SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution|Approved by AICTE| Affiliated to Anna University

Kuniamuthur, Coimbatore - 641008

DEPARTMENT OF INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABI

B.TECH. INFORMATION TECHNOLOGY

REGULATION 2022

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

KUNIAMUTHUR, COIMBATORE-641008

DEPARTMENT OF INFORMATION TECHNOLOGY

Department Vision

To impart quality education by providing opportunities for shaping and transforming students into eminent and ethical IT professionals, researchers, innovators and entrepreneurs with requisite skill set to excel in the dynamic field of IT.

Department Mission

- To provide state of art computer education.
- To equip staff and students with the latest skills in the field
- To keep pace with new invention and technology development, thereby set the trend for the futuristic information technology education and research with ethical and moral values.

PROGRAMME OUTCOMES

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

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

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

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

10. 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.

11. 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.

12. 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.

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Graduates will have a profound knowledge in the various programming languages and possess globally competent skill sets by inculcating continuous up gradation of their technical skills and personality traits.

PEO 2: Graduates will be able to analyze and find solutions to various applications and reconcile the dynamic trends in the field of Information Technology.

PEO 3: Graduates will contribute to the society by their ethical behaviour and effective teamwork.

PEO 4: Graduates will excel with different skills like effective communication, leadership qualities, and provide smart solutions in business environment

Mapping of POs to PEOs

Programme Educational Objectives	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PEO 1	3	3	3	3	3	3	3	2	1	2	2	3
PEO 2	3	3	3	3	3	2	2	2	2	1	2	2
PEO 3	2	2	2	2	2	2	2	3	3	3	2	1
PEO 4	2	2	3	2	2	2	3	3	3	3	3	3

1	Reasonably agreed	**2**	Moderately agreed	**3**	Strongly agreed

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DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAMME SPECIFIC OUTCOMES

PSO 1:

Graduates will demonstrate multidisciplinary knowledge for problem solving by creating solutions for product based and application-based software for the advancement of the society.

PSO 2:

Graduates attain advance knowledge in Information and Communication Technologies (ICT) thereby creating real time solutions for different projects by using modern tools prevailing in the current trends.

PSO 3:

Graduates will exhibit state of the art technologies by applying their knowledge in various programming skills to overcome the demand of sustainable development.

R2022

SEMESTER I

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22MA102	Mathematics I	3/1/0	4	4	60/40	BSC
2.	22EC111	Digital Logic and Design	3/0/0	3	3	60/40	ESC
3.	22EN101	Technical Communication Skills	2/0/2	4	3	50/50	HSMC
4.	22CH101	Engineering Chemistry	3/0/2	5	4	50/50	BSC
5.	22IT101	Application Development Practices	3/0/2	5	4	50/50	PCC
6.	22CS101	Problem Solving using C++	3/0/2	5	4	50/50	PCC
7.	22EC112	Digital Logic Design Laboratory	0/0/2	2	1	40/60	ESC
8.	22MC101	Mandatory Course – I (Induction Programme)	3 Weeks			0/100	MC
			Total	**28**	**23**	**800**	

SEMESTER II

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

SEMESTER III

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22GE201	Universal Human Values	3/0/0	3	3	60/40	HSMC
2.	22IT301	Computer Architecture	3/0/0	3	3	60/40	PCC
3.	22MA302	Random Variables and Statistics	3/1/0	4	4	60/40	BSC
4.	22TA201	Tamils and Technology	1/0/0	1	1	60/40	HSMC
5.	22IT302	Web Technology	1/0/4	5	3	50/50	PCC
6.	22AD301	Design and Analysis of Algorithms	1/0/4	5	3	50/50	PCC
7.	22CS301	Advanced Java Programming	1/0/4	5	3	50/50	PCC
8.	22MCXXX	Mandatory Course-III	2/0/0	2	0	0/100	MC
			Total	28	20	800	

SEMESTER IV

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22IT401	Formal Languages and Automata Theory	3/0/0	3	3	60/40	PCC
2.	22MA401	Optimization and Project Management	3/1/0	4	4	60/40	BSC
3.	22IT402	Software Testing	1/0/4	5	3	50/50	PCC
4.	22AD401	Cloud Computing	1/0/4	5	3	50/50	PCC
5.	22CS402	Web Frameworks	1/0/4	5	3	50/50	PCC
6.	22CS403	Operating Systems	3/0/2	5	4	50/50	PCC
7.	22MCXXX	Mandatory Course-IV	2/0/0	2	0	0/100	MC
			Total	29	20	700	

SEMESTER V

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22IT501	Data Communications and Computer Networks	3/0/0	3	3	60/40	ESC
2.	22XX0XX	Open Elective – I	3/0/0	3	3	60/40	OEC
3.	22EC511	Fundamentals of Data and Mobile Communications	3/0/0	3	3	60/40	ESC
4.	22XXXXX	Professional Elective-I	0/0/6	6	3	40/60	PEC
5.	22XXXXX	Professional Elective-II	3/0/0	3	3	60/40	PEC
6.	22CS502	Principles of Compiler Design	3/0/2	5	4	50/50	PCC
7.	22IT502	Data Communications and Computer Networks Laboratory	0/0/3	3	1.5	40/60	ESC
8.	22IT503	Mini Project	0/0/2	2	1	40/60	PW
			Total	28	21.5	800	

SEMESTER VI

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22IT601	Embedded Systems and Internet of Things	3/0/0	3	3	60/40	PCC
2.	22XXXX	Emerging Elective - I	3/0/0	3	3	60/40	EEC
3.	22CS602	Cryptography and Network Security	3/0/0	3	3	60/40	PCC
4.	22XXXXX	Professional Elective-III	0/0/6	6	3	40/60	PEC
5.	22XXXXX	Professional Elective-IV	3/0/0	3	3	60/40	PEC
6.	22IT602	Data Science using Python	3/0/2	5	4	50/50	PCC
7.	22IT603	Embedded Systems and Internet of Things Laboratory	0/0/3	3	1.5	40/60	PCC
			Total	26	20.5	700	

SEMESTER VII

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1.	22IT701	Computational Biology	3/0/0	3	3	60/40	PCC
2.	22XXXX	Open Elective-II	3/0/0	3	3	60/40	OEC
3.	22XXXX	Emerging Elective - II	3/0/0	3	3	60/40	EEC
4.	22XXXXX	Professional Elective-V	3/0/0	3	3	60/40	PEC
5.	22XXXX	Professional Elective-VI	3/0/0	3	3	60/40	PEC
6.	22IT702	Big Data Analytics	3/0/2	5	4	50/50	PCC
7.	22EES01	Employability Enhancement Skills			2	0/100	EES
			Total	20	21	700	

SEMESTER VIII

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
PROJECT WORK							
1	22IT801	Project	0/0/24	24	12	40/60	PW
			Total	24	12	100	

HUMANITIES AND MANAGEMENT COURSES (8 Credits)

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

BASIC SCIENCE COURSES (24 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	22MA102	Mathematics I	3/1/0	4	4	BSC
2.	22MA202	Mathematics II	3/1/0	4	4	BSC
3.	22PH201	Physics	3/0/2	5	4	BSC
4.	22CH101	Engineering Chemistry	3/0/2	5	4	BSC
5.	22MA302	Random Variables and Statistics	3/1/0	4	4	BSC
6.	22MA401	Optimization and Project Management	3/1/0	4	4	BSC

ENGINEERING SCIENCE COURSES (15.5 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	22EE111	Basics of Electrical and Electronics Engineering	2/1/0	3	3	ESC
2.	22EE114	Basics of Electrical and Electronics Engineering Laboratory	0/0/2	2	1	ESC
3.	22EC111	Digital Logic and Design	3/0/0	3	3	ESC
4.	22EC112	Digital Logic Design Laboratory	0/0/2	2	1	ESC
5.	22EC511	Fundamentals of Data and Mobile Communications	3/0/0	3	3	ESC
6.	22IT501	Data Communications and Computer Networks	3/0/0	3	3	ESC
7.	22IT502	Data Communications and Computer Networks Laboratory	0/0/3	3	1.5	ESC

PROFESSIONAL CORE COURSES (70.5 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	22IT101	Application Development Practices	3/0/2	5	4	PCC
2.	22CS101	Problem Solving using C++	3/0/2	5	4	PCC
3.	22CS201	Data Structures and Algorithms	3/0/2	5	4	PCC
4.	22IT201	Database Management Systems	3/0/2	5	4	PCC
5.	22AD201	Java Programming	3/0/2	5	4	PCC
6.	22AD301	Design and Analysis of Algorithms	1/0/4	5	3	PCC
7.	22IT301	Computer Architecture	3/0/0	3	3	PCC
8.	22IT302	Web Technology	1/0/4	5	3	PCC
9.	22CS301	Advanced Java Programming	1/0/4	5	3	PCC
10.	22CS402	Web Frameworks	1/0/4	5	3	PCC
11.	22CS403	Operating Systems	3/0/2	5	4	PCC
12.	22IT401	Formal Languages and Automata Theory	3/0/0	3	3	PCC
13.	22IT402	Software Testing	1/0/4	5	3	PCC
14.	22AD401	Cloud Computing	1/0/4	5	3	PCC
15.	22CS502	Principles of Compiler Design	3/0/2	5	4	PCC
16.	22IT601	Embedded Systems and Internet of Things	3/0/0	3	3	PCC
17.	22IT602	Data Science using Python	3/0/2	5	4	PCC
18.	22CS602	Cryptography and Network Security	3/0/0	3	3	PCC
19.	22IT603	Embedded Systems and Internet of Things Laboratory	0/0/3	3	1.5	PCC
20.	22IT701	Computational Biology	3/0/0	3	3	PCC
21.	22IT702	Big Data Analytics	3/0/2	5	4	PCC

PROFESSIONAL ELECTIVE VERTICAL COURSES

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
Data Science & Analytics						
1.	22IT901	Artificial Intelligence and Machine learning	3/0/0	3	3	PEC
2.	22IT902	NLP with Predictive Analysis	3/0/0	3	3	PEC
3.	22IT903	Deep Learning Techniques	3/0/0	3	3	PEC
4.	22IT904	Cognitive Systems and Analytics	3/0/0	3	3	PEC
5.	22CS903	Business Analytics	3/0/0	3	3	PEC
6.	22CS904	Social Network Mining and Analysis	3/0/0	3	3	PEC
Software Development						
1.	22IT911	Open Source Systems	3/0/0	3	3	PEC
2.	22AD901	App Development	0/0/6	6	3	PEC
3.	22IT912	Advanced Application Development	0/0/6	6	3	PEC
4.	22CS911	API Development using MVC Architecture	3/0/0	3	3	PEC
5.	22CS912	Software Project Management	3/0/0	3	3	PEC
6.	22CS913	Design of Software Agents	3/0/0	3	3	PEC
Cloud Computing & Data Storage Technologies						
1.	22IT921	Cloud Services and Integration	3/0/0	3	3	PEC
2.	22IT922	Data Warehousing and Data Mining	3/0/0	3	3	PEC
3.	22CS921	Software Defined Networks	3/0/0	3	3	PEC
4.	22CS922	Storage Technologies	3/0/0	3	3	PEC

5.	22CS923	Data Virtualization	3/0/0	3	3	PEC
6,	22CY935	Security and Privacy in Cloud	3/0/0	3	3	PEC
Cyber Security & Data Privacy						
1.	22IT931	Cyber Threats and Vulnerabilities	3/0/0	3	3	PEC
2.	22IT932	Blockchain Technology	3/0/0	3	3	PEC
3.	22IT933	Ethical Hacking and Auditing Frameworks	3/0/0	3	3	PEC
4.	22CY921	Data Privacy and Security	3/0/0	3	3	PEC
5.	22CY944	Cyber Crime and Forensics	3/0/0	3	3	PEC
6.	22CY945	Digital and Mobile Forensics	3/0/0	3	3	PEC
Networks and Security						
1.	22IT941	Wireless Sensor Networks and its Applications	3/0/0	3	3	PEC
2.	22IT942	Mobile Adhoc Networks	3/0/0	3	3	PEC
3.	22CS941	Wireless Networks	3/0/0	3	3	PEC
4.	22CS942	Mobile and Wireless Security	3/0/0	3	3	PEC
5.	22CS943	Modern Cryptography	3/0/0	3	3	PEC
6.	22CY926	Social Network Security	3/0/0	3	3	PEC
Creative Media						
1.	22IT951	User Experience Design	3/0/0	3	3	PEC
2.	22IT952	Streaming Analytics	3/0/0	3	3	PEC
3.	22CS951	Game Design	3/0/0	3	3	PEC
4.	22CD903	Multimedia and Animation	3/0/0	3	3	PEC
5.	22CD904	Video Creation and Editing	3/0/0	3	3	PEC
6.	22CY954	Augmented and Virtual Reality Technologies	3/0/0	3	3	PEC

