SafwatZaky, “Computer Organization”, McGraw-Hill, 6 th Edition 2018.	
3	M. Morris R. Mano, Michael D. Ciletti, “Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog”, 6th Edition, Pearson, 2018.	
Reference Books:		
1	William Stallings, Computer Organization and Architecture –Designing for Performance, Eighth Edition, Pearson Education, 2010.	
2	John F. Wakerly, “Digital Design: Principles and Practices”, 5 th Edition, Pearson, 2018.	
3	Donald P leach, Albert Paul Malvino, GoutamSaha,”Digital Principles and Application”, 8th Edition., McGraw Hill education (India) Private Limited, 2015.	

Web References:	
1	http://www.hp.com/hpinfo/newsroom/press_kits/2013/hpmoonshot2013/DS_Moonshot_System.pdf
2	https://www.hpe.com/h20195/v2/getpdf.aspx/c04168328.pdf?ver=11
3	http://documents.opto22.com/casestudies/2183_Case_Study_San_Diego_Supercomputer_Center.pdf
Online Resources:	
1	https://www.coursera.org/learn/making-architecture
2	https://www.coursera.org/learn/comparch
3	http://nptel.ac.in/video.php?subjectId=106102062
4	http://nptel.ac.in/courses/106102062/

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								End Semester Examination (50%)
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 Marks)	
	Component -I (2 marks)	Component -II (2 marks)		Component -III (2 marks)	Component -IV (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcome	Bloom's Level		Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				Marks	
C102.1	Apply		Component – I		Classroom or online Quiz		2	
C102.2	Remember		Component - II		Group Assignment		2	
C102.3	Analyze		Component - III		Presentation		2	
C102.4	Apply		Component – IV		Group Activities		2	
C102.5	Understand							
Summative assessment based on Continuous and End Semester Examination								
Bloom's Level	Continuous Assessment (12%)					End Semester Examination (50%) [50 Marks]		
	CIA1 [6 Marks]			CIA2 [6 Marks]				
Remember	30			30		20		
Understand	50			40		50		
Apply	20			30		30		
Analyse	-			-		-		
Evaluate	-			-		-		
Create	-			-		-		
Summative assessment based on Continuous and End Semester Examination – Practical								

Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	20	20
Understand	30	30
Apply	50	50
Analyse	-	-
Evaluate	-	-
Create	-	-

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	J	k	l	1	2	3
C102.1	3	3	3	3								2	3	2	1
C102.2	2	3	3	2	2							2	3	1	1
C102.3	3	3	3	2	3							2	3	3	1
C102.4	2	3	3	3	2								2	2	2
C102.5	2	2	3	1	2								3	3	2
C102.6	3	3	3	3	3							1	3	1	2
		3	Strongly agreed				2	Moderately agreed				1	Weakly agreed		

21AD103	PYTHON LABORATORY		0/0/3/1.5
Nature of Course		L (Programming)	
Course Objectives:			
1	To understand and execute Python script using types and expressions.		
2	To understand the difference between expressions & statements and to understand		
3	the concept of assignment semantics.		
4	To utilize high level data types such as lists and dictionaries.		
5	To import and utilize a module and to perform read & write operations on files.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C103.1	Recognize the general principles and good Algorithmic problem solving.	[U]	
C103.2	Read, write, execute by hand simple Python programs.	[U]	
C103.3	Structure simple Python programs for solving problems.	[U]	
C103.4	Decompose a Python program into functions.	[AP]	
C103.5	Represent compound data using Python lists, tuples and dictionaries.	[AP]	
C103.6	Read and write data from data sheets and Analyse data.	[A]	
Course Contents:			
Laboratory Experiments:			
1. Programs for Familiarizing with the syntax and basic concepts			
2. Programs to perform various string operations			
3. Implementing conditional, control and repetition statements.			
4. Creating Functions and recursive functions.			
5. Programs for Familiarizing File operations			
6. Initializing Packages and implementing programs based on it			
7. Creating and processing data files.			
8. Implementing GUI using turtle			
9. Loading Data with Numpy			
10. Visualizing the data using matplotlib lib			
			Total Hours:45
Text Books:			
1	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2 nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/think-python/)		

2	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3	Fabio Nelli, "Python Data Analytics: Data Analysis and science using pandas, matplotlib and python programming language", Apress.
Reference Books:	
1	Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
2	Timothy A. Budd, "Exploring Python", Mc Graw Hill Education (India) Private Ltd., 2015.
3	John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013.
4	Peter Morgan, "Data Analysis from scratch with python: Beginner guide using python, pandas, Numpy, SCIKIT-learn, IPython, TensorFlow and Matplotlib", AI Sciences, 2018.
Web References:	
1	http://nptel.ac.in/courses/106106145/
2	https://www.codecademy.com/learn/learn-python
3	https://www.coursera.org/learn/python-data-analysis#syllabus
Online Resources:	
1	https://www.programiz.com/python-programming
2	https://www.fullstackpython.com/best-python-resources

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (60%)		End Semester Examination (40%)
	FA (45 Marks)	SA (15 Marks)	Practical Examination (40 Marks)
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate			
Create			

* FA - Performance based assessment observation and Record evaluated for 100 marks each experiment

* SA – Model examination conducted and evaluated for 100 marks

* End Semester practical examination conducted and evaluated for 100 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
C103.1	3	3	2	2	3	3	3	3	1	1	2	2	2	3	3
C103.2	3	3	3	3	2	2	2	3			2	3	3	3	2
C103.3	3	3	2	2	3	3	3	3	1	1	2	2	3	2	2
C103.4	3	3	3	3	2	2	2	3			2	3	2	2	3
C103.5	3	3	2	2	3	3	3	3			2	2	3	3	
C103.6	3	3	2	2	3	3	3	3			2	2	3	3	3

21ME103	ENGINEERING PRACTICES LABORATORY		0/0/3/1.5
Nature of Course	Practical application		
Pre Requisites	Nil		
Course Objectives:			
1	To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry.		
2	To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C103.1	Identify and solve the basic engineering problems at home and in workplace.	[AP]	
C103.2	Develop the surfaces and make simple components like tray and funnel.	[C]	
C103.3	Make simple metal joints using welding equipment and wooden joints using carpentry tools.	[AP]	
C103.4	Prepare pipe connections and sand moulds.	[AP]	
C103.5	Understand the fundamentals of hot forging and injection moulding	[U]	
C103.6	Examine and troubleshoot electrical and electronic circuits	[A]	
Course Contents:			
GROUP A (CIVIL & MECHANICAL)			
Manufacturing Methods –Sheet metal operations – Welding – arc welding, gas welding, Study of TIG & MIG welding. Study of foundry, Demonstration of Smithy and Injection moulding – Carpentry work using power tools – Plumbing components and pipelines			
List of Experiments:			
S.No	List of Experiments	CO Mapping	RBT
1	Preparation of butt joints and lap joints using arc welding	C103.3	[AP]
2	Sheet metal Forming and Bending, Model making – Trays and funnels.	C103.2	[C]
3	Preparation of wooden joints by sawing, planning and cutting.	C103.3	[AP]
4	Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.	C103.4	[AP]

5	Demonstration of foundry operations like mould preparation for solid and split piece pattern.	C103.4	[U]
6	Demonstration of Smithy operations	C103.5	[AP]
7	Demonstration of assembly of pump / Demonstration of Injection moulding	C103.5	[AP]

GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING)

List of Experiments:

Basic Circuit Elements: Resistor, inductor, capacitor. Introduction to measuring equipments:

Moving iron meter, moving coil meter, Wattmeter, Energy meter, CRO, Multi-meter. Digital logic circuits, PCB design, fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent lamp, iron box, mixer grinder, study of FM radio and mobile phone.

S.No.	List of Experiments	CO Mapping	RBT
1	Study and identification of electronic components with specification.	C103.6	[U]
2	Testing of CRO and Electronic components using Multimeter.	C103.6	[A]
3	Generation and measurement of signals using CRO.	C103.6	[A]
4	Familiarisation of digital basic gate IC's.	C103.6	[AP]
5	Soldering practice-components devices and circuits- using general purpose PCB.	C103.6	[AP]
6	Demonstration of meters and electrical components.	C103.6	[AP]
7	Safety precautions with electrical components.	C103.6	[AP]
8	Residential house wiring.	C103.6	[A]
9	Measurement of power and energy.	C103.6	[A]
10	Trouble shooting of electrical equipments.	C103.6	[A]

Total Hours:45

Reference Books:

1	Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint).
2	Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promoters Pvt Ltd., 2014.

3	Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012.
4	D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
5	E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Web References:

1	www.nptel.ac.in
2	www.sme.org
3	http://www.allaboutcircuits.com/education/

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks]	End Semester Examination [40 marks]
Remember	10	10
Understand	10	10
Apply	40	40
Analyze	20	20
Evaluate	10	10

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
C103.1	3	3	2	2	3	3	3	3	1	1	2	2	2	3	3
C103.2	3	3	3	3	2	2	2	3			2	3	3	3	2
C103.3	3	3	2	2	3	3	3	3	1	1	2	2	3	2	2
C103.4	3	3	3	3	2	2	2	3			2	3	2	2	3
C103.5	3	3	2	2	3	3	3	3			2	2	3	3	
C103.6	3	3	2	2	3	3	3	3			2	2	3	3	3

21GE201	UNIVERSAL HUMAN VALUES	3 /0 /0 /3
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 complementarity 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 about themselves and their surroundings (family, society, nature).	[U]
C201.2	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
C201.3	Apply responsibilities towards their commitments (human values, human relationship and human society).	[AP]
C201.4	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	[AP]
C201.5	Analyse ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[AN]
C201.6	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in the nature.	[U]
Course Contents:		
Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being - Harmony in Myself! 15Hours		
Purpose and motivation for the course. Self-Exploration—Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A		

look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient 'I' and the 'Material Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical Facility. Understanding the Body as an instrument of 'I' (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: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail-Programs to ensure Sanyam and Health.

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 15Hours

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and Competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence.

Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics 15Hours

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems. Case studies of typical holistic technologies, management models and eco-friendly production systems. Strategy for transition from the present state to Universal Human Order: a. Individual level: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.