OPEN ELECTIVE COURSES

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	22IT001	Mobile Applications Development using Android	3/0/0	3	3	OEC
2.	22IT002	PHP and MySQL	3/0/0	3	3	OEC
3.	22IT003	Blockchain Essentials	3/0/0	3	3	OEC
4.	22IT004	Cloud and Virtualization	3/0/0	3	3	OEC
5.	22IT005	REST API using Spring Boot	0/0/6	6	3	OEC
6.	22IT006	Introduction to Cyber Security	3/0/0	3	3	OEC

EMERGING ELECTIVE COURSES

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
Emerging Elective Courses – Stream 1						
1.	22IT008	Kotlin for Cross-platform Application Development	3/0/0	3	3	EEC
2.	22IT009	Extended Reality	3/0/0	3	3	EEC
3.	22IT011	Principles of Industry 4.0	3/0/0	3	3	EEC
Emerging Elective Courses – Stream 2						
4.	22IT007	Open-Source Deep Learning Frameworks	3/0/0	3	3	EEC
5.	22IT010	Explainable AI	3/0/0	3	3	EEC
6.	22IT012	Fog and Edge Computing	3/0/0	3	3	EEC

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

S. No	Course Code	Course Title	Credits	Category
1.	22EES01	Employability Enhancement Skills	2	EES

MANDATORY COURSES

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

VALUE ADDED COURSES

S. No	Course Code	Course Title	Credits	Category
1.	22VA900	Application Development using Flutter	1	VAC
2.	22VA901	Ruby on Rails	1	VAC
3.	22VA130	Effective Communication Skills	2	VAC

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

S. No	Stream	I	II	III	IV	V	VI	VII	VIII	Credits	AICTE Norms
1.	Humanities (HSMC)	3	1	4						8	**16**
2.	Basic Sciences (BSC)	8	8	4	4					24	**23**
3.	Engineering Sciences (ESC)	4	4			7.5				15.5	**29**
4.	Professional Core (PCC)	8	12	12	16	4	11.5	7		70.5	**59**
5.	Professional Electives (PEC)					6	6	6		18	**12**
6.	Open Electives (OEC)					3		3		6	**9**
7.	Emerging Elective (EEC)						3	3		6	
8.	Project Work (PW)					1			12	13	
9.	Employability Enhancement Skills (EES)							2		2	**15**
10.	Mandatory Course (MC)										**Non-Credit**
	Total	23	25	20	20	21.5	20.5	21	12	**163**	
	AICTE (CSE)	**18**	**23**	**23**	**21**	**20**	**23**	**20**	**15**		**163**

22MA102		MATHEMATICS I *(COMMON TO CSE, IT, AI&DS, CSD)*	3/1/0/4

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

Course Objectives:

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

Course Outcomes (Theory)

Upon completion of the course, students shall have ability to

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

Course Contents:

MODULE 1 - LINEAR ALGEBRA   **20 Hours**

VECTOR SPACE: Vector space: Dimension – Basis – Orthogonality – Projections - Gram-Schmidt orthogonalization and QR decomposition. - **MATRICES:** Definition – Types of matrices – Characteristic equation – Eigenvalues and Eigenvectors of a real matrices and their properties (excluding proof) – Eigenvalues of a matrix by power method - Solution of system of linear equations by Gauss Elimination and Gauss Jordan method - Iterative methods: Gauss Jacobi method and Gauss Seidel method- Inverse of a matrix by Gauss Jordan method.

MODULE 2 – CALCULUS   **20 Hours**

DIFFERENTIAL CALCULUS: Solution of First order ordinary differential equations: Taylor's series method – Runge kutta method of fourth order – Second and Higher order Linear differential equations with constant coefficients – Method of Variation of Parameters – Higher order Linear differential equations with variable coefficients: Euler Cauchy's equation. **INTEGRAL CALCULUS:** Evaluation of definite integrals using Bernoulli's formula – Beta and Gamma functions – Evaluation of Integrals using Beta and Gamma Functions – Numerical integration: Trapezoidal rule and Simpson's rule for single and double integrals**.**

MODULE 3 - LAPLACE TRANSFORM   **20 Hours**

Convergence of Laplace transform – Transform of some standard functions –Unit step function- Unit Impulse function – Properties –Shifting theorem- transforms of derivatives and integrals - Initial and final value theorem – Laplace Transform of periodic functions – Inverse Laplace transform – Partial fraction method – Convolution theorem (Excluding Proof) – Solving second order ordinary differential equations using Laplace Transform.

	Total Hours:	**60**

Text Books:	
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14th Edition, Pearson, Reprint, 2018.
2	Howard Anton and Chris Rorrs, "Elementary Linear Algebra", 9th Edition, John Wiley & Sons, 2000.
3	Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.
Reference Books:	
1	Veerarajan. T, "Engineering Mathematics II", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
2	Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, 2012.
3	N.P. Bali and Dr. Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi publications Ltd, 2014.
4	Gilbert Strang, "Linear Algebra and its Applications", 3rd Edition, Harcourt College Publishers, 1988.
Web References:	
1	https://onlinecourses.nptel.ac.in/noc21_ma16/preview
2	https://onlinecourses.nptel.ac.in/noc22_ma72/preview
3	https://archive.nptel.ac.in/courses/111/106/111106139/
4	http://nptel.ac.in/video.php?subjectId=117102060/
Online Resources:	
1	https://www.coursera.org/learn/ordinary-differential-equations
2	https://www.coursera.org/learn/linearalgebra1/
3	https://www.classcentral.com/course/swayam-laplace-transform-19925
4	https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C102.1	Remember	Quiz	20
C102.2	Understand	Seminar	20
C102.3 – C102.5	Apply	Tutorial	20

C102.3 – C102.5	Apply	Assignment		20

Assessment based on Summative and End Semester Examination

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

Assessment based on Continuous and End Semester Examination

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

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
C102.1	1	1											3	2	2
C102.2	2	2											3	2	2
C102.3	3	3											3	2	2
C102.4	3	3											3	2	2
C102.5	3	3											3	2	2

22EC111		**DIGITAL LOGIC AND DESIGN**	**3/0/0/3**
Nature of Course		G (Theory analytical)	

Course Objectives:	
1.	To understand how computers operate at the most basic level.
2.	To gain familiarity to the principles of combinational logic and the design of combinational circuits.
3.	To understand the basics of sequential logic devices and the design of sequential circuits.
4.	To learn the process of modeling the combinational and sequential logic circuits using Verilog.
5.	To understand the concepts of Programmable logic devices.

Course Outcomes		
Upon completion of the course, students shall have ability to		
C111.1	Identify and encode information in binary and to manipulate Boolean functions using Boolean algebra.	[U]
C111.2	Interpret and minimize Boolean functions and implement them using digital logic gates.	[U]
C111.3	Illustrate and design different combinational logic circuits.	[A]
C111.4	Analyze and design various sequential circuits.	[A]
C111.5	Construct Verilog models for digital logic circuits.	[AP]
C111.6	Implement digital logic circuits using programmable logic devices.	[AP]

Course Contents:

Introduction: **15 Hours**

Number Systems- Binary codes – Binary Arithmetic - Boolean algebra - Boolean functions –Minimization of Boolean Functions using Karnaugh Maps - Implementation of Logic Circuits using Gates (Two Level/Multi level Implementation).

Combinational Logic: **15 Hours**

Analysis and Design Procedures-Circuits for Arithmetic Operations- Multiplexer-Demultiplexer -Decoder-Encoders- and their use in Logic Synthesis-Verilog Modelling for Combinational Circuits.

Synchronous Sequential Logic & Programmable Logic devices: **15 Hours**

Latches-Flipflops-Analysis and Synthesis of Clocked Sequential Circuits – Registers- Shift Registers-Ripple Counters-Synchronous Counters-Special Counters-Verilog Modelling for

Sequential circuits-Finite State Machines, PROM, PLA, PAL, FPGA.

	Total Hours	**45**

Text Books:	
1.	M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson, 2018.
2.	C.H. Roth Jr., Larry L. Kinney, "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2014.

Reference Books:	
1.	John F. Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson, 2018.
2.	Donald P Leach, Albert Paul Malvino, Goutam Saha, "Digital Principles and Application", 8th Edition, McGraw Hill education (India) Private Limited, 2015.
3.	Clive Woods, Brian Holdsworth, "Digital Logic Design", 4th Edition, O'Reilly Media, 2002.
4.	Donald D. Givone, "Digital Principles and Design", 7th Edition, McGraw-Hill, 2010.

Web References:	
1.	https://www.xilinx.com/support/documentation/university/Vivado-eaching /HDLDesign/2013x/Nexys4/Verilog/docs-pdf/Vivado_tutorial.pdf.

Online Resources:	
1.	https://www.edx.org/course/computation-structures-part-1-digital-mitx-6-004- 1x-0
2.	https://swayam.gov.in/course/1392-digital-circuits-and-systems
3.	http://www.nesoacademy.org/electronics-engineering/digital-electronics/digital
4.	http://www.digital.iitkgp.ernet.in/dec/index.php

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C111.1	Remember	Quiz	20
C111.2	Apply	Assignment	20
C111.4	Understand	Quiz	20
C111.6	Apply	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	-	-	-
Understand	30	10	20
Apply	40	60	50
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-
Assessment based on Continuous and End Semester Examination			
Continuous Assessment (40%) [200 Marks]			End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks		CA 2 : 100 Marks	
SA 1 (60 Marks)	FA 1 (40 Marks)	SA 2 (60 Marks)	FA 2 (40 Marks)
	Component - I (20 Marks) / Component - II (20 Marks)		Component - I (20 Marks) / Component - II (20 Marks)

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

22EN101	**TECHNICAL COMMUNICATION SKILLS** **(MCT/CIVIL/IT/EEE/ECE/AI&DS/CYBER/CSE/CSD)** **(SEMESTER I)** **(MECH- SEMESTER II)**	**2/0/2/3**

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

Course Objectives:

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

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

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

Course Contents:

Module I   **10 Hours**
Introduction-Listening: - Listening to News in NDTV and Times Now Channels. Speaking: Introduction to Effective Communication - Barriers to Effective Communication- Tips to develop Communication Skills - Self Introduction - Overview of Business Communication-Short Talk on Business Topics -Impromptu Speaking (Public Speaking) - Non-Verbal Communication-SATORI-Sharing Personal Information- **Reading:** Reading Comprehension- Values and its Importance. **Writing:** SWOT Analysis -Book Review - Movie Review-Vocabulary Building.

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

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

	Total Hours	**30**

Lab Components		
1	Listening Comprehension 1. News in NDTV and Times Now Channels 2. Listening to Specific Information	[AP]
2	Impromptu Speaking	[AP]
3	Reading Comprehension related to Competitive Exams	[U]
4	Immersion Activity and Presentation	[AP]

5	Group Discussion		[AP]
6	Group Assignment – Form an NGO		[AP]
			30 Hours
		Total Hours:	**30+30=60**

Text Books:	
1	Basic Communication Skills for Technology, by Andrea J Rutherford, Pearson Publishers, 2000
2	Remedial English Grammar. F.T. Wood. Macmillan.2007
3	Oxford Guide to Effective Writing & Speaking by John Seely, Oxford University Press.2005
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.
Reference Books:	
1	Touchstone Student's Book 1 by Michael McCarthy, Jeanne McCarten, Helen Sandiford, Cambridge University Press.2005
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3	Touchstone Student's Book 2 by Michael McCarthy, Jeanne McCarten, Helen Sandiford, Cambridge University Press.2015
Web References:	
1	http://www.academiccourses.com/Courses/English/Business-English
2	https://www.liveworksheets.com/worksheets/en/English_as_a_Second_Language_(ESL)/Technical_English
Online Resources:	
1	https://www.coursera.org/specializations/business-english
2	https://www.businessenglishresources.com/learn-english-for-business/student-section/practice-exercises-new/

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C101.1 C101.2	Remember	Quiz	**20**
C101.3	Apply	Technical Presentation	**20**
C101.4	Understand	Reading Comprehension	**20**
C101.5	Apply	Group Assignment	**20**
Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (25%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

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

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

22CH101	ENGINEERING CHEMISTRY Common for all B.E / B.Tech Engineering courses (Except CSBS & M.Tech CSE)	3/0/2/4

Nature of Course	: E (Theory Skill based)
Pre requisites	: NIL

Course Objectives:

1	To understand the principles and applications of electrochemistry and to learn electroanalytical methods.
2	To learn the effect of corrosion in materials and the methods for prevention of corrosion.
3	To understand the basic concepts, synthesis, and applications of nanomaterials.
4	To explore the synthesis and properties of important engineering plastics and energy sources.
5	To understand the concepts of photophysical and photochemical processes in spectroscopy.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Recall the principle and working of reference electrodes and conductivity meters as an analyzer.	[R]
C101.2	Apply the various corrosion control techniques in real time industrial environments.	[AP]
C101.3	Interpret the basic concepts and applications of Nano chemistry.	[U]
C101.4	Use the knowledge of various energy sources in storage devices and polymeric products in engineering field.	[AP]
C101.5	Interpret the principle and working of certain analytical techniques.	[U]

Course Contents

Electrochemistry and Corrosion: **15 Hours**

Electrochemistry-Introduction**,** Oxidation and reduction potentials-Free energy and emf, cell potentials, Nernst equation and applications. Reference electrodes-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Electrochemical cells-electrolytic cell-reversible and irreversible cells. Water treatment-characteristics of water-hardness-types and estimation of hardness by EDTA method with numerical problems. Importance of corrosion-types–mechanism of dry and wet corrosion-galvanic corrosion-differential aeration corrosion. Corrosion protection-electroplating of Chromium-electroless plating of Nickel.