Total Hours:30

Text Books:	
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2	Rajni Setia, Priyanka Sharma, " Human Values", Genius Publication", Jaipur, 2019.
Reference Books:	
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3	India Wins Freedom - Maulana Abdul Kalam Azad.
Web References:	
1	https://examupdates.in/professional-ethics-and-human-values/
2	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html
3	https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf
Online Resources:	
1	https://nptel.ac.in/courses/109/104/109104068/
2	https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b
3	https://www.thebalancecareers.com/life-skills-list-and-examples-4147222

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		
	Compo nent -I (4 marks)	Compo nent –II (4 marks)		Compo nent -III (4 marks)	Compo nent -IV (4 marks)	
Assessment Methods & Levels (based on Blooms' Taxonomy)						
Formative assessment based on Capstone Model (16%)						
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				Marks
C201.1	Understand & Apply	Component - I		Pre-Test and Post -Test		4
C201.2	Understand & Apply	Component - II		Online Quiz		4
C201.3	Understand & Apply	Component - III		Buddy Program		4
C201.4						

C201.5	Apply	Component - IV	Seminar	4
C201.6				
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment (24%)		End Semester Examination (60%) [60 Marks]	
	CIA1 [12 Marks]	CIA2 [12 Marks]		
Remember	10	10	10	
Understand	10	20	20	
Apply	40	40	40	
Analyse	40	30	30	
Evaluate	-	-	-	
Create	-	-	-	

Mapping of Course Outcomes (CO) with Programme Outcomes(PO) and Programme Specific Outcomes(PSO)															
COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C201.1	3	3	2	2	3	3	3	3	1	1	2	2	2	3	3
C201.2	3	3	3	3	2	2	2	3			2	3	3	3	2
C201.3	3	3	2	2	3	3	3	3	1	1	2	2	3	2	2
C201.4	3	3	3	3	2	2	2	3			2	3	2	2	3
C201.5	3	3	2	2	3	3	3	3			2	2	3	3	
C201.6	3	3	2	2	3	3	3	3			2	2	3	3	3

21MA201	ENGINEERING MATHEMATICS II		2/1/2/4
Nature of Course		J (Problem analytical)	
Pre requisites		Concepts of Differentiation and Integration.	
Course Objectives:			
1	To gain knowledge in integrals, which are needed in engineering applications.		
2	To develop logical thinking and analytical skills in evaluating multiple integrals.		
3	To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines.		
4	To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C201.1	Determine the area and volume by applying the techniques of double and triple integrals.		[R]
C201.2	Finding the values of integrals through different numerical methods.		[U]
C201.3	Differentiate and integrate a vector-valued functions to solve real world applications.		[AP]
C201.4	Calculate grad, div, curl and use Gauss, Stokes and Greens theorem to simplify the calculations of integrals.		[AP]
C201.5	Apply Laplace transform techniques in system modelling, digital signal processing, process control, solving boundary value problems.		[AP]
C201.6	Apply Laplace transform methods for solving linear differential equations.		[AP]
Course Contents:			
INTEGRAL CALCULUS: (18 Hrs)			
Definite integrals: Evaluation of definite integrals using Bernoulli's formula –Multiple Integrals: Double integration in Cartesian coordinates –Area as double integral –Change of order of Integration – Triple integration in Cartesian co-ordinates –Volume as triple integral –Beta and Gamma functions – Relation between 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.			

VECTOR CALCULUS:		(14 Hrs)
Vector differential operator – Gradient of a scalar point function - Directional derivatives –Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields –Simple problems – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (theorems statements only)– Simple applications involving cubes and rectangular parallelepipeds.		
LAPLACE TRANSFORM:		(16 Hrs)
Convergence of Laplace transform – Transform of some standard functions –Unit step function – Unit Impulse function – Properties – Initial and final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Application of Laplace transform for solving second order ordinary differential equation.		
Lab Components:		
<div>1. Double integrals evaluation in cartesian coordinates using MATLAB.</div> <div>2. Triple integral calculations using MATLAB in cartesian and cylindrical coordinates.</div> <div>3. Double integral evaluation in MATLAB by Trapezoidal rule.</div> <div>4. Evaluation of gradient, curl and divergence in MATLAB.</div> <div>5. Line integral over a vector field using MATLAB</div> <div>6. Applying Green's theorem to solve integrals in MATLAB.</div> <div>7. Relation between Laplace transform of function and its derivative using MATLAB.</div> <div>8. Laplace transform of Dirac delta and Heaviside functions in MATLAB.</div> <div>9. Solving Differential Equations in MATLAB using Laplace Transform.</div> <div>10. Inverse Laplace Transform of symbolic expressions using MATLAB.</div>		
		Total Hours:(48+12): 60
Text Books:		
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 th Edition, Pearson, Reprint,2018.	
2	Kreyszig. E, “Advanced Engineering Mathematics” Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.	
3	Grewal. B.S, “Higher Engineering Mathematics”, 43 rd 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, 4 th edition, 2012.
3	N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 9 th edition, Laxmi publications ltd, 2014.

Web References:

1	http://nptel.ac.in/video.php?subjectId=122107037
2	http://nptel.ac.in/courses/122107036/
3	http://nptel.ac.in/video.php?subjectId=117102060

Online Resources:

1	https://www.coursera.org/learn/pre-calculus
2	https://www.coursera.org/learn/linearalgebra1
3	https://alison.com/courses/Advanced-Mathematics-1
4	https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 marks)	
	Compon ent -I (2 marks)	Compon ent -II (2 marks)		Compon ent -III (2 marks)	Compon ent -IV (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcom e	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				Marks		
C201.1	Remember	Component – I		Quiz		2		
C201.2	Understand	Component - II		Assignment		2		
C201.3	Apply	Component - III		Seminar		2		
C201.4	Apply							
C201.5	Apply	Component - IV		Tutorial		2		
Summative assessment based on Continuous and End Semester Examination								
Bloom's Level	Continuous Assessment (12%)				End Semester Examination (50%) [50 Marks]			
	CIA1 [6 Marks]		CIA2 [6 Marks]					
Remember	30		30		20			
Understand	50		40		50			

Apply	20	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Summative assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	Continuous Assessment (30%)		
	FA (22 Marks)	SA (8 Marks)	
Remember	20	20	
Understand	30	30	
Apply	50	50	
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
C201.1	2	2	2										2		
C201.2	2	1	2										1		
C201.3	3	3	2										2		
C201.4	3	3	2											1	
C201.5	3	3	2						2					2	
C201.5	3	3	2						2					2	

21EN101	TECHNICAL COMMUNICATION SKILLS		2/0/2/3
Nature of Course		: E (Theory Skill Based)	
Pre requisites		Basics of English Language	
Course Objectives:			
1	To enhance learners' LSRW skills.		
2	To develop effective communication skills.		
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 corporate environment.		[AP]
C101.3	Understand and communicate effectively in personal and professional situation.		[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]
C101.6	Apply language skills with ease in academic and real-life situations.		[AP]
Course Contents:			
Listening and Speaking: (17 Hrs)			
Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others - Listening to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions			
Speaking - Speaking about Giving Directions / Instruction - Talk about Preferences-Agree and Disagree - Giving Opinions - Speaking Practices by Giving Examples, Reasons and Additional Information- Short Talk on Business Topics- Non Verbal Communication- Presentation using Digital Tools- Effectiveness of Narration- Leadership, Conflict and Persuasion.			
Reading: (13 Hrs)			

Reading Short Texts - Skimming and Scanning - Comparing Facts and Figures - Reading and Understanding Specific Information in a Text - Cloze Reading - Identifying Reasons and Consequences Through Reading Practices - Comprehension - Collocations.

Grammar and Writing:

(15 Hrs)

Parts of Speech- Tenses – Subject Verb Agreement - Sentence Structures - Connectives - Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal Passive Voice - Vocabulary Building - Business Vocabulary -- Synonyms, Antonyms – British and American Words - One Word Substitution- Identifying Common Errors. Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Calling for Quotation, Seeking Clarification, Placing an Order and Complaint Letter) - Email Writing – Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume Writing - Paragraph Writing – Proof Reading and Editing--Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart).

Lab Components

1	Listening Comprehension	[E]
2	Pronunciation, Intonation, Stress and Rhythm	[E]
3	Situational Dialogues	[E]
4	Formal Presentation	[E]
5	Group Discussion	[E]
6	Interview Skills- Online and Offline	[E]
	Total Hours:	60

Text Books:

1	Practical English Usage. Michael Swan. OUP. 1995.
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 Heasley. Cambridge University Press. 2006.
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Web References:

1	http://www.academiccourses.com/Courses/English/Business-English
2	https://steptest.in
Online Resources:	
1	https://www.coursera.org/specializations/business-english
2	http://www.academiccourses.com/Courses/English/Business-English
3	https://scoop.eduncle.com/one-word-substitution-list

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Mark s)	FA 1		SA 2 (6 mark s)	FA 2		FA (22 mark s)	SA (8 Mark s)	
	Compone nt -I (2 marks)	Compone nt -II (2 marks)		Compone nt -III (2 marks)	Compone nt -IV (2 marks)			

Assessment Methods & Levels (based on Blooms'Taxonomy) - Theory				
Formative assessment based on Capstone Model (8%)				
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)		Marks
C101.1	Understand	Component - I	Quiz	2
C101.2	Apply			
C101.3	Apply	Component - II	Impromptu speaking	2
C101.4	Understand			
C101.5	Apply	Component - III	Reading comprehension	2
C101.6	Apply	Component - IV	Group assignment	2
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%) [50 Marks]	
	CIA1 [6 Marks]	CIA2 [6 Marks]		
Remember	20	20	20	
Understand	40	40	40	
Apply	40	40	40	
Analyse	-	-	-	
Evaluate	-	-	-	
Create	-	-	-	
Summative assessment based on Continuous and End Semester Examination - Practical				
Bloom's Level	Continuous Assessment (30%)			
	FA (22 Marks)	SA (8 Marks)		
Remember	20	20		

Understand	40	40
Apply	40	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
C101.1									2	3		2			2
C101.2									3	3		1			1
C101.3								2	2	2		1			1
C101.4								1	1	2					1
C101.5								1	3	3		2			2
C101.6								1	3	3		2			2

21PH104	PHYSICS		3/0/3/4.5
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			
C104.1	Recall and interpret the basic concepts of lasers and various types of optical fibers for articulating in engineering applications.		[R]
C104.2	Describe and conduct experiments in photonic materials.		[U]
C104.3	Acquire basic understanding and fundamental concepts of superconductors.		[R]
C104.4	Discuss the dual nature of radiation and matter.		[U]
C104.5	Solve Schrodinger's equations on finite and infinite potential well problems.		[AP]
C104.6	Apply quantum idea for understanding the working of quantum computing.		[AP]
Course Contents:			
Laser and Fiber optics: (15 Hrs)			
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 – 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– Optical fibers for computing applications–PC to PC communication and fiber optics in computer networking.			
Photonics and Superconductors: (15 Hrs)			
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 – 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.