Nano-Chemistry and Energy sources: **15 Hours**

Nano Chemistry-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-Solid oxide and polymer electrolytes in H_2-O_2 fuel cell. Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

Polymer chemistry and Spectroscopic techniques: **15 Hours**

Introduction-monomers and polymers-classification of polymers-Degree of Polymerization (Simple problems). 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).

Field work:
Industrial visit- Moulding and spectroscopic techniques

Theory:			45 Hours
Lab Components:			**30 Hours**
1	Determination of total, temporary, calcium and magnesium hardness of water sample by EDTA method.		[E]
2	Estimation of alkalinity of water sample.		[E]
3	Estimation of dissolved oxygen in water		[E]
4	Potentiometry- determination of redox potentials and emf's		[E]
5	Conductometric titration-mixture of acids vs NaOH		[E]
6	Determination of strength of strong acid by pH metry		[E]
7	Determination of corrosion rate of mild steel in acid medium		[E]
8	Electroplating of nickel over copper		[E]
9	Spectrophotometry-Estimation of iron in water		[E]
10	Determination of single electrode potential of Zinc and Copper by given solution		[E]
		Total Hours:	**75**

Understanding the concepts by simple Demonstrations / Experiments:

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

Text Books:

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

Reference Books:

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

Web References:

1	http://www.analyticalinstruments.in/home/index.html
2	www.springer.com › Home › Chemistry › Electrochemistry
3	https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry

4	www.edx.org/
5	https://www.ntnu.edu/studies/courses
6	www.corrosionsource.com/
Online Resources:	
1	https://ocw.mit.edu/courses/chemistry
2	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf
3	https://alison.com - Spectroscopic technique, Colorimetry
4	https://ocw.mit.edu/courses/chemistry
5	nptel.ac.in/courses/113108051

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

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

Assessment based on Summative and End Semester Examination - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA 1: [60 Marks]	CIA 2: [60 Marks]	
Remember	20	20	20
Understand	35	35	35
Apply	45	45	45
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

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

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

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

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

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

Course Objectives:

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

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Identify the driving forces and adopt Agile approaches to software development practices.	[AP]
C101.2	Demonstrate the values and practices of Scrum and how to setup the GitHub repository.	[U]
C101.3	Find the working model and learn basic web concepts to develop Static and Dynamic web pages.	[R]
C101.4	Utilize the knowledge of HTML and CSS code to create personal and/or business websites following current professional and/or industry standards.	[AP]
C101.5	Develop dynamic web page with validation and event handling mechanisms.	[AP]

Course Contents:

Module - I: **15 Hours**

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

Module - II: **15 Hours**

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

Module - III: **15 Hours**

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

	Total Hours	**45**

Lab Component:

S. No	List of Experiments
1	Draw basic UML diagrams (use case, Activity, class, interaction, State charts, Component and Deployment diagram)
2	Develop DFD model (level-0, level-1)
3	Design a web page using HTML basic tags.
4	Develop web site with suitable contents and links.
5	Design web pages using lists and tables.
6	Build a web client-side Login, Registration form and Dashboard with drop down menus.
7	Develop a HTML form and validation using HTML5 features.
8	Create a website using HTML: To embed an image map in a web page. To fix the hot spots. Show all the related information when the hot spots are clicked.
9	Apply style specification in HTML page using CSS.
10	Develop dynamic web application using HTML, CSS and JavaScript.

	Total Hours	**30**

Text Books:	
1.	Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1st Edition, 2010.
2.	Jeff Sutherland, "Scrum the Art of Doing Twice the Work in Half the Time", Random House Publisher, 1st Edition, 2014.
3.	Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
4.	Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley India Pvt. Limited, 5th Edition, 2008.
5.	Jennifer Niederst Robbins., "Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics", O'Reilly Media, 5th Edition,2018.
6.	Jennifer Smith and the AGI Creative Team, "Web Design with HTML and CSS", Wiley Publisher, 1st Edition, 2011.
7.	Stephen Blumenthal, "JavaScript: JavaScript for Beginners - Learn JavaScript Programming with ease",1st Edition, 2017.
Reference Books:	
1.	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2nd Edition, 2014.
2.	Mike Cohn, "User Stories Applied: For Agile Software", Addison Wesley, 2nd Edition, 2016.
3.	Thomas a Powell, "HTML & CSS: The Complete Reference", 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
4.	Russ Ferguson, "Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development", Apress Publishers, 3rd Edition, 2019.
5.	Deitel, Deitel, Goldberg, "Internet and World Wide Web – How to program", 5th Edition, Prentice Hall Publishers, 2012.
Web References:	
1.	https://www.coursera.org/specializations/agile-development
2.	https://www.edx.org/learn/agile
3.	https://nptel.ac.in/courses/106/105/106105182/
4.	https://developer.mozilla.org/en-US/docs/Web/HTML
5.	https://developer.mozilla.org/en-US/docs/Web/CSS
6.	https://developer.mozilla.org/en-US/docs/Web/JavaScript
Online Resources:	
1.	http://www.agilenutshell.com/
2.	https://www.atlassian.com/agile/scrum
3.	https://www.youtube.com/user/AgileMikeCohn
4.	https://www.coursera.org/learn/html-css-javascript-for-web-developers
5.	https://online-learning.harvard.edu/subject/javascript

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

Formative Assessment based on Capstone Model - Theory

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

Assessment based on Summative and End Semester Examination - Theory

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

Assessment based on Continuous and End Semester Examination – Practical

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

Assessment based on Continuous and End Semester Examination

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

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

22CS101	**PROBLEM SOLVING USING C++**	**3/0/2/4**
Nature of Course	C (Theory Concept), K (Problem Programming)	
Prerequisites	Nil	

Course Objectives:

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

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

C101.1	Solve problems using operators and control Statements	[AP]
C101.2	Write C++ programs for processing strings and arrays	[AP]
C101.3	Apply the concepts of pointers and functions in programs.	[AP]
C101.4	Develop C++ programs using various object-oriented concepts to solve real world problems	[A]
C101.5	Implement the concepts on file streams and operations	[AP]

Course Contents:

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

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

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

	Total Hours (Theory)	**45**

Lab Component

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

10.	Programs using inheritance concepts
11.	Programs using exception handling concept
12.	Programs using Files.
13.	Mini project

Total Hours (Lab)	30
Total Hours (45+30)	75

Text Books:

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

Reference Books:

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

Web References:

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

Online Resources:

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

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C101.1	Apply	Quiz	20
C101.2, C101.3	Apply	Assignment	20
C101.4	Analyze	Group Assignment	20
C101.5	Apply	Case Study	20
Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	20	20
Understand	40	30	30
Apply	40	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	20	20
Understand	30	20	20
Apply	50	60	60
Analyse	10	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

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

22EC112	DIGITAL LOGIC DESIGN LABORATORY	0/0/2/1

Nature of Course: M (Practical application)

Course Objectives:

1.	To design and construct combinational and sequential circuits based on an abstract functional specification.
2.	To simulate and design Digital logic circuits using Verilog.

Course Outcomes

C112.1	Ability to design interpret and minimize Boolean functions and implement them using digital logic gates.	[AN]
C112.2	Analyzing and implementing the various combinational logic Circuits and verifying its truth table.	[AN]
C112.3	Analyzing the various sequential logic circuits and its characterization.	[AN]
C112.4	Simulation of Combinational circuits using simulation tool.	[AN]
C112.5	Simulation of Sequential circuits using simulation tool.	[AN]

Course Content:

S.No	List of Experiments	CO Mapping	RBT
1	Realization of Boolean Functions using Logic Gates.	C112.1	[AN]
2	Analysis and Synthesis of Arithmetic expressions using adders/subtractor.	C112.2	[AN]
3	Design the Code Converter using logic gates.	C112.2	[AN]
4	Design the 4x1 multiplexer and 1x4 demultiplexer	C112.2	[AN]
5	Design an octal to binary encoder and binary to octal decoder using logic gates.	C112.2	[AN]
6	Design and Implementation of Multibit sequential circuit (Shift Registers).	C112.3	[AN]
7	Design and Implementation of Synchronous Counters.	C112.3	[AN]
8	Simulation of adder circuit using Verilog simulation tool	C112.4	[AN]
9	Simulation of multiplexer using Verilog simulation tool	C112.4	[AN]
10	Verilog modelling of synchronous counters.	C112.5	[AN]
		Total Hours	30

Reference Books:

1. John F. Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson,2018.

2. Donald P Leach, Albert Paul Malvino, Goutam Saha, "Digital Principles and Application",

   8th Edition, McGraw Hill education (India) Private Limited, 2015.

3. Clive Woods, Brian Holdsworth, "Digital Logic Design", 4th Edition, O'Reilly Media, 2002.

4. Donald D.Givone, "Digital Principles and Design", 7th Edition, McGraw-Hill,2010.

Web References:

1. https://www.xilinx.com/support/documentation/university/Vivado-eaching /HDLDesign/2013x/Nexys4/Verilog/docs-pdf/Vivado_tutorial.pdf.

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

Assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (60%) [100 Marks]		End Semester Practical Examination (40%) [100 Marks]
	FA (75 Marks)	SA (25 Marks)	
Remember	-	-	-
Understand	30	20	20
Apply	30	40	40
Analyse	40	40	40
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
C112.1	3	3	3	3								2	3	2	1
C112.2	2	3	3	2	2							2	3	1	1
C112.3	3	3	3	2	3							2	3	3	1
C112.4	2	3	3	3	2								2	2	2
C112.5	2	2	3	1	2								3	3	2

22MC101	INDUCTION PROGRAMME (FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES)	1/0/0/0
Nature of Course	Induction Programme	
Pre requisites	Nil	

Course Objectives:

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

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

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

Course Contents:

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

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

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

LITERARY AND PROFICIENCY MODULES: Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage with societal institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of

Reading, writing, speaking – debate, role play etc. Communication and computer skills. (CO mapping: C101.1, C101.2, C101.3)

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

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

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

Course Articulation Matrix (Lab)

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1						3	3	3	3	3	3	3			1
2						3	3	3	3	3	3	3			1
3						3	3	3	3	3	3	3			1

22MA202	MATHEMATICS II CSE/ IT/ AI&DS /CSD	3/1/0/4

Nature of Course	C (20% Descriptive & 80% Analytical)
Prerequisites	-

Course Objectives:

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

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

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

Course Contents

MODULE 1: Propositional and Predicate Calculus   **20 Hours**
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   **20 Hours**
Sets: Basic sets - Operations on Sets – Law on Sets - Cartesian product of sets – **Relations:** Types of relations and their properties – Relational matrix and graph of a relation – Equivalence relations – Partial ordering - **Functions:** Classification of functions–Composition of functions – Inverse function-Permutation functions- recursive function - Hashing function - Counting: Permutations and Combinations - Mathematical induction

MODULE 3: Number Theory & Recurrence Relation   **20 Hours**
Number Theory: Division algorithm - Base-b representations - Number patterns - Prime and composite numbers - GCD- Euclidean algorithm - Fundamental theorem of arithmetic – LCM - Wilson's Theorem - Fermat's Theorem -Tau and Sigma Function.
Recurrence Relation: Recurrence relations - Formation of recurrence relation - Solving linear recurrence relations – Generating functions.

	Total Hours:	**60**

Text Books:

1	Kenneth H. Rosen, - Discrete Mathematics and its Applications, 8th Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 8th Edition, 2021.

2	Tremblay J.P and Manohar R, - Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011	
3	Koshy. T-"Elementary Number Theory with Applications. Elsevier Publications, New Delhi, 2nd Edition, 2007.	

Reference Books:

1	P. Grimaldi, - Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson Education sia, New Delhi, Fifth Edition, 2019.
2	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, —Discrete Mathematical Structures, 6th 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
4	https://youtu.be/qvw1GX93JSY

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C202.1	Remember	Quiz	20
C202.2	Understand	Seminar	20
C202.3 – C202.5	Apply	Tutorial	20
C202.3 – C202.5	Apply	Assignment	20

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

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

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

22EE111	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (Common to CSE, IT, AIDS, CSD, CS and M.TECH)	2/1/0/3

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

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

Course Contents:

Module I: DC Circuits and AC Circuits **15 Hours**
DC Circuits - Electrical circuit elements (R, L and C) - Voltage and Current Sources - Kirchoff's current and voltage law - analysis of simple circuits with dc excitation - Mesh and Nodal Analysis. **AC Circuits** - Representation of sinusoidal waveforms, Peak and RMS values, Phasor representation, Real power, Reactive power, Apparent power, Power factor. Analysis of single phase ac circuits consisting of R, L, C, RL and RC. Three phase balanced circuits - Voltage and Current relations in star and delta connections.