Quantum Mechanics and Quantum computing:

(15 Hrs)

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 supremacy, differences in quantum and classical computation.

Lab Component		30 Hours
1	Particle size determination and measurement of d-spacing in CD using Laser.	[U]
2	Determination of wavelength, angle of divergence and coherence length of laser source.	[U]
3	Determination of numerical aperture and acceptance angle parameter of optical fiber using Laser source.	[U]
4	Characteristics curves of solar cell.	[U]
5	Characteristics curve of light dependent resistor (LDR).	[U]
6	Determination of bandgap of semiconductor.	[U]
7	Determination and verification of Stefan law.	[U]
8	Determination of Planck's constant using electroluminescence.	[U]
9	Determination of entangled photons using spectrometer.	[U]
10	Determination of wavelength of mercury spectrum – Spectrometer	[U]
Life Skills Experiments		
1	How does a fuel (gas/liquid) pump nozzle shut off?	
2	How does a circuit breaker work?	
3	How to Check Earthing at Home?	
		Total Hours: 75
Text Books:		
1	Rajendran, V "Engineering Physics" Mc Graw Hill Publications Ltd, New Delhi, 2016.	
2	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11 th edition, Wiley, 2018.	

Reference Books:	
1	William T. Silfvast “Laser Fundamentals” Cambridge University Press, 2012
2	Fedor Mitschke “Fiber Optics physics and Technology”, 2 nd edition, Springer, 2017.
3	Chakrabarti P. “Optical Fiber Communication”, McGraw Hill Education, 2015.
4	Kasap, Safa, Capper, “Handbook of Electronic and Photonic Materials” 2 nd edition, Springer, 2017.
5	Balkan, Naci, Erol, Ayşe, “Semiconductors for Optoelectronics”, 1 st edition Springer, 2020.
6	Bhattacharya D. K. and Poonam Tandon, “Engineering Physics”, Oxford University press, 2014
7	David J. Griffiths, “Introduction to Quantum Mechanics”, 2 nd edition, Cambridge university press, 2017.
8	Chris Bernhardt, “Quantum Computing for Everyone” The MIT press, 2019

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 Marks)	
	Component -I (2 marks)	Component -II (2 marks)		Component -III (2 marks)	Component -IV (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				Marks		
C104.1	Understand	Component – I		Quiz		2		
C104.2	Remember	Component - II		Assignment		2		
C104.3	Understand	Component - III		Seminar		2		
C104.4	Understand							
C104.5	Apply	Component - IV		Tutorial		2		
Summative assessment based on Continuous and End Semester Examination								
Bloom's Level	Continuous Assessment (12%)				End Semester Examination (50%) [50 Marks]			
	CIA1 [6 Marks]		CIA2 [6 Marks]					
Remember	30		30		20			
Understand	50		40		50			
Apply	20		30		30			
Analyse	-		-		-			

Evaluate	-	-	-
Create	-	-	-
Summative assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	Continuous Assessment (30%)		
	FA (22 Marks)	SA (8 Marks)	
Remember	20	20	
Understand	30	30	
Apply	50	50	
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
C104.1	2	1	1										1		
C104.2	1	1	1										1		
C104.3	2	1	2											2	
C104.4	2	1	2											2	
C104.5	3	2	3						1				2	2	
C104.6	3	2	3						1				2	2	

21AD201	DATA STRUCTURES USING C		3/0/2/4
Nature of Course	: F (Theory Programming)		
Pre requisites	: Fundamentals of Problem Solving		
Course Objectives:			
1	To learn the features of C		
2	To handle functions, pointers, structures, unions and files using C		
3	To manipulate linear and non-linear data structures		
4	To explore the applications of linear and non-linear data structures		
5	To familiarize the concepts of hashing.		
Course Outcomes:			
Upon completion of the course, students shall have ability to:			
C201.1	Develop C programs for any real-world technical application using basic programming construct, arrays and strings	[AP]	
C201.2	Apply advanced features of C in solving problems	[AP]	
C201.3	Design applications using sequential and random-access file processing	[AP]	
C201.4	Demonstrate operations like insertion, deletion, searching, traversing etc. on linear and non- linear data structures	[AP]	
C201.5	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.	[AP]	
C201.6	Choose appropriate data structure for any real-world data set.	[A]	
Course Contents:			
MODULE I: C PROGRAMMING: (15 Hrs)			
Basic Features: Introduction -Data Types – Variables – Operations – Expressions and Statements – Conditional and Iterative Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays- Strings. Advanced Features: Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Storage classes - Preprocessor Directives.			
MODULE II: LINEAR DATA STRUCTURES – LIST, STACK, QUEUE: (15 Hrs)			
Abstract Data Types (ADTs) – List ADT – Array based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly linked lists – Application of lists – Polynomial Manipulation. Stack ADT – Operations – Applications – Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – Applications of queues.			

MODULE III: NON-LINEAR DATA STRUCTURES:		(15 Hrs)
Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Graphs- Breadth First traversal - Depth- first traversal- Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		
Laboratory Component:		
S.No.	List of Experiments	
1.	Practice of C Programming using Branching and Iterative constructs.	
2.	Programs using Functions and Arrays	
3.	Programs using Structures and Pointers.	
4.	Implementation of Stack using Arrays	
5.	Implementation of Stack using Linked List.	
6.	Implementation of Queue using Arrays	
7.	Implementation of Queue using Linked List.	
8.	Implementation of Binary Search Tree.	
9.	Implementation of hashing techniques	
Total Hours: 60 Hours		
Text Books:		
1	YashavantKanetkar, “Let us C”, 15 th Edition, BPB Publications, 2017	
2	ReemaThareja, “Programming in C”, 2 nd Edition, Oxford University Press, 2016.	
3	PradipDey and ManasGhosh, “Programming in C”, 2 nd Edition, Oxford University Press, 2011.	
4	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education India, 3 rd Edition 2013.	
Reference Books:		
1	Ellis Horowitz, SartajSahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2 nd Edition, University Press, 2008	
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.	
3	Robert Kruse, C.L.Tondo, Bruce Leung, ShashiMogalla , “Data Structures and Program Design in C”, 2 nd Edition, Pearson Education, 2007	
4	Jean-Paul Tremblay and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2 nd Edition, Tata McGraw-Hill, 1991.	
5	Seymour Lipschutz, “ Data Structures by Schaum series”, 2 nd Edition, Tata McGraw Hill, 2013.	

Web References:	
1	http://www.nptel.ac.in
2	https://visualgo.net/en
Online Resources:	
1	https://www.youtube.com/watch?v=-CpG3oATGIs
2	http://lcm.csa.iisc.ernet.in/dsa/dsa.html
4	http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
5	http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
Formative Assessment based on Capstone Model (8%)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C201.1	Apply	Assignment – 1	2
C201.2	Apply	Quiz	2
C201.3, C201.4	Apply	Assignment – 2	2
C201.5	Apply	Case Study	2
Summative Assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Internal Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA 1 [6 Marks]	CIA 2 [6 Marks]	
Remember	20	10	10
Understand	10	10	15
Apply	70	80	75
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Summative Assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	10	10
Understand	20	10
Apply	70	80
Analyse	-	-
Evaluate	-	-
Create	-	-

Summative Assessment based on Continuous and End Semester Examination
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Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Mks)	FA 1		SA 2 (6 Mks)	FA 2		FA (22 Mks)	SA (8 Mks)	
	Comp - I (2 Mks)	Comp - II (2 Mks)		Comp - I (2 Mks)	Comp - II (2 Mks)			

Theory:

- SA 1 & SA 2 are continuous internal examination conducted each for 100 marks
- FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.
- ES exams conducted and evaluated for 100 marks

Practical:

- FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- SA – Model Examination conducted and evaluated for 100 marks

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C201.1	3	3	1	1	2								3	1	2
C201.2	3	3	2	1	1								3	1	2
C201.3	3	3	1	2	1								3	2	3
C201.4	3	3	3	3	2								3	1	1
C201.5	3	3	3	3	2								3	1	1
C201.6	3	3	3	3	2								3	1	1
			3	Strongly agreed			2	Moderately agreed			1	Weakly agreed			

21ME111	ENGINEERING GRAPHICS		1/0/3/2.5
Nature of Course		Practical application	
Pre - Requisites		Basic Drawing and Computer Knowledge	
Course Objectives:			
1	To know the method to construct the conic curves used in engineering applications.		
2	To develop an understanding of Isometric to orthographic views and vice versa.		
3	To learn the basic projection of straight lines and plane surfaces.		
4	To develop the imagination of solids inclined to one reference plane.		
5	To know the development of surfaces used in various fields.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C111.1	Understand the basic concepts of Engineering Graphics.		[U]
C111.2	Sketch isometric, orthographic projections and projection of lines and planes		[AP]
C111.3	Develop lateral surfaces of solids including prisms and pyramids		[AP]
C111.4	Construct projections of lines, planes, solids and isometric views using modelling software.		[A]
Course Contents:			
Conic curves and special curves – Isometric projections, Isometric to orthographic projection-Orthographic to Isometric projection-Projection of lines and plane surfaces-Projection of solids-Development of surfaces-Introduction to perspective projection.			
S.No	List of Experiments	CO Mapping	RBT
1	Introduction to drafting software.	C111.1	U
2	Construction of conic curves (Ellipse, Parabola and Hyperbola)	C111.1	U
3	Construction of special curves (Cycloid and Involute)	C111.1	U
4	Isometric to orthographic projections – manual sketches	C111.2	AP
5	Isometric to orthographic projections – software sketches	C111.4	A
6	Projection of lines - inclined to HP, VP and Both HP & VP	C111.4	A
7	Projection of plane surfaces (Hexagon, Pentagon and circle) – inclined to any one of the principle planes	C111.4	A
8	Projection of solids (Prism and Pyramid) – inclined to HP	C111.3	AP

9	Projection of solids (Cone and Cylinder) – inclined to VP	C111.3	AP
10	Development of surfaces (Prism, Pyramid, Cone and Cylinder)	C111.4	A
11	Introduction to perspective projection	C111.2	U
Total Hours:45			
Reference Books:			
1	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50 th Edition, 2014.		
2	K. V. Natarajan, “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, 2018.		
3	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2011.		
4	Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2013.		
Web References:			
1	http://nptel.ac.in/courses/112102101/		
2	www.solidworks.com		