Module II: Magnetic Circuits and Electrical Machines **15 Hours**
Magnetic Circuits - Definitions - MMF, Flux, Reluctance, Magnetic Field Intensity, Flux Density, Fringing, Self and Mutual Inductances, Static machines: BH characteristics, Construction and working principle of single-phase and three phase transformers. Rotating machines: Generation of rotating magnetic fields, Construction and working principle of DC machines, Three-phase induction motor and Synchronous motor.

Module III: Basics of Electronics and Applications **15 Hours**
Semiconductor - PN junction diode - Zener diode - Rectifier - Half wave, Full wave and Bridge rectifier - Bipolar Junction Transistor Introduction - Common base, Common emitter and Common collector configuration - Field Effect Transistor Introduction - Construction and characteristics of JFETs - MOSFET - Depletion type MOSFET, Enhancement type MOSFET, Transfer characteristics.

	Total Hours	**45**

Text Books:

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

Reference Books:

1	Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of Electrical Engineering", CRC press, 2012.
2	D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, Revised 1st Edition 2017,
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, 'Electronic Devices and Circuits',

		Pearson Education, 6th Edition, 2013.
Web References:		
	1	http://nptel.ac.in/course.php?disciplineId=108
	2	https://ocw.mit.edu/courses/find-by topic/#cat=engineering&subcat=electricalengineering&spec=electricpower
	3	https://nptel.ac.in/video.php?subjectId=117103063
	4	https://onionesquereality.wordpress.com/.../more-video- lectures-iit-open
	5	https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf
Online Resources:		
	1	http://www.electrical-knowhow.com/
	2	https://www.edx.org/course/electricity-magnetism-part-1-ricex-phys102-1x-1
	3	https://www.mooc-list.com/course/fundamentals-electrical-engineering-coursera
	4	https://nptel.ac.in/course.php

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C111.1	Analyze	Quiz	20
C111.2	Analyze	Tutorial	20
C111.3	Understand	Group Assignment	20
C111.4	Apply		
C111.5	Understand	Presentation	20

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

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

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C111.1	3	3	3	3					2	2			3		3
C111.2	3	3	3	3					2	2			3		3
C111.3	3	3	3	3					2	2			3		3
C111.4	3	3	3	3					2	2			3		3
C111.5	3	3	3	3					2	2			3		3
1	Reasonably Agreed			2	Moderately Agreed				3	Strongly Agreed					

22TA101	HERITAGE OF TAMILS / தமிழர் மரபு		1/0/0/1
Nature of Course:	C (Theory Concept)		
Pre requisites:	NIL		

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

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

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

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

	Total Hours:	15

Text-cum-Reference Books:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

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

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

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

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

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

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

22PH201		PHYSICS (CSE, IT, AI&DS, CYBER & CDS)	3/0/2/4

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

Course Objectives:

1.	To learn the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems.
2.	To make the students enrich basic knowledge in various fields such as Laser, Optical fibers, Photonics, Superconductors and quantum mechanics of physics and apply the same in computing fields.

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

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

Course Contents:
Laser and Fiber optics **15 Hours**
Laser: Characteristics of laser – Principle of spontaneous emission and stimulated emission – Einstein's theory of matter radiation interaction and A and B coefficients (derivation) – Population inversion – Pumping – Nd-YAG and CO_2 laser – Applications: Laser printer, Data storage and Bar code scanner.
Fiber optics: Light propagation through fibers, acceptance angle, numerical aperture – Types of fibers: step index, graded index, single mode and multimode – V – number - Optical fibers for computing applications – PC to PC communication and fiber optics in computer networking.

Photonics and Superconductors **15 Hours**
Photonics: Introduction to photonic materials – Photonic crystals – Liquid crystal display (LCD) Light sources: Light emitting diode (LED) – Photo dependence resistor – Photo detectors: PIN, avalanche – Photo voltaic effect, Solar cell – 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 Hours**
Quantum Mechanics: Planck's quantum theory (derivation) – Matter waves, de-Broglie wavelength, Heisenberg's uncertainty principle – Schrödinger's wave equation: time independent and time dependent – Physical significance of wave function – Particle in a one-dimensional potential box – Electron microscope: SEM and TEM – Postulates of quantum mechanics. *Quantum computing*: Introduction to quantum computing – qubits, entanglement, decoherence and quantum supremacy, differences in quantum and classical computation.

	Total Hours: 45	
Lab Component		**30 Hours**
1	Particle size determination and measurement of d-spacing in CD using Laser.	[E]
2	Determination of wavelength, angle of divergence and coherence length of laser source.	[E]
3	Determination of numerical aperture and acceptance angle parameter of optical fiber using Laser source.	[E]
4	Characteristics curves of solar cell.	[E]

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

Text Books:

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

Reference Books:

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

Web References:

1	https://www.studocu.com/in/document/mahatma-gandhi-university/engineering-physics/lasers-engineering-physics-lecture-notes-module-i/23900829
2	https://www.nitsri.ac.in/Department/PHYSICS/Unit_IV__Laser.pdf
3	https://www.lifewire.com/fiber-optic-cable-817874
4	https://www.nap.edu/read/5954/chapter/4
5	https://www.sciencedirect.com/science/article/pii/S2211379718314268
6	https://lecturenotes.in/notes/13602-note-for-optical-fibre-communication-ofc-by-sunil-s-harakannanavar
7	https://ocw.mit.edu/courses/materials-science-and-engineering/3-46-photonic-materials-and-devices-spring-2006/lecture-notes/
8	http://wcchew.ece.illinois.edu/chew/course/QMALL20121005.pdf
9	https://www.technologyreview.com/2019/01/29/66141/what-is-quantum-computing/
10	https://www.quantum-inspire.com/kbase/what-is-a-qubit/
11	https://www.cl.cam.ac.uk/teaching/0910/QuantComp/notes.pdf

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C201.1	Understand	Online Quiz - I	20
C201.2	Remember	Assignment - I	20
C201.3	Understand	Online Quiz - II	20
C201.4	Understand	Assignment - II	20
C201.5	Apply		

Assessment based on Summative and End Semester Examination - Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

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

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

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

Course Objectives:

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

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

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

Course Contents:

Module I Linked List & Stack   **15 Hours**
Linked List: Array vs Linked list - Types of linked list - Singly, Doubly and Circular Linked list - Applications of linked list. **Stack:** Stack Model, Array and Linked list implementation of Stack –Applications of Stack - Infix, Prefix and Postfix expressions - infix to postfix conversion - Expression Evaluation- Balancing Parenthesis.

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

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

	Total Hours (Theory):	**45**

Lab Component

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

	Total Hours(Lab):	**30**

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

Text Books:	
1	Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.
2	Anany Levitin, "Introduction to the design & analysis of algorithms", 3rd Edition, Pearson Education, 2021.
3	Michael T. Goodrich, "Data Structures and Algorithms in C++", 2nd Edition, Wiley Publication, 2011.
Reference Books:	
1	Seymour Lipschutz, "Data Structures by Schaum Series", 2nd Edition, Tata McGraw Hill, 2013.
2	Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", 5th Edition, Career Monk, 2016.
3	Debasis Samanta, "Classic data structures", Prentice Hall of India, 2nd Edition, 2014.
Web References:	
1	https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms
2	https://www.edx.org/course/data-structures-algorithms-using-c
Online Resources:	
1	https://www.programiz.com/dsa I
2	https://freevideolectures.com/course/2519/c-programming-and-data-structures
3	https://www.cprogramming.com/algorithms-and-data-structures.html

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C201.1	Apply	Quiz	20
C201.2	Apply	Assignment	20
C201.3	Apply	Case study	20
C201.4	Analyse	Group Assignment	20
C201.5	Analyse		

Assessment based on Summative and End Semester Examination - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	10	10
Understand	40	40	40
Apply	40	40	40
Analyse	-	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	30	30	30
Apply	60	40	40
Analyse	-	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

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

22IT201	DATABASE MANAGEMENT SYSTEMS	3/0/2/4

Nature of Course:	D (Theory Application)
Prerequisites:	Nil

Course Objectives:

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

Course Outcomes:

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

C201.1	Conceptualize data using the relational model.	[U]
C201.2	Improve the database design through normalization.	[U]
C201.3	Manipulate a database using SQL.	[AP]
C201.4	Implement advanced SQL concepts on database.	[AP]
C201.5	Infer the transactions management 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.

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**

Text Books:

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

Reference Books:

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

Web References:

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

Online Resources:

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

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C201.1	Understand	Quiz	**20**
C201.2		Assignment	**20**
C201.3, C201.4	Apply	Group Assignment	**20**
C201.5	Analyse	Case Study	**20**
Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	10	20
Understand	40	30	30
Apply	50	40	40

Bloom's Level			
Analyse	-	20	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	20	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	20	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

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

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

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

MODULE I Introduction to Java   **15 Hours**

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

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

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

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

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

	Total Hours:	**45**

Laboratory Component:

S. No.	List of Experiments
1	Implementation of simple java program using Command Line Arguments
2	Implementation of simple java programs using decision making statements
3	Implementation of simple java programs using Looping statements
4	Implementation of Simple java programs using Jump statements
5	Implementation of 1D Array
6	Implementation of 2D Array
7	Implementation of String functions
8	Implementation of simple java program using Streams
9	Implementation of simple java program using Date and Number classes
10	Implementation of simple java program using Tokenizing
	Total Hours:	**15**

Text Books:

1	Herbert Schildt, "Java: The Complete Reference", 9th Edition, Tata McGraw Hill, 2014.

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

Reference Books:

1	Paul Deitel, Harvey Deitel, "Java How To Program", 10th Edition, Prentice Hall Publications, 2014.
2	Y. Daniel Liang, "Introduction to Java Programming", 9th Edition, Prentice Hall Publications, 2015.
3.	Ed Roman, RIma Patel, Sriganesh, Gerald Brose, "Mastering Enterprise Java Beans" 3rd Edition, Wiley, 2005.

Web References:

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

Online Resources:

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

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

Formative Assessment based on Capstone Model - Theory

Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C201.1	Understand	Quiz & Assignment	20
C201.2	Apply	Assignment	20
C201.3	Apply	Case study	20
C201.4	Analyze	Group Assignment	20
C201.5	Apply		

Assessment based on Summative and End Semester Examination - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	10	10	10
Understand	40	40	40
Apply	40	40	40
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10

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

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

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

22EE114	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY** **(Common to CSE, IT, AIDS, CSD, CS and M.TECH)**	0/0/2/1

Nature of Course	: M (Practical application)
Pre-requisites	: Nil

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

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

Text Books:

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

Reference Books:

1	Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of Electrical Engineering", CRC press, 2012.
2	D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, Revised 1st Edition 2017,

3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, 'Electronic Devices and Circuits', Pearson Education, 6th Edition, 2013.

Web References:

1	http://nptel.ac.in/course.php?disciplineId=108
2	https://ocw.mit.edu/courses/find-by topic/#cat=engineering&subcat=electricalengineering&spec=electricpower
3	https://nptel.ac.in/video.php?subjectId=117103063

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

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

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C114.1	3	1											3		3
C114.2	3	1											3		3
C114.3	3	1											3	2	
C114.4	3	2											3		3
C114.5	3	1											3	2	
1	Reasonably Agreed		2		Moderately Agreed			3		Strongly Agreed					

22MC102		**ENVIRONMENTAL SCIENCES**		**2/0/0/0**
Nature of Course		:C (Theory Concept)		
Pre requisites		: Basics in Environmental Studies		

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

C102.1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
C102.2	Illustrate the importance of natural resources and conservation of biodiversity.	[U]
C102.3	Interpret and analyze the impact of engineering solutions in a global and societal context.	[U]
C102.4	Apply the gained knowledge to overcome pollution problems.	[AP]
C102.5	Apply the gained knowledge in various environmental issues and sustainable development.	[AP]

Course Contents:

Natural Resources:

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

Environmental Pollutions:

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

Social issues and the Environment:

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

	Total Hours:	**30**

Text Books:

1	Anubha Kaushik and C P Kaushik "Perspectives in Environmental Studies" 4th 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", 13th Edition, McGraw Hill,2015.
3	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 3rd Edition, Pearson Education, 2014.