Summative assessment based on Continuous and End Semester Examination			
Bloom’s Level	Continuous Assessment (60%)		End Semester Examination (40%)
	FA (45 Marks)	SA (15 Marks)	Practical Examination (40 Marks)
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate			
Create			

- * FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- * SA – Model examination conducted and evaluated for 100 marks
- * End Semester practical examination conducted and evaluated for 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
C111.1	2	2	1				2	2	3			2	3	2	
C111.2	2	2	1				2	2	3			2	3	2	
C111.3	2	2	1				2	2	3			2	3	2	
C111.4	2	2	1				2	2	3			2	3	2	

21AD301	ARTIFICIAL INTELLIGENCE PRINCIPLES AND TECHNIQUES	3 / 0 / 0 / 3
Nature of Course:	H (Theory technology)	
Pre requisites:	NIL	
Course Objectives:		
1	To understand the main approaches to 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 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		
C301.1	Understand the importance of agents with its types.	[U]
C301.2	Analyze the various search strategies in the problems.	[AN]
C301.3	Explain the knowledge representation, problem solving, and learning methods of artificial intelligence.	[U]
C301.4	Analyze the knowledge of AI applications.	[AN]
C301.5	Understand the basics of an expert system.	[U]
Course Contents:		
Overview of Artificial Intelligence and Agents: Introduction to AI, Types of AI, Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. 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.		
Search techniques: Uninformed search strategies: breadth first search, depth first search, depth limited search, bidirectional search. Heuristic search strategies: Greedy best-first search, A* search, AO* search, memory bounded heuristic search, Optimization problems: Hill climbing search, simulated annealing search, local beam search. Constraint satisfaction problems: Adversarial search, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, iterative deepening. Knowledge & reasoning: Knowledge representation issues, representation, approaches to knowledge representation.		
Representing Knowledge: Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning. Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. Expert Systems: Architecture, Roles of Expert System.		
		Total Hours: 45
Text Books:		
1.	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill- 2008.	
2.	Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.	
Reference Books:		
1.	Rich E, Knight K, Nair S B, Artificial Intelligence, 3 rd edition, Tata McGraw-Hill, 2009.	

2.	Luger George F, Artificial Intelligence: Structures and Strategies for Complex problem solving, 6 th edition, Pearson Education, 2009.
3.	Carter M, Minds and Computers: An Introduction to the Philosophy of Artificial Intelligence, Edinburgh University Press, 2007.
4.	Stuart Russel and Peter Norvig "AI – A Modern Approach", 2 nd Edition, Pearson Education 2007.

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.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_agents_and_environments.htm
2.	https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (16%)

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)	Marks
C301.1, C301.2	Analyze	Quiz	4
C301.3	Understand	Assignment	4
C301.4	Analyze	Idea Presentation	4
C301.5	Understand	Case Study	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (24%)		End Semester Examination (60%) [60 Marks]
	CIA1 [12 Marks]	CIA2 [12 Marks]	
Remember	10	10	10
Understand	30	30	30
Apply	30	30	30
Analyse	30	30	30
Evaluate			
Create			

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)	

* SA 1 & SA 2 are continuous internal examination conducted each for 100 marks

* FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.

* ES exams conducted and evaluated for 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
C301.1	2			1						1			3	1	
C301.2	2	1	1	1						1	1		2	2	
C301.3	2	1	1	1						1	1		1	2	
C301.4	2	1	1	1						2	2		2	1	
C301.5	2	1	1	1						1	1		1	1	

21MA302		MATHEMATICAL STRUCTURES		2/1/2/4
Nature of Course		J (Problem analytical)		
Prerequisites		Higher secondary mathematics		
Course Objectives:				
1	To study the concepts needed to test the logic of a program.			
2	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.			
3	To use number theory in computer networks and security.			
4	To acquire thorough knowledge of fundamental notions from lattice theory and properties of lattices.			
Course Outcomes:				
Upon completion of the course, students shall have ability to				
C302.1	Recall the basic concepts of logic, Sets, Relations, Functions and Number theory.			[R]
C302.2	Acquire critical thinking skills by understanding the logical structure of the language.			[U]
C302.3	Use the concepts of Discrete Mathematics in software development and hardware design.			[AP]
C302.4	Demonstrate the fundamental Concepts of sets, relations, mathematical functions and all of its properties.			[AP]
C302.5	Apply discrete mathematics in formal representation of various computing constructs and algebraic structures.			[AP]
C302.6	Apply integrated approach to number theory.			[AP]
Course Contents:				
Module 1: Propositional and Predicate Calculus				15 hrs
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.				
Module 2: Set Theory				15 hrs

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- **Counting:** Permutations and Combinations.

Module 3: Lattices and Number Theory

15 hrs

Lattices: Partially ordered sets - Hasse diagram - Lattices and their properties - **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.

Course Outcomes: (Laboratory)

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

C302.1	Construct mathematical arguments using logical connectives and quantifiers.
C302.2	Verify the correctness of an argument using propositional and predicate logic and truth tables.
C302.3	Understand the basic principles of sets and operations in sets.
C302.4	Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.
C302.5	Evaluate the problems in Number Theory.
C302.6	Evaluate quotients and remainders from division Algorithm.

Laboratory Component:

S.No	List of Experiments	CO Mapping	RBT
1.	Generate the truth table for mathematical logic using suitable mathematical software.	C302.1	[AP]
2.	Assign the truth table actions to decisions using suitable mathematical software	C302.2	[AP]
3.	Examine the logical validity of the arguments using suitable mathematical software.	C302.2	[AP]
4.	Using logical operators to test truth values of statements in suitable mathematical software	C302.2	[AP]
5.	Verification of De-Morgan's law using suitable mathematical software	C302.3	[AP]
6.	Set operations using suitable mathematical software.	C302.3	[AP]

7.	Compute permutations functions using suitable mathematical software.	C302.4	[AP]
8.	Compute combinations functions using suitable mathematical software.	C302.4	[AP]
9.	Compute prime and composite numbers using suitable mathematical software.	C302.5	[AP]
10.	Compute Least common multiple of two integers using suitable mathematical software.	C302.5	[AP]
11.	Compute Greatest common divisor of two integers using suitable mathematical software.	C302.5	[AP]
12.	Compute Quotient and remainder of two integers by division algorithm using suitable mathematical software.	C302.6	[AP]
Total Hours: 60			
Text Books:			
1	Tremblay J.P and Manohar R, —Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30 th Reprint, 2011		
2	Kenneth H.Rosen, —Discrete Mathematics and its Applications, Seventh Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Seventh Edition, 2017.		
3	Koshy .T-“Elementary Number Theory with Applications. Elsevier Publications, New Delhi,Second Edition, 2007.		
Reference Books:			
1	Ralph.P.Grimaldi, —Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education Asia, 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.		
4	David Houcque-Introduction to MATLAB for Engineering Students -2005		
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	https://www.maa.org/press/ebooks/resources-for-teaching-discrete-mathematics

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								End Semester Examination (50%)
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 marks)	
	Compon ent -I (2 marks)	Compon ent -II (2 marks)		Compon ent -III (2 marks)	Compon ent -IV (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcom e	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				Marks		
C302.1	Remember	Component – I		Quiz		2		
C302.2	Understand	Component - II		Assignment		2		
C302.3	Apply	Component - III		Seminar		2		
C302.4	Apply							
C302.5	Apply	Component - IV		Tutorial		2		
Summative assessment based on Continuous and End Semester Examination								
Bloom's Level	Continuous Assessment (12%)			End Semester Examination (50%) [50 Marks]				
	CIA1 [6 Marks]		CIA2 [6 Marks]					
Remember	30		30		20			
Understand	50		40		50			
Apply	20		30		30			
Analyse	-		-		-			
Evaluate	-		-		-			
Create	-		-		-			
Summative assessment based on Continuous and End Semester Examination – Practical								
Bloom's Level	Continuous Assessment (30%)							
	FA (22 Marks)		SA (8 Marks)					
Remember	20		20					
Understand	30		30					
Apply	50		50					
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
C302.1	1	1		1	1								1		
C302.2	2	2		2	2								1		
C302.3	3	3		3	3								1		
C302.4	3	3		3	3								1		
C302.5	3	3		3	3								1		
C302.6	3	3		3	3								1		

21AD302	ANALYSIS OF ALGORITHMS	3 / 0 / 2 / 4
Nature of Course:	I (Problem Concepts)	
Pre requisites:	Data Structures	
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		
C302.1	Illustrate the searching and sorting algorithms.	[U]
C302.2	Interpret the design principles of greedy and pattern searching algorithms with examples.	[AP]
C302.3	Explain the problem-solving methodology used in Backtracking.	[A]
C302.4	Analyze the time and space complexities of dynamic programming strategy in solving complex problems	[A]
C302.5	Employ range query and graph algorithms in real world problems.	[AP]
Course Contents:		
Sorting, Searching and String Algorithms:		[15 Hours]
Searching & Sorting, Divide and Conquer – Bubble sort, Insertion sort, Selection sort, Binarysearch, quick sort, merge sort - Heaps & Hashing – Binary heap, heap sort - Greedy Algorithms – Activity selection problem, Fractional knapsack - String algorithms - Naive algorithm, Rabin Karp algorithm, KMP algorithm, Z algorithm, Manachers algorithm - Tries - Making a trie node, Insert, Search and Remove operation in Tries, Huffman coding.		
Greedy and Dynamic Programming:		[15 Hours]
Backtracking - Rat in a maze, Permutation and Combination, N Queen problem and Problemson Backtracking, Knight's Tour Problem, Subset Sum, M-Coloring Problem, Hamiltonian Cycle Problem, Sudoku Solver, Sieve of Sundaram, Prime Numbers after P with Sum S. 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 - Dijkstra's Algorithm, Floyd warshall Algorithm, Kruskal's Algorithm for Minimum Spanning Tree, Prim's Algorithm for 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.	Anany Levitin, "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, Sartaj Sahni 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

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
Formative Assessment based on Capstone Model (8%)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C302.1	Understand	Assignment	2
C302.2	Apply	Quiz	2

C302.3, C302.4	Analyze	Tutorial	2
C302.5	Analyze	Case Study	2
Summative Assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Internal Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA 1 [6 Marks]	CIA 2 [6 Marks]	
Remember	20	10	10
Understand	10	10	15
Apply	50	60	55
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Summative Assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	10	10
Understand	20	10
Apply	70	80
Analyse	-	-
Evaluate	-	-
Create	-	-