Web References:

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

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

Online Resources:

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

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

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

Course Outcome	Bloom's Level	Assessment Component	Marks
C102.1	Remember	Quiz	10
C102.2	Understand	Case study based on environmental aspect	20
C102.3	Understand	Class Presentation	10
C102.4	Apply	Assignment	10

Summative assessment based on Continuous Assessment

Bloom's Level	Continuous Assessment		Term End Assessment [50 marks]
	CIA-I [0 marks]	CIA-II [0 marks]	
Remember	-	-	30
Understand	-	-	40
Apply	-	-	30
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							3						2		
C102.2							3						2		
C102.3						2	3							2	
C102.4							3						2		
C102.5							3						2		

22GE201	**UNIVERSAL HUMAN VALUES** **(Common to all Branches)**	**3/0/0/3**

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

Course Objectives:

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

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

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

Course Contents:

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

15 Hours

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

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

15 Hours

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

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

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

15 Hours

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

		Total Hours:	45

Text Books:

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

Reference Books:

1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2	The Story of My Experiments with Truth –by Mohandas Karamchand Gandhi
3	IndiaWins Freedom-MaulanaAbdulKalamAzad.

Web References:

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

Online Resources:

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

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C201.1	Understand & Apply	Online Quiz	20
C201.2	Understand & Apply	Group Assignment	20
C201.3	Understand	Presentation	20
C201.4	Apply		
C201.5	Apply	Seminar	20

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

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

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

22IT301		**COMPUTER ARCHITECTURE**	3/0/0/3
Nature of Course		C (Theory Concept)	
Pre requisites		Nil	
Course Objectives:			
	1.	To study the concepts of the basic structure and operation of a digital computer.	
	2.	To learn the working of different types of arithmetic operations.	
	3.	To understand the different types of control and the concept of pipelining.	
	4.	To learn the working of different types of memories.	
	5.	To understand the different types of communication with I/O devices and standard I/O interfaces	
Course Outcomes			
Upon completion of the course, students shall have ability to			
C301.1		Recall the design of the various units and functionality of digital computers that store and process information via instruction sets and addressing modes.	[R]
C301.2		Interpret the logic design of fixed-point add, subtract, multiply and divide hardware and instantiating the concepts of fast adders, high speed multiplier, booth multiplier and carry save addition techniques.	[U]
C301.3		Classify the hazards of pipelining technique and use in high performance processors.	[U]
C301.4		Make use of various memory components and memory mapping techniques including Cache and virtual memory for increasing the memory bandwidth and high performance.	[AP]
C301.5		Categorize different ways of communication with I/O devices using various interconnection networks including bus structures	[A]

Course Contents:

Architecture Fundamentals and Memory Organization: **15 Hours**
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. Case Study: Raptor Cove CPU Micro architecture by intel.

Processor Design: **15 Hours**
Arithmetic Unit: Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Signed Numbers, Fast Multiplication, Integer Division, Floating Point Numbers and Operations**.** Control Unit: Execution of a Complete Instruction - Hardwired Control and Micro Programmed Control. Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets, Data Path and Control Consideration and Superscalar Operation. Case study: Intel's x86 Core2 and i7 microarchitectures

Interfacing and Communication: **15 Hours**
I/O fundamentals: Handshaking, Buffering; I/O techniques: Programmed I/O, Interrupt-Driven I/O, DMA, Buses, Bus Protocols, Local and Geographic Arbitration. Interrupt Structures, Vectored and Prioritized, Interrupt Overhead, Interrupts and Reentrant Code. Multicore Architecture: Multicore Processors, Centralized and Distributed Shared Memory Architecture, Parallel Computers.

	Total Hours	**45**

Text Books:		
1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization", McGraw- Hill, 6th Edition 2017.	
2.	John P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 3rd Edition, 2017.	
3.	William Stallings, "Computer Organization and Architecture Designing for Performance", 10th Edition, Pearson Education, 2016.	
Reference Books:		
1.	David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier, 5th Edition, 2013.	
2.	John L. Hennessy and David A. Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufmann, 5th Edition, 2011.	
3.	M. J. Flynn, "Computer Architecture: Pipelined and Parallel Processor Design", Narosa Publishing House, 2013.	
Web References:		
1.	https://www.cs.cmu.edu/~fp/courses/15213-s07/lectures/27-multicore.pdf	
2.	https://fdocuments.in/document/intel-core-i7-processor.html	
3.	https://www.intel.com/content/dam/www/public/us/en/documents/manuals/64-ia-32-architectures-software-developer-instruction-set-reference-manual-325383.pdf	
Online Resources:		
1.	https://www.coursera.org/learn/comparch	
2.	https://www.eguardian.co.in/computer-architecture-mcqs/	
3.	http://nptel.ac.in/courses/106102062/	

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C301.1	Remember	Assignment	20
C301.2, C301.3	Understand	Group Assignment	20
C301.4	Apply	Online Quiz	20
C301.5	Analyse	Seminar	20

Assessment based on Summative and End Semester Examination

Revised Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	30	10	20
Understand	60	30	30
Apply	10	30	30
Analyse	-	30	20

Evaluate	-	-	-
Create	-	-	-

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

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

22MA302	**RANDOM VARIABLES AND STATISTICS** **THIRD SEMESTER (CSE / IT / AI & DS / CYBER)** **FOURTH SEMESTER (CSD)**	3/1/0/4

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

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

MODULE I - PROBABILITY AND STANDARD DISTRIBUTIONS   **20 Hours**
Probability: Probability concepts – Addition and Multiplication law of probability – Conditional probability – Total probability theorem – Bayes theorem. **Standard distributions**: Discrete distributions – Binomial, Poisson, Geometric – Continuous distributions – Uniform, Exponential, Normal distributions.

MODULE II - RANDOM VARIABLES   **20 Hours**
One dimensional random Variables: Discrete random variables – Probability mass function – Continuous random variables – Probability density function – Moment generating Function. **Two dimensional random variables**: Joint distributions – Marginal and conditional distributions – Covariance – Correlation – Regression – Central limit theorem (statement only).

MODULE III - STATISTICS   **20 Hours**
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.

	Total Hours:	**60**

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 Pubishers, 4th 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, 9th Edition, Pearson Education, Delhi, 2014.

2	Henry Stark and John W. Woods —Probability and Random Processes with Applications to Signal Processing, 3rd Edition, 2001.
3	Richard A. Johnson, Irwin Miller, John Freund, "Miller & Freund's Probability and Statistics for Engineers", 9th Edition,2016.

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/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C302.1	Remember	Quiz	20
C302.2	Understand	Seminar	20
C302.3 – C302.5	Apply	Tutorial	20
C302.3 – C302.5	Apply	Assignment	20

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C302.1	2	1	1	1									1		
C302.2	1	2	2	1									2		
C302.3	2	2	2	3									2		
C302.4	1	1	2	2									2		
C302.5	2	3	2	3									3		

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

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

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

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

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

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

	Total Hours:	**15**

Text-cum-Reference Books:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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

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

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

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

Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

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

22IT302		**WEB TECHNOLOGY**	1/0/4/3
Nature of Course	F (Theory Programming)		
Prerequisites	Java Programming		

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

Course Outcomes

Upon completion of the course, students shall have ability to

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

Course Contents:

Introduction **15 Hours**

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

React Components and Styles **15 Hours**

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

Deploying and Testing Web Applications **15 Hours**

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

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

	Total Hours	**45**

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

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

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

Formative Assessment based on Capstone Model - Theory

Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C302.1	Understand	Quiz	20
C302.2	Apply	Quiz	20
C302.3	Apply	Mini Project	20
C302.4	Analyze		
C302.5	Analyze	Mini Project	20

Assessment based on Summative Assessment - Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C302.1	3	3	3	2	2				2	2	2	2	3	3	2
C302.2	3	3	3	2	2				2	2	2	2	3	2	3
C302.3	3	3	3	3	2				3	2	2	2	3	2	2
C302.4	3	3	3	2	3				2	2	2	2	3	3	3
C302.5	3	3	3	2	3				2	2	2	2	3	2	2

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

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

Course Objectives:

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

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

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

Course Contents:

Sorting, Searching and String Algorithms: [15 Hours]

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

Greedy and Dynamic Programming: [15 Hours]

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

Tree and Graph Algorithms: [15 Hours]

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

	Total Hours:	45

	Lab Component
1	Implementation of Linear, Binary Search and Tries.
2	Implementation of Sorting Algorithms - Bubble, Insertion, Selection, Merge Sort, Quick sort, Heap Sort.
3	Implementation of Greedy Algorithms.
4	Implementation of Pattern Searching Algorithms.
5	Implementation of Backtracking Algorithms.
6	Implementation of Dynamic Programming.
7	Implementation of Range Query Algorithms.
8	Implementation of Minimum Spanning Tree.
9	Implementation of Shortest path Algorithms.
10	Implementation of Maximum Flow Minimum cut Algorithm.
	Total Hours: 30

Text Books:

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

Web References:

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

Online Resources:

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

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

Formative Assessment based on Capstone Model - Theory

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

Assessment based on Summative Assessment - Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

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

Mapping of Course Outcomes (CO) with Programme Outcomes(PO) and Programme Specific Outcomes(PSO)																
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C301.1	3	3	3	1	3	2	1	2			2	1	3	2	2
C301.2	3	3	3	1	3	2	1	2				1	3	2	2
C301.3	3	3	3	1	3	2	1	2			1	1	3	2	2
C301.4	3	3	3	1	3	2	1	2				2	3	2	2
C301.5	3	3	3	1	3	2	1	2				2	3	2	2

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

Course Objectives:

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

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

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

Course Contents:
Module I   Introduction to OOPS   15 Hours
Class and Object, Encapsulation and Abstraction, Inheritance, Polymorphism, Message Passing, Keywords: this, super, static, final, extends and implements. Method Signature and Prototype, Mutator Methods and Accessor Methods, Var-Arg Method, hashCode() and toString() methods. Immutable Objects Vs Mutable Objects, User defined Immutable Class, Constructors: Introduction, Default Constructor, User Defined Constructors, Constructor Overloading, Instance Variable, Instance Methods, Instance Block and Instance Flow Of Execution. Regular Expressions (RegEx).

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

Module II   Abstraction, Exception Handling & Collections   15 Hours
Abstraction: Abstract Methods and Abstract classes. Interfaces, abstract classes and Interfaces, Concrete Methods Vs Abstract Methods, Differences between classes, abstract classes and Interfaces, Marker Interfaces

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

Module III   Swings, Servlets & JDBC   15 Hours
Swings: Introduction, JLabel, JButton, JTextField ,JTextArea, JPasswordField, JCheckbox, JComboBox, JRadioButton, JScrollBar, JMenuItem and JMenu.

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

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

List of Experiments

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

	Total Hours	**30 Hours**

Text Books:

1.	Herbert Schildt, "Java:The Complete Reference",12th Edition, McGraw Hill, 2021.
2.	Robert Liguori, Patricia Liguori, "Java 8 Pocket Guide", O'Reilly Media, 2014.
3.	Shagun Bakliwal, Hands-on Application Development using Spring Boot, bpb publisher, 2021.

Reference Books:

1.	Paul Deitel, Harvey Deitel, "Java How to Program", 10th Edition, Prentice Hall Publications, 2014.
2.	Cay S. Horstmann and Gary Cornell, "Core Java, Vol.2: Advanced Features", 9th Edition, Prentice Hall,2013.

Web References:

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

Online Resources:

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

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

Formative Assessment based on Capstone Model – Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%)** **[80 Marks]**
C301.1 & C301.3	Apply	Quiz	20
C301.2	Apply	Assignment	20
C301.4 & C301.5	Apply	Case Study	40

Assessment based on Summative Assessment – Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

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

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

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22IT401		**FORMAL LANGUAGES AND AUTOMATA THEORY**	3/0/0/3
Nature of Course		G (Theory Analytical)	
Pre requisites		Nil	
Course Objectives:			
1.		To study Mathematical models such as Finite Automata, Pushdown Automata and Turing machines.	
2.		To employ the Rule of pumping Lemma to prove that Language is not Regular	
3.		To frame context free grammar to accept various programming constructs	
4.		To design Turing machines to accept recursive languages	
5.		To categorize types of grammar based on Pattern.	
Course Outcomes			
Upon completion of the course, students shall have ability to			
C401.1		Construct Finite Automata based on regular expressions and will be able to build Regular Expressions to suit pattern of language.	[AP]
C401.2		Model languages with a recursive structure using Context free Grammar.	[AP]
C401.3		Construct Pushdown automata and Turing machine mathematical models.	[AP]
C401.4		Analyze the languages that are regular and context free using pumping Lemma	[A]
C401.5		Inspect the properties of Regular languages and context free Languages, Decidable and Undecidable languages	[A]

Course Contents:

Finite Automata and Regular Languages: **15 Hours**
Mathematical Preliminaries and Notations, Chomsky Hierarchy of languages, Concepts of Automata Theory, Finite Automata - Deterministic Finite Automata (DFA)- Non-Deterministic Finite Automata (NFA) - Finite Automata with epsilon transitions - NFA with epsilon to NFA - NFA with epsilon to DFA conversion - NFA to DFA conversion. Regular Expressions: Finite Automata and Regular Expressions - Applications of Regular Expressions-Regular Grammars. Properties of regular languages - Pumping lemma for regular languages - Equivalence of Minimization of Finite Automata - Closure properties of regular languages.

Context Free Languages: **15 Hours**
Context Free Grammar (CFG) - Derivation Trees-Ambiguous Grammar - Equivalence of Parse Trees and Derivation - Applications of Context Free grammar. Definition of Pushdown Automata-Language of Pushdown Automata - Acceptance of String in Pushdown Automata- Equivalence of CFG and Pushdown Automata - Pumping Lemma for CFL – Closure Properties of CFL - Deterministic Pushdown Automata - Simplification of CFG – Chomsky Normal Form - Greibach Normal form

Turing Machines: **15 Hours**
Turing Machines - Language of Turing Machines - Instantaneous Description of Turing Machine - Turing machine as a computing device-Techniques of Turing Machine – Universal Turing Machine - Types of Turing Machine - Multiple Track Turing Machine-Two-way infinite tape Turing Machine - Multi Tape Turing Machine - Recursive and Recursive Enumerable Sets - Post Correspondence problem

	Total Hours	**45**

Text Books:	
1.	Hopcroft J.E, Motwani R and Ullman J.D, "Introduction to Automata Theory, Language and Computations", 3rd Edition, Pearson Education, 2014.
2.	Martin J, "Introduction to Languages and the Theory of Computation", 4th Edition, TMH, 2011.

Reference Books:	
1.	Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishers, 6th Edition, Jones and Bartlett Publishers, Inc, 2016.
2.	Kamala Krithivasan and Rama R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009.
3.	Greenlaw, "Fundamentals of Theory of computation, Principles and Practice", Elsevier, 2008.
4.	Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, Cengage India, 2014.

Web References:	
1.	https://lewis.seas.harvard.edu/files/harrylewis/files/introduction_0.pdf
2.	https://www.cl.cam.ac.uk/teaching/1213/RLFA/materials.html
3.	https://www.cse.iitb.ac.in/~akg/courses/2019-cs310/index.html

Online Resources:	
1.	https://www.udemy.com/course/theory-of-computation-online-course/
2.	https://nptel.ac.in/courses/106/104/106104148/
3.	https://www.youtube.com/watch?v=58N2N7zJGrQ&list=PLBlnK6fEyqRgp46KUv4ZY69yXmpwKOIev

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

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

Assessment based on Summative and End Semester Examination

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

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C401.1	2	3	2	3	2							1	2	2	2
C401.2	2	3	2	2	2								2	2	2
C401.3	2	2	2	3	2							1	1	2	2
C401.4	2	1	2	1	1								1	1	1
C401.5	2	1	2	2	2								2	1	2

22MA401	OPTIMIZATION AND PROJECT MANAGEMENT (COMMON TO CSE /IT/AI&DS)	3/1/0/4
Nature of Course	B (100% Analytical)	
Pre requisites	-	

Course Objectives:

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

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

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

Course Contents:

MODULE I - DEVELOPMENT OF OPERATIONS RESEARCH AND LINEAR PROGRAMMING(20 Hours)
Linear programming problem: Graphical method – Simplex method – Big M Method – Transportation problem: North west corner method – Least cost method – Vogel's approximation method – Optimal solution – MODI method – Balanced and unbalanced Transportation problem – Assignment problem – Hungarian method.

MODULE II - QUEUEING MODELS **(20 Hours)**
Introduction to Queuing Models – Characteristics –– Birth and death processes – Markovian queues – Single and multiple server queueing models – Little's formula – Non Markovian Queueing Model M/G/1

MODULE III - **SIMULATION** **(20 Hours)**
Simulation: Introduction – Types of simulation models – Discrete Event Simulation – Monte - Carlo Simulation – Advantages and Disadvantages – Application of Simulation to queuing and inventory – Case study.

	Total Hours:	**60**

Text Books:

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

Reference Books:

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

3	S. D Sharma, Operation Research, Kedarnath Ram Nath Publishers,2020
Web References:	
1	http://nptel.ac.in/courses/111104079/
2	http://nptel.ac.in/video.php/subjectId=117105085
3	http://nptel.ac.in/syllabus/111105041/
4	https://www.aicte-india.org/flipbook/p&ap/Vol.%20II%20UG/UG_2.html#p=8
5	https://www.britannica.com/topic/operations-research
Online Resources:	
1	https://www.edx.org/course/operations-research-an-active-approach
2	https://in.coursera.org/learn/operations-research-modeling
3	https://in.coursera.org/projects/simulation-call-centre-operations

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C401.1	Remember	Quiz	20
C401.2	Understand	Seminar	20
C401.3 – C401.5	Apply	Tutorial	20
C401.3 – C401.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C401.1	1	1	1										1		
C401.2	2	2	2										1		
C401.3	3	3	3										2		
C401.4	3	3	3										2		
C401.5	3	3	3										2		

22IT402	**SOFTWARE TESTING**	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

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

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

Course Contents:

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

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

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

	Total Hours	**45**

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

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

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

Web References:	
1.	https://www.coursera.org/projects/building-test-automation-framework-using-selenium-and-testng

2.	https://www.edx.org/professional-certificate/delftx-automated-software-testing
3.	https://onlinecourses.nptel.ac.in/noc22_cs12/preview
4.	https://www.nextgenerationautomation.com/post/selenium-coding-exercises
5.	https://www.studytonight.com/maven/build-and-test-maven-project

Online Resources:

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

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

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

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

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

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

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

22AD401	CLOUD COMPUTING	1/0/4/3
Nature of Course	F (Theory Programming)	
Pre requisites	Database Management Systems	

Course Objectives:

1	To understand the evolution of AWS from the existing technologies.
2	To have knowledge on AWS security and various scaling methods.
3	To team the necessary skills for design, develop and deploy services in 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:

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

Course Contents:

MODULE I MANAGING CLOUD USING AWS   **15 Hours**
Introduction, Future of AWS, Services - AWS EC2, AWS S3 - Cloud storage, Types, Benefits, AWS IAM - AWS Security, Working of IAM, Components AWS CloudFront Working, Benefits. Introduction, Snapshots vs AMI, Different scaling plans. Introduction, Benefits, Algorithms used for load balancing.
Case study: E-commerce Website Infrastructure on AWS.

MODULE II CONTAINERIZATION USING DOCKERS   **15 Hours**
Docker, Containers, Usage of containers, Terminology, Docker Run Static sites, Docker Images, Docker File, Docker on AWS, Docker Network, Docker Compose, Development Workflow, AWS EC Services.
Case study: Microservices Architecture for a Social Media Application using Docker and AWS.

MODULE III DEVOPS   **15 Hours**
Introduction, Test Driven Development, Continuous Integration, Code coverage, Best Practices, Virtual Machines vs Containers, Rolling Deployments, Continuous Deployment, Auto Scaling. **Case Study:** Open Stack, Cloud based ML Solutions in Healthcare. **Case study:** Cloud-Based Machine Learning Solutions in Healthcare.

	Total Hours:	**45**

List of Experiments:		
1	Study of Hosted Hypervisor and Bare Metal Hypervisor.	
2	Install a Virtualbox / VMware Workstation with different flavours of linux or windows S	
3	Implementation of Virtual Machine(S) and create a Virtual Datacenter.	
4	Configuration of Virtual Internetworking Components.	
5	Configuration of Virtual Internetworking Components.	
6	Install a docker engine and docker client on windows.	
7	Creation and removal of container, container images.	
8	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim	
9	Find a procedure to transfer the files from one virtual machine to another virtual machine Using VMWare	
10	Install Google App Engine. Create a hello world app and other simple web applications using python / java	
		Total Hours: 30

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

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

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

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C401.1	Apply	Quiz & Assignment	20
C401.2 & C401.5	Understand	Assignment	20

| C401.3 | Apply | Case study | 20 |
| C401.4 & C401.6 | Analyze | Assignment | 20 |

Assessment based on Summative Assessment - Theory

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

Assessment based on Continuous and End Semester Examination - Practical

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

Assessment based on Continuous and End Semester Practical Examination

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

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

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

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

Course Objectives:

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

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

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

Course Contents:

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

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

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

	Total Hours: 45

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

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

Total Hours: 45

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

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

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

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

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C402.1, C402.2 & C402.3	Apply	Mini Project	**40**
C402.4	Understand	Quiz	**20**
C402.5	Apply	Case Study	**20**

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

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

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

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

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22CS403		**OPERATING SYSTEMS**	3/0/2/4
Nature of Course:		F (Theory Programming)	
Pre requisites:		Nil	

Course Objectives:

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

Course Outcomes

Upon completion of the course, students shall have ability to

C403.1	Review the basic concepts and functions of operating systems.	[U]
C403.2	Interpret the processes and threads in operating systems for real world problems.	[U]
C403.3	Examine CPU scheduling algorithms, process synchronization mechanisms and deadlock handling methods.	[AP]
C403.4	Practice memory management techniques including virtual memory and page replacement algorithms.	[AP]
C403.5	Illustrate the concepts related to mass storage, I/O and file system.	[AP]

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

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

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

	Total Hours:	**45**

Laboratory Component:	
S. No	**List of Experiments**
1.	Study of Basic Linux Commands, proc file system of linux, disk I/O, buffer caches, disk monitoring tool
2.	Implementation of Shell Programming
3.	Implementation of Unix System Calls
4.	Implementation of Non Pre emptive and Pre emptive CPU Scheduling Algorithms
5.	Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
6.	Implementation of Banker's Algorithm for Deadlock Avoidance
7.	Implementation of Memory Allocation and Management Techniques
8.	Implementation of Page Replacement Techniques
9.	Implementation of File organization Techniques and study on modern file systems like ZFS, btrfs, ext4 etc.
10.	Implementation of Disk Scheduling Algorithms. Compare CPU and Disk Scheduling algorithms in terms of the number of voluntary and involuntary context switches.

	Total Hours:	**30**

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

Reference Books:	
1.	Andrew S. Tanenbaum, Modern Operating Systems 5th Edition, Pearson Education, 2016.
2.	William Stallings, "Operating Systems – Internals and Design Principles", 8th Edition, Pearson Publications, 2014.

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

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

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C403.1	Understand	Quiz	20
C403.2	Understand	Assignment	20
C403.3 & C403.4	Apply	Tutorial	20
C403.5	Apply	Case Study	20

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

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C403.1	2	2	2						2	1		2	2	2	2
C403.2	3	3	3	2	2				2	1		3	3	2	2
C403.3	3	3	3	3	3				2	1		3	3	2	2
C403.4	3	3	3	3	3				2	1		3	3	2	2
C403.5	3	3	3						2	1		3	2	2	2
C403	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**3**	**3**	**2**	**2**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed	

22IT501	DATA COMMUNICATION AND COMPUTER NETWORKS	3/0/0/3
Nature of Course	C (Theory Concept)	
Prerequisites	Nil	

Course Objectives:

1.	To study the concepts of data communications and functions of different layers of ISO/OSI reference architecture.
2.	To understand the error detection and correction methods.
3.	To study the concepts of sub netting and routing mechanisms.
4.	To understand the different types of protocols and network components.
5.	To study and configure Switches and Routers.

Course Outcomes

Upon completion of the course, students shall have ability to

C501.1	Understand the fundamentals of data communications and functions of layered architecture.	[U]
C501.2	Apply the algorithms for error detection and correction in a network.	[AP]
C501.3	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and routing technologies.	[A]
C501.4	Understand the application layer protocols and gain familiarity with common networking & Application Protocols.	[U]
C501.5	Analyze the fundamental process and working of transport layer protocols.	[A]

Course Contents:

Data Communications and Physical layer   **15 Hours**
Introduction**,** Network topologies, Categories of Networks, Network Models: ISO/OSI model, TCP / IP model and protocols, Performance Metrics. Different types of transmission media, Errors in transmission: attenuation, noise. Encoding (NRZ, NRZI, Manchester, 4B/5B), Networking Devices: Hubs, Bridges, Switches, Routers and Gateways. Switching: Circuit Switched Networks, Packet Switched Networks. **Case Study:** Build network architecture and choose the right topology for a bank connecting several branches located km apart.

Data Link and Network Layer   **20 Hours**
Data Link Layer: Design issues, Error detection and Correction: Types of errors, Error detection (Parity check, CRC, Checksum), Error correction. Flow control and error control mechanisms : Stop and Wait ARQ, Go-back-N ARQ, Selective Repeat ARQ. Channel allocation problem**.** LAN : Ethernet, Bluetooth. **MAC Layer:** Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA. **Network layer:** Design issues**,** Addressing: Classful and Classless addressing, Subnetting, Network Address Translation. Routing: Static and Dynamic Routing , Unicast Routing and Multicast routing protocols. Quality of Service**.** Network Layer Protocols: IPv4, IPv6, ARP, DHCP, ICMP. **Case Study:** Design the subblocks and address allocation to group of customers in an organization.

Transport layer and Application Layer   **10 Hours**
Services of transport layer, User Datagram Protocol, Transmission Control Protocol, Connection establishment and termination, Congestion control algorithms, Socket Programming. **Application Layer:** DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW.