Summative Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Mks)	FA 1		SA 2 (6 Mks)	FA 2		FA (22 Mks)	SA (8 Mks)	
	Comp - I (2 Mks)	Comp - II (2 Mks)		Comp - I (2 Mks)	Comp - II (2 Mks)			

Theory:

- SA 1 & SA 2 are continuous internal examination conducted each for 100 marks
- FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.
- ES exams conducted and evaluated for 100 marks

Practical:

- FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- SA – Model Examination conducted and evaluated for 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
C302.1	3	3	3	1	3	2	2	1	2		2	1	3	2	2
C302.2	3	3	3	1	3	2	2	1	2			1	3	2	2
C302.3	3	3	3	1	3	2	2	1	2		1	1	3	2	2
C302.4	3	3	3	1	3	2	2	1	2			2	3	2	2
C302.5	3	3	3	1	3	2	2	1	2			2	3	2	2

21IT301	WEB DEVELOPMENT USING REACT		3/0/2/4
Nature of Course	F (Theory programming)		
Pre requisites	Nil		
Course Objectives:			
1.	To discuss the essence of front-end development skills.		
2.	Ability to understand and use JavaScript in client-side web applications.		
3.	To impart the knowledge of React components used in web application development platforms.		
4.	To deploy and test the React App used in Web Applications.		
Course Outcomes			
Upon completion of the course, students shall have ability to			
C301.1	Demonstrate the client-side JavaScript application development and the React library.		[U]
C301.2	Illustrate the single page applications in React.		[U]
C301.3	Utilize the various React features including components and forms.		[AP]
C301.4	Show the functionality of front-end UI applications using React.		[R]
C301.5	Apply CSS for designing responsive React applications.		[AP]
C301.6	Identify the use Redux-Redux and Axios package.		[AP]
Course Contents:			
Module - I: [15 Hours]			
JavaScript Essentials, How JavaScript works, Event loop, Stack, Heap and Queue, Node.js Fundamentals, Introduction to Node.js, Why Node.js?, Traditional Programming Limitations, React Introduction, Overview of frameworks, libraries for client side Web applications, Understanding “what” and “why” React, React Component Demonstration using code pen, Environment Setup for React Application. Understanding NPM commands, Using VS Code, VS Code extensions for ES6, 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.			
Module - II: [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)			

Module – III:		[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, Handling 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:			
S. No.	List of Experiments		
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.		
3.	Adam Bouch, “React and React Native”, Packt Publishing,3 rd Edition, 2020.		
4.	Kirupa Chinnathambi , “Learning React : A Hands-On Guide to Building Web Applications Using React and Redux”, Pearson Education, Second Edition,2018.		
Reference Books:			
1.	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.		
2.	Carlos Santana Roldan, “React Cookbook”, Packt Publishing,2018.		
3.	Lionel Lopez, “React: Quickstart Step-by-step Guide to Learning React Javascript Library (React.js, Reactjs, Learning React Js, React Javascript, React Programming)”, CreateSpace Independent Publishing Platform.2017.		

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

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
Formative Assessment (FA) based on Capstone Model (8%)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C301.1	Understand	Assignment – 1	2
C301.2	Understand	Quiz	2
C301.3, C301.4	Apply, Remember	Assignment – 2	2
C301.5, C301.6	Apply	Case Study	2
Summative Assessment (SA) based on Continuous and End Semester Examination			
Bloom's Level	Continuous Internal Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA 1 [6 Marks]	CIA 2 [6 Marks]	
Remember	20	10	10
Understand	10	10	15
Apply	70	80	75
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Summative Assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	10	10
Understand	20	10
Apply	70	80
Analyse	-	-
Evaluate	-	-
Create	-	-

Summative Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Mks)	FA 1		SA 2 (6 Mks)	FA 2		FA (22 Mks)	SA (8 Mks)	
	Comp - I (2 Mks)	Comp - II (2 Mks)		Comp - I (2 Mks)	Comp - II (2 Mks)			

Theory:

- SA 1 & SA 2 are continuous internal examination conducted each for 100 marks
- FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.
- ES exams conducted and evaluated for 100 marks

Practical:

- FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- SA – Model Examination conducted and evaluated for 100 marks

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

21CS302	JAVA PROGRAMMING		3/0/2/4
Nature of Course	F (Theory Programming)		
Pre requisites	Nil		
Course Objectives:			
1	To learn the object oriented concepts using java programming.		
2	To analyze the types of constructor, inheritance and polymorphism.		
3	To apply the concepts of package, abstract class and interface.		
4	To apply the concepts of exception handling mechanisms in real time problems.		
Course Outcomes			
Upon completion of the course, students shall have ability to			
C302.1	Construct the Java programs using class, access modifiers, condition and looping statements.	[AP]	
C302.2	Implement the java programs using string class, files and serialization concepts.	[AP]	
C302.3	Develop the programs using object-oriented concepts such as inheritance, abstraction, interface and packages.	[AP]	
C302.4	Classify the usage of different keywords based on its functionality and use the concepts of association, composition and aggregation for programming.	[A]	
C302.5	Construct the program using polymorphism and exception handling mechanisms to solve real time problems.	[AP]	
Course Contents:			
Module 1:		15 Hours	
Identifiers & JavaBeans, Legal Identifiers, Sun's Java Code Conventions, JavaBeans Standards, Declare Classes, Source File Declaration Rules, Class Declarations and Modifiers, Concrete Subclass, Declaring an Interface, Declaring Interface Constants, Declare Class Members, Access Modifiers, Nonaccess Member Modifiers, Constructor Declarations, Variable Declarations, Declaring Enums. An Overview of the Wrapper Classes, Creating Wrapper Objects, Using Wrapper Conversion Utilities, Autoboxing. if and switch Statements, if-else Branching, switch Statements, Loops and Iterators, using while Loops, Using do Loops, Using for Loops, using break and continue, Unlabelled Statements, Labelled Statements.			
Module 2		15 Hours	
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, 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. Class and Object, Encapsulation and Abstraction, Inheritance, Polymorphism, Message Passing, Class Syntax, Access Modifiers, class, class Name, extends, implements keywords, Possible, syntaxes of Classes, Procedure to use classes in Java, Internal flow in Class Utilization, More than one class in Single Java Appl, Concrete Methods Vs Abstract Methods. Abstract Classes, Interfaces, Method Syntax.

Module 3

15 Hours

User defined Immutable Class, Object and Instance Constructors : Introduction, Default Constructor, User Defined Constructors, Constructor Overloading, Instance Block and Instance Flow Of Execution, 'this' keyword, 'static' keyword, Class.forName() method internal functionality, newInstance() method internal functionality, Utilizations of Class.forName() and newInstance() methods, Factory Methods, Singleton classes, final keyword, 'public static final' Convention for constant variables, enum keyword, main() method, Introduction To Relationships, Association, Composition and Aggregation. Inheritance: Introduction, Types of Inheritance, Static Context in Inheritance, Instance Context in Inheritance, Method Overloading, Rules and Regulations for Method Overriding, Abstract Methods and Abstract classes Introduction, Concrete Method and Abstract Method, Concrete class and Abstract Class, Abstract Class, Interfaces, Syntaxes between classes, abstract classes and Interfaces. Exception - Call Stack Mechanism the try catch block, The Finally Block, Exception Hierarchy, Multiple Exceptions In a Catch Block, Parameterized Try Block, Overriding Methods And Exception. Creating Your Own Exception, The Assert Keyword.

Total Hours		45
Laboratory Component:		
S. No	List of Experiments	
1.	Write a Java program to demonstrate the Methods, Classes and Constructors.	
2.	Write a Java program to demonstrate String concepts.	
3.	Write a Java program to implement the Inheritance concepts.	
4.	Write a Java program to implement the Polymorphism.	
5.	Write a Java program to implement the abstract Class and interfaces.	
6.	Write a Java program to demonstrate the concept of File handling.	
7.	Write a Java program to demonstrate serialization.	
8.	Write a Java program to demonstrate the Java Packages.	
9.	Write a Java program to implement Exception Handling Mechanism.	
Total Hours		30

Text Books:

1.	Herbert Schildt, "Java: The Complete Reference", 11th Edition, Oracle Press, 2021
2.	Paul Deitel, Harvey Deitel, "Java How to Program, Late Objects", 11th Edition, Pearson Education, 2018

Reference Books:	
1.	Cay S. Horstmann, "Core Java Volume I—Fundamentals", 11th Edition, Pearson Education, 2020
2.	Y. Daniel Liang, "Introduction to Java Programming", 9th Edition, Prentice Hall Publications, 2015
3.	Robert W Sebesta, "Programming the World Wide Web", 7th Edition, Pearson Education Inc., 2014.
4.	Steven Holzner, "Java 2 Black book", Dreamtech Press, 2011.
5.	Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000
Web References:	
1.	https://docs.oracle.com/javase/tutorial/
2.	https://onlinecourses.nptel.ac.in/noc20_cs58/preview
3.	http://www.javatpoint.com
4.	https://www.geeksforgeeks.org/functional-programming-in-java-with-examples/
Online Resources:	
1.	https://www.coursera.org/learn/object-oriented-java
2.	https://www.coursera.org/specializations/java-object-oriented

Summative assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 Marks)	
	Component -I (2 marks)	Component -II (2 marks)		Component -I (2 marks)	Component -II (2 marks)			

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
Formative assessment based on Capstone Model (8%)			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)	Marks
C302.1	Apply	Quiz	2
C302.2	Apply	Assignment	2
C302.3	Apply	Case study	2
C302.4 & C302.5	Analyse	Group Assignment	2
Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%)
	CIA1	CIA2	

	[6 Marks]	[6 Marks]	[50 Marks]
Remember	10%	10%	10%
Understand	40%	40%	40%
Apply	40%	40%	40%
Analyse	10%	10%	10%
Evaluate	-	-	-
Create	-	-	-

Summative assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	10%	10%
Understand	30%	10%
Apply	40%	60%
Analyse	20%	20%
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
C302.1	3	3	2	2	2				2			2	3	2	2
C302.2	3	3	2	2	2				2			2	3	2	2
C302.3	3	3	2	2	2				2			2	3	2	2
C302.4	3	3	2	2	2				2			2	3	2	2
C302.5	3	3	2	2	2				2			3	3	2	2

21CS303	MANAGING DATA USING RDBMS		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:			
C303.1	Conceptualize data using the data models.		[U]
C303.2	Improve the database design through normalization.		[U]
C303.3	Manipulate a database using SQL.		[AP]
C303.4	Implement advanced SQL concepts on database.		[AP]
C303.5	Infer the transactions management and storage structures 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 III Queries and Transactions			15 Hours
Creation and Dropping of Views, Creation and Execution of Stored Procedures Cursors and Triggers - Opening, Fetching and Closing, Creation , Insertion, Deletion and Updating Database Applications: Payroll Processing Systems, Railway Reservation Systems, Bank Management System Introduction, Storage media and file structures, B+ Tree Hashing – static and Dynamic, Introduction to Query Processing – Issues in query optimization – Steps in query processing, Concurrency control and transactions, Lock based protocols Recovery System – Failure classification.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. Document Database creation using MongoDB			
9.Study of Cloud Storage			

10. 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 Hours	
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

Summative assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)	Theory Examination (50 Marks)	
SA 1 (6 Marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 mark s)		SA (8 Mark s)
	Compo nent -I (2 marks)	Compon ent -II (2 marks)		Compo nent -I (2 marks)	Compon ent -II (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcome	Bloom's Level		Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)			Marks		

C303.1	Understand	Quiz	2
C302.2	Understand	Assignment	2
C303.3 & C303.4	Apply	Group Assignment	2
C303.5	Analyze	Case study	2
Summative assessment based on Continuous and End Semester Examination-Theory			
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA1 [6 Marks]	CIA2 [6 Marks]	
Remember	10%	10%	20%
Understand	40%	30%	30%
Apply	30%	40%	40%
Analyze	20%	20%	10%
Evaluate	-	-	-
Create	-	-	-
Summative assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	Continuous Assessment (30%)		
	FA (22 Marks)	SA (8 Marks)	
Remember	20%	10%	
Understand	20%	20%	
Apply	40%	40%	
Analyse	20%	30%	
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
C303.1	3	1			1					1		1	2		1
C303.2	3	3	3	3					2	2		3	3	2	2
C303.3	3	3	2	1					2	1	2	3	3	2	2
C303.4	3	3	2	2	2				2	1	2	2	3	2	2
C303.5	3	2	2		2				1	2	2	3	2	2	2

21AD401		FUNDAMENTALS OF OPERATING SYSTEMS		3 / 0 / 0 / 3	
Nature of Course:		G - Theory analytical			
Pre requisites:		Computer Architecture and Digital Logic			
Course Objectives:					
1	To understand the design principles of Operating System.				
2	To describe the mechanisms of OS to handle processes and threads and their communication.				
3	To explore the various scheduling approaches and to provide solutions for concurrency, deadlock and starvation.				
4	To identify the mechanisms involved in Memory management and its schemes.				
5	To analyze the various I/O and File management techniques.				
6	To understand the basics of Embedded OS, Computer Security threats and distributed systems				
Course Outcomes:					
Upon completion of the course, students shall have ability to					
C401.1	Identify the basic concepts and design issues of operating systems.			[R]	
C401.2	Understand the principles of process and threads.			[U]	
C401.3	Illustrate the approaches in scheduling and deadlocks to apply in real world problems.			[AP]	
C401.4	Apply concepts of memory management including Virtual Memory to the issues that occur in Real time applications.			[AP]	
C401.5	Identify issues related to IO hardware, file system and disk management			[U]	
Course Contents:					
Computer System Overview: Operating System Functions and design issues – The Evolution of Operating Systems – Developments leading to Modern Operating Systems – Virtual Machine – OS design considerations for Multiprocessor and Multicore – Process description and control – Threads.					
Concurrency and Memory: Mutual Exclusion and Synchronization – Deadlock and Starvation – Uniprocessor Scheduling – Multiprocessor and Real-Time Scheduling – Memory Management requirements – Memory partitioning – Paging – Segmentation – Virtual Memory.					
Input / Output and File Systems: I/O Devices – Organization of the I/O Function - OS design issues – I/O Buffering – Disk Scheduling – RAID – Dish Cache – File Management Overview – File Organization and Access – B-Trees – File Directories – File Sharing – Record Blocking – Secondary Storage Management - File System Security.					
Case Study: Embedded Operating Systems – Operating System Security – Distributed Processing – Client/Server Computing and Clusters.					
				Total Hours:	45
Text Books:					
1.	William Stallings, “Operating Systems – Internals and Design Principles”, 9 th Edition, Pearson Publications. 2017.				

2.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 10 th Edition, John Wiley, 2018
Reference Books:	
1	Andrew S. Tanenbaum, Modern Operating Systems 5 th Edition, Pearson Education, 2016.
2	D.M Dhamdhere, "Operating Systems"- A Concept based Approach, 3 rd Edition, McGraw Hill, 2017.
Web References:	
1	http://geeksforgeeks.org/Operating Systems
2	https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
Online Resources:	
1	https://www.coursera.org/learn/os-power-user
2	https://nptel.ac.in/courses/106108101/
3	https://learn.saylor.org/course/CS401

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (16%)

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)	Marks
C401.1, C401.2	Analyze	Quiz	4
C401.3	Understand	Assignment	4
C401.4	Analyze	Idea Presentation	4
C401.5	Understand	Case Study	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (24%)		End Semester Examination (60%) [60 Marks]
	CIA1 [12 Marks]	CIA2 [12 Marks]	
Remember	10	10	10
Understand	30	30	30
Apply	30	30	30
Analyse	30	30	30
Evaluate			
Create			

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	FA 1	SA 2	FA 2	

(12 Marks)	Component -I (4 marks)	Component -II (4 marks)	(12 marks)	Component -I (4 marks)	Component -II (4 marks)	
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- * SA 1 & SA 2 are continuous internal examination conducted each for 100 marks
- * FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.
- * ES exams conducted and evaluated for 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
C401.1	1	1	1									2			2
C401.2	3	3	2									3			2
C401.3	3	3	2									2			3
C401.4	3	3	2									3			3
C401.5	3	3	2									3			2

21AD402	DATA WAREHOUSING AND MINING		3/0/0/3
Nature of Course:		D (Theory application)	
Pre requisites:		Nil	
Course Objectives:			
1	To know the Architecture of a Data Mining system.		
2	To be familiar with the Data warehouse architecture and its Implementation.		
3	To explore the various Mining techniques		
4	To understand the 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 evolutionary path that has led to the purpose of adapting to Data Warehouse and Data Mining techniques in various domains.		[U]
C402.2	Identify the need of Data Warehouse tools and techniques for designing and developing different types of databases.		[AP]
C402.3	Measure the performance of any classification algorithm and Clustering.		[AP]
C402.4	Comprehend the importance and role that Data Warehouse and Data Mining play in various fields.		[U]
C402.5	Apply the knowledge on Clustering Methods and its applications using real time data.		[AP]
Course Contents:			
Introduction to Data Warehousing and Data Mining			15Hours
Data Warehousing Components –Building a Data warehouse – Data Warehouse Architecture, OLAP vs OLTP, OLAP operations - Data Warehouse v/s Data Mining, Data Mining Process, Data Mining Functionalities, Data Pre-processing – Descriptive Data Summarization, Data Cleaning, Integration and Transformation, Reduction.			
Data Mining Concepts:			15Hours
Classification, Issues in Classification, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Prediction – Prediction techniques, Linear and Non-Linear Regression. Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis.			
Clustering and its real time application:			15Hours
Categorization of Major Clustering Methods: Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Outlier Detection. Applications of clustering -Pattern recognition, Finding similar users on Twitter, Analyzing the Stack Overflow data set.			
			Total Hours:45

Text Books:	
1	ReemaThareja, “Data Warehousing”, Oxford University Press.
2	Jiawei Han, MichelineKamber and Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.
3	Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
Reference Books:	
1	W.H. Inmon, “Building the Data Warehouse”, John Wiley & Sons, Inc, 4th Edition, 2005
2	VikramPudi, P. RadhaKrishana “Data Mining”, Oxford University press
3	K.P. Soman, ShyamDiwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
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

Assessment Methods & Levels (based on Blooms’ Taxonomy) - Theory			
Formative Assessment based on Capstone Model (8%)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C402.1	Apply	Assignment – 1	2
C402.2	Apply	Quiz	2
C402.3, C402.4	Apply	Assignment – 2	2
C402.5	Apply	Case Study	2
Summative Assessment based on Continuous and End Semester Examination			
Bloom’s Level	Continuous Internal Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA 1 [6 Marks]	CIA 2 [6 Marks]	
Remember	20	10	10
Understand	10	10	15
Apply	70	80	75

Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Summative Assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	10	10
Understand	20	10
Apply	70	80
Analyse	-	-
Evaluate	-	-
Create	-	-

Summative Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Mks)	FA 1		SA 2 (6 Mks)	FA 2		FA (22 Mks)	SA (8 Mks)	
	Comp - I (2 Mks)	Comp - II (2 Mks)		Comp - I (2 Mks)	Comp - II (2 Mks)			

Theory:

- SA 1 & SA 2 are continuous internal examination conducted each for 100 marks
- FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.
- ES exams conducted and evaluated for 100 marks

Practical:

- FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- SA – Model Examination conducted and evaluated for 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
C402.1	1	2	1									2	2	2	1
C402.2	3	3	2									3	2	3	2

C402.3	3	3	2									2	3	3	3
C402.4	3	3	2									3	3	2	3
C402.5	2	3	3									2	3	2	3

21MA404	RANDOM VARIABLES AND STATISTICS		2 / 1 / 2 / 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			
C404.1	Recall the concepts of basic probability.		[R]
C404.2	Understand how to handle situations involving random variable.		[U]
C404.3	Applying different pattern of standard distributions in real life problems.		[AP]
C404.4	Use distribution in cluster analysis of similar binary variables		[AP]
C404.5	Derive the logic and attain the knowledge of hypothesis testing.		[AP]
C404.6	Apply the analytical comparisons using ANOVA.		[AP]
Course Contents:			
Module 1: Probability and Random Variables		15 hrs	
Probability: Probability concepts - Addition and Multiplication law of probability – Conditional probability - Total probability theorem - Bayes theorem – Random Variables: One dimensional random variable - Discrete random variables -Probability mass function - Continuous random variables - Probability density function- Moment generating Function.			
Module 2: Standard distributions		15hrs	
Standard distributions: Discrete distributions - Binomial – Poisson – Geometric – Continuous distributions - Uniform – Exponential - Normal distributions –Two dimensional random variables: Joint distributions - Marginal and conditional distributions – Covariance – Correlation- Regression- Applications of two-dimensional random variables in Machine learning.			
Module 3: Statistics		15 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.