	Total Hours	**45**

Text Books:	
1.	Behrouz A. Forouzan, "Data communication and Networking", 6th Edition, Tata McGraw-Hill, 2021.
2.	A S Tanenbaum, DJ Wetherall, "Computer Networks", 6th Edition, Prentice-Hall, 2021.
Reference Books:	
1.	Peterson & Davie, "Computer Networks, A Systems Approach", 6th Edition, Elsevier, 2021.
2.	William Stallings, "Data and Computer Communications", 10th Edition, PHI, 2013.
3.	Bertsekas and Gallagher "Data Networks, 2nd Edition, PHI, 2000.
4.	JF Kurose, KW Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Addison-Wesley, 2021.
Web References:	
1.	https://www.udacity.com/course/computer-networking--ud436
2.	http://freevideolectures.com/Course/3162/Computer-Networking-Tutorial
Online Resources:	
1.	https://www.coursera.org/learn/computer-networking
2.	https://nptel.ac.in/courses/106105183
3.	https://www.edx.org/learn/computer-networking

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C501.1	Understand	Quiz	20
C501.2	Apply		
C501.3	Analyze	Assignment	20
C501.4	Understand	Seminar	20
C501.5	Analyze	Certification	20

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C501.1	3	3	2	-	-	-	-	-	-	-	-	2	3	2	-
C501.2	3	3	3	3	2	-	-	-	-	-	-	3	3	3	3
C501.3	3	3	3	3	2	-	-	-	-	-	-	3	3	3	2
C501.4	3	2	3	2	2	-	-	-	-	-	-	2	3	2	-
C501.5	3	3	-	2	2	-	-	-	-	-	-	2	3	3	-

22EC511	FUNDAMENTALS OF DATA AND MOBILE COMMUNICATIONS	3/0/0/3
Nature of Course:	H (Theory Technology)	
Prerequisites:	Nil	

Course Objectives:

1.	To understand the key modules of digital communication systems with emphasis on digital modulation techniques.
2.	To introduce the principles with the basics of source and channel coding/decoding.
3.	To enable the students to understand the mobile radio communication principles, types and to study the recent trends adopted in cellular and wireless systems and standards.

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

C511.1	Review the knowledge of basic communication systems and its principles.	[U]
C511.2	Analyze the data transmission in digital communication using analog carriers.	[A]
C511.3	Apply the error control codes like Linear Block codes, Hamming codes, Cyclic codes, Convolutional codes and Vitterbi Decoder.	[AP]
C511.4	Describe the cellular concept and capacity improvement Techniques.	[U]
C511.5	Understand the latest trends in wireless communication.	[U]

Course Contents:

Base band transmission: **15 Hours**
Basics of communication systems, Need for modulation, Sampling theorem, Pulse code modulation (PCM), Delta Modulation, Data transmission using analog carrier (BFSK, BPSK, QPSK) - Comparison of various digital Communication system

Error control coding: **15 Hours**
Channel Coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Vitterbi Decoder

Introduction to Wireless Communication: **15 Hours**
Cellular concept, System design fundamentals, Coverage and Capacity improvement in Cellular system - Multiple access techniques: FDMA, TDMA and CDMA - OFDM - Latest trends: GSM, 4G (LTE), WLAN technology: IEEE 802.11, Wi-Fi, HIPERLAN and RFID technology.

	Total Hours:	**45**

Text Books:

1.	S. Haykin, "Digital Communications", John Wiley, 2nd Edition, 2014
2.	T.S. Rappaport, "Wireless Communication Principles", 2nd Edition, Pearson, 2010.
3.	A.F. Molisch, "Wireless Communications", Wiley, 2nd Edition, 2010.
4.	Jochen Schiller, "Mobile Communications", Addison Wesley, 2nd Edition, 2011.

Reference Books:

1.	P.Muthu Chidambaranathan, "Wireless Communications", PHI, 2010
2.	A.Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
3.	J.G.Proakis, "Digital Communication" , Tata McGraw – Hill, 4th Edition, 2014.
4.	R.E.Zimer, R.L.Peterson, "Introduction to Digital Communication", PHI, 3rd Edition, 2001.
5.	Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 3rd Edition, 2005.

6.	B.Sklar, "Digital Communications: Fundamentals & Applications", Pearson Education, 2nd Edition, 2001

Web References:

1.	https://ieeexplore.ieee.org/document/8246822
2.	https://nptel.ac.in/courses/117102059/
3.	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-36-communication-systems-engineering-spring-2009/lecture-notes/

Online Resources:

1.	https://ce.uci.edu/areas/engineering/networks/
2.	http://scpd.stanford.edu/search/publicCourseSearchDetails.do?method=load&courseId=12075
3.	https://www.edx.org/course/system-view-communications-signals-hkustx-elec1200-1x-1
4.	https://www.udemy.com/introduction-to-wireless-communications/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C511.1	Understand	Quiz	20
C511.2	Analyze	Assignment	20
C511.4	Understand	Case Study	20
C511.5	Understand	Seminar Presentation	20

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C511.1	3	3	3	3								2	3	1	2
C511.2	3	3	3	3								2	3	1	2
C511.3	2	3	3	2								2	3	1	1
C511.4	3	3	3	2	3							2	3	3	1
C511.5	2	2	3	1	2								2	2	2

22CS502	**PRINCIPLES OF COMPILER DESIGN**	3/0/2/4
Nature of Course:	D (Theory Design)	
Pre requisites	Theory of Computation	

Course Objectives:

1.	To introduce the major concept areas of language translation and compiler design
2.	To understand, design and construct a lexical analyzer and parser.
3.	To employ code generation schemes
4.	To perform optimization of codes and gain knowledge about runtime environments
5.	To provide practical programming skills necessary for constructing a compiler using LEX and YACC tools

Course Outcomes:

Upon completion of the course, students shall have ability to

C502.1	Construct a lexical analyzer to identify the tokens in a program	[AP]
C502.2	Construct a parser through the application of grammar.	[AP]
C502.3	Discuss the intermediate code generation and symbol table organization techniques	[U]
C502.4	Implement Frontend and Backend of a compiler for simple C statements.	[AP]
C502.5	Analyze the code optimization strategies of a compiler.	[A]

Course Contents:

MODULE I Lexical Analysis and Syntax analysis   **15 Hours**

Introduction to Phases of a compiler - **Lexical Analysis:** Role of Lexical Analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens. Finite Automata - From a regular expression to an NFA and DFA. **Syntax Analysis:** Role of the parser -Context-Free Grammars - **Top-Down parsing**: Recursive Descent Parsing - Predictive Parsing. **Bottom-up parsing**: Shift Reduce Parsing - LR Parsers - LEX and YACC tools.

MODULE II Semantics analysis and Intermediate Code Generation   **15 Hours**

Introduction to Semantics Analysis - Type Checking. **Intermediate Code Generation**: Intermediate Languages- Declarations - Assignment Statements - Boolean Expressions - Case Statements - Back patching - Procedure Calls. **Run Time Environments**: Source Language Issues - Storage Organization - Storage Allocation strategies.

MODULE III Code Generation and Code Optimization   **15 Hours**

Issues in the design of code generator - The Target Machine - Basic Blocks and Flow Graphs - A simple Code generator - DAG representation of Basic Blocks - Peephole Optimization. **Code Optimization:** Principal Sources of Optimization - Optimization of Basic Blocks - Introduction to Global Data Flow Analysis. **Case Study**: Just-in-time Compilation with adaptive optimization - Compiler for Data science.

	Total Hours:	**45**

Laboratory Experiments:
1. Implementation of lexical analyzer using C and LEX TOOL.
2. Implementation of a calculator that takes an expression (with digits, + and *), computes and prints its value, using YACC.
3. Implementation of a parser using LEX and YACC.
4. Implementation of symbol table
5. Implementation of Predictive parsing.
6. Implementation of Shift Reduce Parsing Algorithm.
7. Implementation of LR parsing.
8. Implementation of front end of a compiler that generates the three address code for a simple language with One data type integer, arithmetic operators, relational operators, variable declaration statement, one conditional construct, one iterative construct and assignment statement.
9. Implementation of back end of the compiler which takes the three address code as input and produces assembly language instructions that can be assembled and run using an 8086 assembler. The target assembly instructions can be simple move, add, sub, and jump.
10. Implementation of the code optimizer phase of a compiler that eliminates dead code and common sub-expressions.

Text Books:

1.	Alfred Aho, Ravi Sethi, Jeffrey D Ullman, Monica S. Lam, "Compilers Principles, Techniques and Tools" , 2nd Edition, Pearson Education Asia, 2013
2.	T.G Manikumar, M Ganga Durga , "Principles of Compiler Design", 1st Edition, MJP Publisher, 2021

Reference Books:

1.	C.N. Fischer and R.J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2010
2.	Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001
3.	Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning, 2003
4.	Dhamdhere, D.M., "Compiler Construction Principles and Practice", 2nd Edition, Macmillan India Ltd., New Delhi, 2008

Web References:

1.	gatecse.in/category/compiler-design/
2.	www.tutorialspoint.com/compiler_design

Online Resources:

1.	http://nptel.ac.in/syllabus/syllabus.php?subjectId=106108113
2.	nptel.ac.in/courses/106104123/

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (10%) [80 Marks]**
C502.1	Apply	Quiz	**20**
C502.2	Apply	Assignment	**20**
C502.3	Understand	Case study	**20**
C502. 4& C502. 5	Apply	Assignment	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	10	10
Understand	40	40	40
Apply	40	40	40
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (15%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	Programme Outcomes(PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C502.1	3	3	3	3	3				2	1	2	2	3	3	2
C502.2	3	3	3	3	3				2	1	2	2	3	3	2
C502.3	3	3	3	3	3				2	1	2	2	3	3	2
C502.4	3	3	3	2	2				2	1	2	2	3	3	2
C502.5	3	3	3	3	3				2	1	2	2	3	3	2
C502	**3**	**3**	**3**	**3**	**3**				**2**	**1**	**2**	**2**	**3**	**3**	**2**
	3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed							

22IT502	**DATA COMMUNICATIONS AND COMPUTER NETWORKS LABORATORY**	**0/0/3/1.5**

Nature of Course	L(Problem Experimental)
Prerequisites:	Nil

Course Objectives:

1	To learn socket programming.
2	To study and learn the network simulation tools.
3	Hands-on Experience on various networking protocols and tools.

Course Outcomes:

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

C502.1	Understand the foundational concepts in networking and system administration.	[U]
C502.2	Apply various networking protocols using sockets.	[A]
C502.3	Construct TCP sockets for client server communication.	[AP]
C502.4	Make use of simulation tools to implement various algorithms.	[AP]
C502.5	Analyze the network file transfer tool used for communication.	[A]

Course Contents:

1. A private organization appoints a system administrator and network administrator for troubleshooting and maintenance. System administrator focuses on servers and computer systems, while network administrators work more specifically with network-related tasks and equipment. Becoming a system administrator/network administrator will entail learning some specialized skills. Elucidate the roles and responsibilities & skill sets of a System administrator / Network administrator.

2. A newly constructed block in your college is planning to provide internet connection and also wants to make all the computers available in the block to be interconnected. The new block is of 'm' floors and overall 'n' rooms in each floor, also it has three buildings in its campus with the same capacity which are separated by 'x' meters.
   a. Identify the networking devices required for constructing the suitable network.
   b. List the features of the networking devices.
   c. Recommend and design the best suitable network type based on installation cost, performance, maintenance, installation time.

3. Build a network architecture for a Hypermarket with 'm' floors and 'n' systems. Choose and design the right Topology to build the architecture.

4. Consider a network with data frames transmitted from sender to receiver. Design a code for bit stuffing and un-stuffing mechanism considering the given input pattern.

5. In a network, assume that the sender sends 'm' frames each of 'n' bits. Develop a code to calculate the checksum value and to check whether the data frames are received in the receiver end.

6. Assume a network scenario where N is the sender's window size = 'm' & damaged frame is 'x';

(a) At this situation, the sender sends frame 1 to 'm' before receiving the knowledge of frame 1. All the frames are numbered to deal with the most and duplicate frames. If the sender does not receive the receiver's acknowledgement, then all the frames available in the current window ie., 1 to 'm' will be retransmitted.

(b) The sender will resend only the damaged frame ie., frame 'x'

	Identify a suitable protocol for the given scenario (a) & (b) and write the code.
	7. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
	8. Recommend and suggest a suitable protocol to send, receive, and synchronize with Mail. Develop a code for implementing the above protocol.
	9. Write a program to find the shortest path between vertices using Open Shortest Path First Routing algorithm.
	10. Write a program for congestion control in a network using leaky bucket algorithm.
	11. Study of Simulators and Emulators.
	12. Simulate a LAN to Create a simple network and show the transfer of packets from one node to another node.