Course Outcomes: (Laboratory)

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

C404.1	Understand the use of R for Big Data analytics.
C404.2	Demonstrate the Data frame from vectors.
C404.3	Analyze and interpret results from correlation and regression.
C404.4	Understand the basic concepts of distributions and find an appropriate distribution for analyzing data specific to an experiment.
C404.5	Explore the types of plots and to represent with the help of functions.
C404.6	Understand to perform the extensive hypothesis tests for one and two samples.

Laboratory Component:

S.No	List of Experiments	CO Mapping	RBT
1.	To perform importing and exporting data using suitable Mathematical software.	C404.1	[AP]
2.	To perform with Vectors and Matrices using suitable Mathematical software.	C404.2	[AP]
3.	To plot Data frames using suitable Mathematical software.	C404.2	[AP]
4.	To Compute Summary Statistics, plotting and visualizing data using Tabulation and Graphical Representations using suitable Mathematical software.	C404.5	[AP]
5.	To solve correlation and simple linear regression model to real dataset using suitable Mathematical software.	C404.3	[AP]
6.	To Fit the following probability distribution: Binomial distribution using suitable Mathematical software.	C404.4	[AP]
7.	To Fit the following probability distribution: Poisson distribution using suitable Mathematical software.	C404.4	[AP]

8.	To Fit the following probability distribution: Normal distribution using suitable Mathematical software.	C404.4	[AP]
9.	To test of hypothesis for One sample mean and proportion from real-time problems using suitable Mathematical software.	C404.6	[AP]
10.	To test of hypothesis for Two sample mean and proportion from real time problems using suitable Mathematical software.	C404.6	[AP]
11.	To perform the t test for independent and dependent samples using suitable Mathematical software.	C404.6	[AP]
12.	To perform Chi-square test for goodness of fit test and Contingency test to real dataset using suitable Mathematical software.	C404.6	[AP]
Total Hours: 60 Hours			
Text Books:			
1	Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & sons, 2000, Reprint 2014.		
2	Peebles Jr. P.Z., —Probability Random Variables and Random Signal Principles, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2016(Chapters 6, 7 and 8).		
3	Palaniammal, S., —Probability and Random Processes, Prentice hall of India, New Delhi, 2014.		
Reference Books:			
1	Ross, S., —A First Course in Probability, Ninth edition, Pearson Education, Delhi, 2014.		
2	Henry Stark and John W. Woods —Probability and Random Processes with Applications to Signal Processing, Third Edition, 2001.		
3	<u>Richard A. Johnson</u> , <u>Irwin Miller</u> , <u>John Freund</u> , "Miller & Freund's Probability and Statistics for Engineers", Ninth edition, 2016.		
4	R for Everyone: Advanced Analytics and Graphics, Jared P. Lander.		
5	Hands-on Programming with R, Garrett Grolemund.		
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 (50%)								End Semester Examination (50%)
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 marks)	
	Compon ent -I (2 marks)	Compon ent -II (2 marks)		Compon ent -III (2 marks)	Compon ent -IV (2 marks)			
Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory								
Formative assessment based on Capstone Model (8%)								
Course Outcom e	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				Marks		
C404.1	Remember	Component – I		Quiz		2		
C404.2	Understand	Component - II		Assignment		2		
C404.3	Apply	Component - III		Seminar		2		
C404.4	Apply							
C404.5	Apply	Component - IV		Tutorial		2		
Summative assessment based on Continuous and End Semester Examination								
Bloom's Level	Continuous Assessment (12%)			End Semester Examination (50%) [50 Marks]				
	CIA1 [6 Marks]		CIA2 [6 Marks]					
Remember	30		30		20			
Understand	50		40		50			
Apply	20		30		30			
Analyse	-		-		-			
Evaluate	-		-		-			
Create	-		-		-			
Summative assessment based on Continuous and End Semester Examination – Practical								
Bloom's Level	Continuous Assessment (30%)							
	FA (22 Marks)		SA (8 Marks)					
Remember	20		20					
Understand	30		30					
Apply	50		50					
Analyse	-		-					
Evaluate	-		-					
Create	-		-					

Course Articulation Matrix (Theory)															
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
C404.1	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
C404.2	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
C404.3	3	3	-	-	-	-	-	-	-	-	-	-		-	-
C404.4	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
C404.5	3	3	-	-	-	-	-	-	-	-	-	-		-	-
C404.6	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
Course Articulation Matrix (Laboratory)															
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
C404.1	1	1	-	-	3	-	-	-	-	-	-	-	1	-	-
C404.2	2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
C404.3	3	3	-	-	3	-	-	-	-	-	-	-		-	-
C404.4	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
C404.5	3	3	-	-	3	-	-	-	-	-	-	-		-	-
C404.6	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-

21IT402	SOFTWARE TESTING USING SELENIUM		3/0/2/4
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
Introduction to Automation Testing, Advantages and Disadvantages History of selenium, why selenium, Difference between selenium and other tools, Components, Variables and Datatypes, Control Statements, Arrays, Strings and Functions, Classes and Objects, Inheritance, and Polymorphism, Exception Handling, Collections, and File Handling.			
Working with Selenium:			15 Hours
Introduction, generating scripts, wait commands, Validation commands, Store commands, Limitations, Sample Program, Navigation, radio Buttons and Checkbox, drop down list, File upload, drag and drop. Error and alert messages, multiple windows, Iframes, web table and calendar, Types and use of framework, Execution of programs, checking reports, Implementing Listeners, run group test cases.			
Maven:			15 Hours
Maven configuration, Executing TestNG from maven, managing Test suites, Read and write excel, Creating and Building test cases, build validation and generic functions, Reports Run project with ANT/MAVEN/Eclipse, JDBC Drivers, Connection Interface, Prepared Statement, Resulset and basic commands, Reading nodes and hubs, Types of browsers, Limitations and Configurations. Running tests on browsers, prioritizing the test cases, node timeout, Grid coding, Scenario building and execution.			
Total Hours			45
Laboratory Component:			

S. No	List of Experiments
1.	Installation of Selenium IDE.
2.	Create a test plan document for any application (e.g. Library Management System)
3.	Write the test cases for various functionalities (Inbox, Compose mail) for any mailing applications.
4.	Write generic method in selenium to handle all locators and return web element for any locator.
5.	Automation of E-Commerce website using selenium.
6.	Script to open Google website using various drivers (ChromeDriver, InternetExplorerDriver)
7.	Consider any system (e.g. ATM system) and study its system specifications and report the various bugs using selenium.
8.	Build a Maven project and test the written code.
Total Hours	
30	
Text Books:	
1.	Rex Allen Jones II, "Absolute Beginner, Part 1 Selenium Webdriver for Functional Automation Testing", 1 st Edition, Createspace Independent Pub, 2016
2.	S Basu, "Selenium with Python Simplified for Beginners", 1 st Edition, 2020
3.	Paul Watson, "Selenium webdriver with Node.js: Beginner's Guide", 1 st Edition, CreateSpace Independent Publishing Platform, 2016.
Reference Books:	
1.	Satya Avasarala, "Selenium Web Driver Practical Guide", 1st Edition, 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

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
Formative Assessment (FA) based on Capstone Model (8%)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C402.3	Understand	Assignment	2
C402.5	Apply	Quiz	2
C402.1, C402.4	Apply	Case Study	2
C402.2, C402.6	Analyze	Group Assignment	2
Summative Assessment (SA) based on Continuous and End Semester Examination			
Bloom's Level	Continuous Internal Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA 1 [6 Marks]	CIA 2 [6 Marks]	
Remember	10	-	10
Understand	20	20	20
Apply	60	50	40
Analyse	10	30	30
Evaluate	-	-	-
Create	-	-	-

Summative Assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	-	-
Understand	20	20
Apply	60	50
Analyse	20	30
Evaluate	-	-
Create	-	-

Summative Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Mks)	FA 1		SA 2 (6 Mks)	FA 2		FA (22 Mks)	SA (8 Mks)	
	Comp - I (2 Mks)	Comp - II (2 Mks)		Comp - I (2 Mks)	Comp - II (2 Mks)			

Theory:

- SA 1 & SA 2 are continuous internal examination conducted each for 100 marks
- FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.
- ES exams conducted and evaluated for 100 marks

Practical:

- FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- SA – Model Examination conducted and evaluated for 100 marks

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

21AD403		CLOUD COMPUTING		3/0/2/4	
Nature of Course		F (Theory Programming)			
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 creating with the help of docker.			
4		To implement automated system update and DevOps lifecycle			
5		To understand virtualization and provide the perfect security for the entire infrastructure.			
Course Outcomes:					
Upon completion of the course, students shall have ability to:					
C403.1		Demonstrate the basic global infrastructure of the AWS Cloud.			[AP]
C403.2		Identify an appropriate solution using AWS Cloud services for various use cases.			[U]
C403.3		Interpret how the components of Docker containers support compute container implementations.			[AP]
C403.4		Examine common Infrastructure Servers, Availability and Scalability.			[A]
C403.5		Learn why automation, culture, and metrics are essential to a successful DevOps project.			[U]
Course Contents:					
MODULE I: MANAGING CLOUD USING AWS				15 Hours	
Introduction, Services provided by AWS, Future of AWS, AWS EC2, AWS S3 - Cloud storage, Types, Benefits, AWS IAM - AWS Security, IAM, Working of IAM, Components AWS Cloud Front Working, Benefits. Introduction, Benefits, Snapshots vs AMI, Working, Different scaling plans. Introduction, Benefits, Algorithms used for load balancing.					
MODULE II: CONTAINERIZATION USING DOCKERS				15Hours	
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.					
MODULE III: DEVOPS				15Hours	
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					
				Total Hours:	45
Lab 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. Deployment of VMs in AWS.					
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	"Docker: Up & Running: Shipping Reliable Containers in Production", Sean P. Kane, Karl Matthias, 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.
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Web References:

1	https://cloudacademy.com/course/introduction-to-devops/intro-3/
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Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory

Formative Assessment based on Capstone Model (8%)

Course Outcome	Bloom's Level	Assessment Component	Marks
C403.1	Apply	Assignment – 1	2
C403.2	Understand	Quiz	2
C403.3, C403.4	Apply	Assignment – 2	2
C403.5	Analyze	Case Study	2

Summative Assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Internal Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA 1 [6 Marks]	CIA 2 [6 Marks]	
Remember	20	10	10
Understand	10	10	15
Apply	70	80	75
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Summative Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	10	10
Understand	20	10
Apply	50	60

Analyse	20	20
Evaluate	-	-
Create	-	-

Summative Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)							End Semester Examination (50%)	
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)		Theory Examination (50 Marks)
SA 1 (6 Mks)	FA 1		SA 2 (6 Mks)	FA 2		FA (22 Mks)	SA (8 Mks)	
	Comp - I (2 Mks)	Comp - II (2 Mks)		Comp - I (2 Mks)	Comp - II (2 Mks)			

Theory:

- SA 1 & SA 2 are continuous internal examination conducted each for 100 marks
- FA1 & FA 2 is internal components conducted as per syllabus requirements. Each Component evaluated for 10 marks each.
- ES exams conducted and evaluated for 100 marks

Practical:

- FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- SA – Model Examination conducted and evaluated for 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
C403.1	2	1	3	3	3	2					2	3	2	3	3
C403.2	1	2	3	3	3	2					2	3	2	3	3
C403.3	2	2	3	3	2	2					2	3	2	3	3
C403.4	2	1	3	3	3	2					2	3	2	3	3
C403.5	2	1	2	3	2	2					2	3	2	3	3

21CS402	WEB FRAMEWORKS		3/0/2/4
Nature of Course	D (Theory Application)		
Pre requisites	: Core 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			
C406.1	Create simple applications with REST API and handle HTTP methods.		[AP]
C406.2	Apply LIKE queries using JPA.		[AP]
C406.3	Build application using Spring Boot and handle CRUD operations with JPQL.		[AP]
C406.4	Demonstrate various relational mapping with JPA.		[U]
C406.5	Develop Spring AOP - Annotation Based Application.		[AP]
Course Contents:			
Module - I		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		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		15 Hours	
OneToOne Relationship Mapping with JPA, Join Query, Lazy Loading in JPA, BiDirectional OneToOne 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.			
Laboratory Component:			
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 +30	
Text Books:	
1.	Kirupa Chinnathambi, "A Hands-On Guide to Building Web Applications Using React and Redux", Addison-Wesley Professional, 2018.
2.	Raja CSP Raman, Ludovic Dewailly, "Building RESTful Web Services with Spring 5", Packt Publishing, 2018.
3.	Leonard Richardson, Sam Ruby "RESTful Web Services" O'Reilly Media, 2008.
1.	
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

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

							Examination (50%)
CA 1 (10 Marks)			CA 2 (10 Marks)			Practical Exam (30 Marks)	Theory Examination (50 Marks)
SA 1 (6 Marks)	FA 1		SA 2 (6 marks)	FA 2		FA (22 marks)	SA (8 Marks)
	Component - I (2 marks)	Component - II (2 marks)		Component - I (2 marks)	Component - II (2 marks)		

Formative assessment based on Capstone Model (8%)			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)	Marks
C402.1	Apply	Assignment – 1	2
C402.2 C402.3	Apply	Assignment - 2	2
C402.4 C402.5	Understand Apply	Quiz	2
		Case Study	2
Summative assessment based on Continuous and End Semester Examination-Theory			
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%)
	CIA1 [6 Marks]	CIA2 [6 Marks]	[50 Marks]
Remember	20%	10%	10%
Understand	10%	10%	15%
Apply	70%	80%	75%
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Summative assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	Continuous Assessment (30%)	
	FA (22 Marks)	SA (8 Marks)
Remember	10%	10%
Understand	20%	20%
Apply	70%	70%
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
C402.1	3	3	3	2	2	2		2	2	2	2	2	2	2	2
C402.2	3	3	3	3	3	3		2	2	2	2	3	3	3	3
C402.3	3	3	3	3	3	3		2	3	2	2	3	3	3	3
C402.4	3	3	3	3	3	3		2	3	3	2	3	3	3	3
C402.5	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3

21AD404		FUNDAMENTALS OF OPERATING SYSTEMS LABORATORY		0 / 0 / 3 / 1.5
Nature of Course		M (Practical Application)		
Pre requisites		Operating Systems Internals and Design principles		
Course Objectives:				
1	To have insight knowledge on different Unix Utilities and system calls.			
2	To experience the practical side of the functioning of various blocks in OS.			
3	To design, simulate and debug various functionalities of operating System such as Process Scheduling and Synchronization.			
4	To apply and analyze Deadlock, Memory Management and Disk Scheduling Techniques for real world problems.			
Course Outcomes:				
Upon completion of the course, students shall have ability to				
C404.1	Demonstrate the use of basic Unix commands and shell programming.			[U]
C404.2	Analyze the efficiency of CPU Scheduling algorithms.			[A]
C404.3	Apply synchronization techniques to processes.			[AP]
C404.4	Analyze the efficiency of Deadlock Prevention and avoidance mechanisms.			[A]
C404.5	Apply disk scheduling, Memory and File Management Techniques to processes.			[AP]
List of Experiments:				
1	Analysis of basic UNIX Commands			
2	Implementation of Simple Shell Scripts			
3	Synthesis of Process, Directory and I/O management Unix System Calls			
4	Simulation and Analysis of Scheduling Algorithms			
5	Implement ion of Threading & Synchronization Applications			
6	Simulation of Deadlock Avoidance and Detection algorithm.			
7	Implementation of Memory Allocation and Management Techniques			
8	Implementation of Page Replacement Techniques			
9	Simulation of Disk Scheduling Algorithms			
10	Implementation of File organization and allocation strategies			
Total Hours:				45
Text Books:				
1	William Stallings, "Operating Systems – Internals and Design Principles", 9 th Edition, Pearson Publications, 2017.			

2	Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts" 10 th Edition, John Wiley.
Reference Books:	
1.	Andrew S. Tanenbaum, Modern Operating Systems 5th Edition, Pearson Education, 2016.
2.	D.M Dhamdhere, "Operating Systems"- A Concept based Approach, 3 rd Edition, McGraw Hill, 2017.
Web References:	
1	http://geeksforgeeks.org/Operating Systems
2	https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
Online Resources:	
1	https://www.coursera.org/learn/os-power-user
2	https://nptel.ac.in/courses/106108101/
3	https://learn.saylor.org/course/CS401

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (60%)		End Semester Examination (40%)
	FA (45 Marks)	SA (15 Marks)	Practical Examination (40 Marks)
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate			
Create			

- * FA - Performance based assessment observation and Record evaluated for 100 marks each experiment
- * SA – Model examination conducted and evaluated for 100 marks
- * End Semester practical examination conducted and evaluated for 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
C304.1	3	3	3					3	3	3		3			3
C304.2	3	3	3					3	2	3		3			3
C304.3	3	3	3					3	3	3		3			3
C304.4	3	3	3					3	3	3		3			3
C304.5	2	3	3					2	3	2		3			2

21MC101	INDUCTION PROGRAMME		1/0/0/0
Nature of Course		Induction Programme	
Pre requisites		Nil	
Course Objectives:			
1.	To have broad understanding of society and relationships		
2.	To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being		
3.	To incorporate meta skills and values		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Explore academic interest and activities		[AP]
C101.2	Work for excellence		[AP]
C101.3	Promote bonding and give a broader view of life and character		[AP]
Course Contents:			
PHYSICAL ACTIVITY: Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.(CO mapping: C101.1, C101.2, C101.3)			
CREATIVE ARTS (students can select any one of their choice): Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on. .(CO mapping: C101.1, C101.2, C101.3)			
UNIVERSAL HUMAN VALUES: Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how			

disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community – local and global- and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills. .(CO mapping: C101.1, C101.2, C101.3)

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

LECTURES BY EMINENT PEOPLE: Teaching with Lectures It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts.(CO mapping: C101.1, C101.2, C101.3)

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

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

Course 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	3	3	3	3			1
C101.2						3	3	3	3	3	3	3			1
C101.3						3	3	3	3	3	3	3			1

21MC102	ENVIRONMENTAL SCIENCES		2/0/0/0
Nature of Course		Theory Concept	
Pre requisites		Basics in Environmental Studies	
Course Objectives:			
1	To learn the integrated themes on various natural resources.		
2	To gain knowledge on the type of pollution and its control methods.		
3	To have an awareness about the current environmental issues and the social problems.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C102.1	Recall and play an important role in transferring a healthy environment for future generation.		[R]
C102.2	Understand the importance of natural resources and conservation of biodiversity.		[U]
C102.3	Understand and analyze the impact of engineering solutions in a global and societal context.		[U]
C102.4	Apply the gained knowledge to overcome pollution problems.		[AP]
C102.5	Apply the gained knowledge in various environmental issues and sustainable development.		[AP]
Course Contents:			
Module 1: Natural Resources			10 Hours
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.			
Module 2: Environmental Pollutions			10 Hours
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. 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.			

Module 3: Social issues and the Environment		10 Hours	
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. HIV AIDS.			
Total Hours:		30	
Text Books:			
1	Anubha Kaushik and C P Kaushik “Perspectives in Environmental Studies” 4 th Edition, New age 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”, 13 th 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		
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:40)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C102.1	Remember	Quiz	5
C102.2	Understand	Mini project based on environmental aspect	15
C102.3	Understand	Class Presentation	10
C102.4 C102.5	Apply	Group Assignment	10

Summative assessment based on Continuous Assessment	
Revised Bloom's Level	Term End Assessment [100 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		

21MC103	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
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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.
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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

21MC105	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” 5 th Edition, McGraw Hill Education.		
Reference Books:			
1	Edgar Thorpe “Mental Ability & Quantitative Aptitude” 3 rd 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		

21MC106	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”, 1 st Edition, Wiley Publishing Ltd, 2015.		
3	Larry James, “The First Book of Life Skills”, 1 st 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		

21MC107	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 ways 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 your 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”, 1 st Edition, Springer Publishing Company, 2011.		
2	Bob Stahl, Elisha Goldstein, Jon Kabat-Zinn, “A Mindfulness–based Stress Reduction Workbook”, 2 nd Edition, New Harbinger Publications, 2019.		
3	Ryan M. Niemiec, “The Strengths-based Workbook for Stress Relief”, 1 st 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		

21MC108	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, 22 nd 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, 5 th Edition, 2019.		
2	M. Laxmikanth, “Constitution of India”, Cengage Learning India, 1 st 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	

21MC109	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	