	Total Hours:	**45**

Text Books:

1	Elliotte Rusty Harold, "Java Network Programming", Developing Networked Applications", O'Reilly Media, 2013.
2	Kenneth L. Calvert, Michael J. Donahoo, "TCP/IP Sockets in Java: Practical Guide for Programmers", Imprint: Morgan Kaufmann, 2008.

Reference Books:

1	Jan Graba, "An Introduction to Network Programming with Java", Springer, 3rd Edition,2013
2	Esmond Pitt, "Fundamental Networking in Java", 3rd Edition, Springer.
3	James F. Kurose, Keith W. Ross, "Computer Networking: A Top-downApproach", Pearson Education, Limited, 6th Edition, 2012.

Web References:

1	https://www.tutorialspoint.com/java/java_networking.htm
2	https://www.javatpoint.com/socket-programming
3	https://www.udemy.com/course/networking-lab-creation-and-configuration/?couponCode=ST15MT31224

Online Resources:

1	https://onlinecourses.nptel.ac.in/noc21_cs18/preview
2	https://www.coursera.org/lecture/distributed-programming-in-java/2-1-introduction-to-sockets-XiZXU

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

Assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (60%) [100 Marks]		End Semester Practical Examination (40%) [100 Marks]
	FA (75 Marks)	SA (25 Marks)	
Remember	-	-	-
Understand	-	-	10
Apply	70	60	60
Analyse	30	40	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
C502.1	3	3	2	2	3	-	-	-	-	-	-	1	3	2	3
C502.2	2	3	3	2	3	-	-	-	-	-	-	1	3	3	2
C502.3	3	3	2	2	3	-	-	-	-	-	-	1	2	2	3
C502.4	2	3	3	2	3	-	-	-	-	-	-	1	3	2	3
C502.5	3	3	3	2	3	-	-	-	-	-	-	1	3	2	2

22IT503	MINI PROJECT	0/0/2/1
Nature of Course	M (Practical Application)	
Pre-Requisites	Programming Languages	

Course Objectives:

1	To identify a problem area and showcasing a strong understanding of the selected domain.
2	To explore the latest advancements within their selected field of study.
3	To understand and adhere to ethical standards and professional practices in software development.

Course Outcomes:

Upon completion of the course, students shall have ability to

C503.1	Identify a problem and carry out a thorough study on the chosen problem	[AP]
C503.2	Analyze ongoing developments in the chosen domain and demonstrate technical knowledge pertaining to the same.	[A]
C503.3	Apply suitable tools, techniques, Algorithms, frameworks to solve the practical problems.	[AP]
C503.4	Develop a solution for the chosen problem and validate the results.	[C]

Course Guidelines:

Introduction: Identify domain, Framing Problem Statement, Dataset Collection, Analyze the Techniques, Organize the work flow. **Experiments:** Develop software life cycle model, Implement, and provide solution for the chosen problem statement, Validate the result, and provide the documentation for findings.

1. The entire semester shall be utilized by the students to do their Mini project work by receiving the directions from the project guide.
2. Every student shall have a project guide who is the member of the faculty of the institution for the in-house project or an industry mentor from the industry as project guide for an industry/internship project.
3. Identification of project guide has to be completed by the end of previous semester of the project work to be carried out.
4. The duration may be used for library reading, laboratory work, literature survey, computer analysis or field work as assigned by the guide and also to present periodical seminars about the progress made in the project.
5. Number of students in the project team should be maximum of 4.
6. Students can select project topics from the thrust areas.
7. Projects can be Research Based, Application Based, or Multidisciplinary.
8. Students can choose projects in line with the Departmental Mission, Vision and Program Outcomes.
9. Students can identify the project area / title, obtain the consent of faculty to guide them.
10. Students can make use of college subscribed E-resources like IEEE, ScienceDirect and Elsevier to choose base papers and thereby do literature surveys.
11. After project guide allocation, the student team must meet the respective project guide and update about the status of project periodically.
12. While working on the project, every student team must keep a project diary and record all relevant information. The diary must be verified and signed by the project guide which will be the periodic progress report and submitted during the project review to the project coordinator.
13. Students should not be involved in unethical behaviour, such as plagiarism, copyright violations, etc while working on projects and when submitting project reports.

14. The progress of the project will be evaluated on a continuous basis by conducting periodic internal reviews. The review committee may be constituted by the Head of the Department.
15. A final external project viva-voce examination will be conducted to evaluate the student project work based on oral presentation and the project report by an Internal and External Examiner.
16. Every student team will be required to prepare and submit two (2) copies plus (no. of students) copies of the Project report of typical length 30 – 60 pages (excluding Appendices).
17. The final report shall be in typewritten form as specified in the guidelines issued by the COE.
18. As outcome of the project, students are motivated to publish papers in Scopus Indexed Journals or present the project work in International Conferences.

Summative assessment based on Continuous and End Semester Examination

Activity	Month	Continuous Assessment [60 marks]	End Semester Examination [40 marks]
Project Evaluation	August	30	
Project Evaluation	September	30	100
Project Evaluation	October	40	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
Cos	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C503.1	3	3	2	2	1			3	3	3		3	2	3	3
C503.2	3	3	3	3	3			3	2	3	2	3	2	3	3
C503.3	3	3	3	3		3	3	3	3	3	3	3	2	3	3
C503.4	3	3	3	3				3	3	3	3	3	2	3	3
	3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed							

22IT601		EMBEDDED SYSTEMS AND INTERNET OF THINGS	3/0/0/3
Nature of Course		D (Theory Application)	
Pre requisites		Nil	

Course Objectives:

1.	To understand the fundamentals of IoT and Embedded systems including essence, basic design and process modeling.
2.	To understand the market perspectives on Internet of Things.
3.	To build simple and low cost IoT applications using Arduino / Raspberry Pi or equivalent boards in Embedded Platform.
4.	To understand the design constraints of real world IoT applications.
5.	To apply the concept of Internet of Things in real world scenarios such as Industrial Automation, Commercial Building Automation, Health care's etc.

Course Outcomes

Upon completion of the course, students shall have ability to

C601.1	Infer the fundamental knowledge on Embedded systems and Internet of Things	[U]
C601.2	Build IoT systems using Raspberry Pi, Arduino, Node MCU on Embedded Platform.	[AP]
C601.3	Examine the application of IoT and identify the Real-World Design Constraints.	[A]
C601.4	Inspect the integration of next generation technologies with IoT	[A]
C601.5	Analyze the performance of IoT applications in different domains.	[A]
C601.6	Relate the security issues on Internet of Things.	[U]

Course Contents:

Introduction to Embedded System and Internet of Things: **15 Hours**
Introduction to Microprocessors and Microcontrollers - 8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling **Fundamentals and Design Methodology of IoT:** Characteristics and Architecture of IoT – Physical Design of IoT – Logical Design of IoT – IoT Enabling Technologies - IoT Levels – IoT Design Methodology.
Case study: EdSim
System Hardware for IoT: **15 Hours**
IoE vs IoT vs M2M – Domain specific IoT - Basic Components – Hardware Kits: Arduino, Node MCU, Raspberry Pi. **Arduino:** Physical Design – Interfaces – Arduino IDE – Arduino Programming with examples: Digital IO – Analog IO – Serial Communication – Condition and Looping statements – Programming using ESP32. **Raspberry Pi:** Physical Design – Interfaces – Pi programming using Python with examples – Python Packages for IoT.
Data Analytics and Security for IoT and IIOT: **15 Hours**
Data Analytics for IoT: Overview of Hadoop ecosystem – MapReduce architecture – MapReduce Job Execution – MapReduce Schedulers. **IoT Security:** Overview of IoT Security – IoT Protocols – Network and Transport Layer Challenges – IoT Gateways and Security – IoT Routing Attacks – Bootstrapping and Authentication – Authentication Mechanisms. **Industrial IoT:** Introduction to IIoT – Key IIoT Technologies - Innovation and the IIoT - Intelligent Devices - Key Opportunities and Benefits.

		Total Hours	**45**

	Text Books:
1.	Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2nd Edition, 2014
2.	Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

	Reference Books:
1.	Mark Torvalds, "Arduino Programming: Step-by-step guide to mastering arduino hardware and software", Createspace Publishing, 2nd Edition, 2018.
2.	Dr. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", 2nd Edition, McGraw-Hill Education, 2016.
3.	Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things Principles and Paradigms", Elsevier, 2016.
4.	Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2016.
5.	Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram," Internet of Things", Wiley Publication, 2019.

	Web References:
1.	https://github.com/connectIOT/iottoolkit
2.	https://www.arduino.cc/
3.	http://www.buyya.com/papers/IoT-Book2016-C1.pdf
4.	https://www.ptc.com/en/technologies/iiot

	Online Resources:
1.	https://nptel.ac.in/courses/106/105/106105166/
2.	https://www.coursera.org/learn/iot
3.	http://www.iotlab.eu/
4.	http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/
5.	https://www.edx.org/course/introduction-to-the-internet-of-things-iot

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C601.1, C601.6	Understand	Assignment	20
C601.2	Apply	Quiz	20
C601.3 C601.4	Analyse	Case Study	20
C601.5	Analyse	Certification	20

Assessment based on Summative and End Semester Examination

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

Assessment based on Continuous and End Semester Examination

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

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

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
C601.1	3	1	2		1	2	1					1	3	3	1
C601.2	3	3	3	3	3	1	2			2		2	3	3	3
C601.3	3	2	3	3	2	2	2			1		1	2	3	2
C601.4	3	3	3	3	3		2		2	2		2	2	3	2
C601.5	3	3	3	3	3		1		2	1		1	2	3	2
C601.6	3	2	1	1	2		1		1		1	2	1	1	1

3	Strongly agreed	2	Moderately agreed	1	Weakly agreed

22CS602	CRYPTOGRAPHY AND NETWORK SECURITY	3/0/0/3
Nature of Course:	G (Theory Analytical)	
Pre requisites:	Data Communications and Computer Networks	

Course Objectives:

1.	To interpret the security goals of cryptography.
2.	To identify the different types of modern cryptographic techniques.
3.	To illustrate public key encryption and hash functions.
4.	To analyze email security, IP security and web security.

Course Outcomes:

Upon completion of the course, students shall have ability to

C602.1	Discuss OSI security architecture and classical encryption techniques.	[U]
C602.2	Apply the Symmetric and Asymmetric Cryptographic algorithms in real-time examples	[AP]
C602.3	Examine the applications of Cryptographic Hash Functions and Message Authentication Codes	[AP]
C602.4	Develop a model for Digital signature system and authentication system	[AP]
C602.5	Apply techniques to enhance the security in different applications and networks	[AP]

Course Contents:

MODULE I Introduction **15 Hours**

Concepts of Cyber security– CIA Triad – OSI Security Architecture (attacks, services, mechanisms)- Cryptography - Network Security – Classical Encryption techniques - Symmetric ciphers - Substitution Techniques - Transposition Techniques- Data Encryption Standard – DES example - The Strength of DES - Block Cipher Design Principles -Advanced Encryption Standard, AES Structure- AES Transformation Functions- AES Key Expansion – AES Example- Multiple Encryption and Triple DES

MODULE II Public-Key Encryption and Hash Functions **15 Hours**

Fermat's and Euler'stheorem - Testing of primality -The Chinese remainder theorem - Public Key Cryptography: RSA- The RSA Algorithm- Diffie-Hellman (ElGamal) - Cryptographic Hash Functions - Applications of Cryptographic Hash Functions -Two Simple Hash Functions - Secure Hash Algorithm (SHA)- SHA 3 - Message Authentication Codes – Requirements – Functions - MACs Based on Hash Functions: HMAC.

MODULE III Network Security Applications **15 Hours**

Digital Signatures: Introduction **-**ElGamal/Schnorr Digital Signature Scheme
Authentication Applications: Remote User-Authentication Principles - Kerberos - **Transport-Level Security:** Web Security Considerations **-** Transport Layer Security – HTTPS - Secure Shell (SSH)- **Wireless Network Security**: Wireless Security - Mobile Device Security- **Network Endpoint Security**: Firewalls - Intrusion Detection Systems - Malicious Software - Distributed Denial of Service Attacks
Case Study: Hardening CISCO Devices based on Cryptography and Security Protocols.

	Total Hours:	**45**

Text Books:

1.	William Stallings, "Cryptography and Network Security - Principles and Practice", 8th Edition, Pearson, 2020.

	Reference Books:
1.	Behrouz A. Forouzon, "Cryptography and network security", 3rd Edition, Tata Mc Graw Hill, 2015.
2.	Atul Kahate, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw-Hill, 2013.

	Web References:
1.	https://crypto.stanford.edu/~dabo/cs255/syllabus.html
2.	http://www.iitg.ac.in/icdcn2006/isg.pdf
3.	http://www.tutorialspoint.com/cryptography/
4.	https://blockgeeks.com/guides/what-is-blockchain-technology/
5.	https://www.kaspersky.com/resource-center/definitions/what-is-cryptocurrency
6.	https://ieeexplore.ieee.org/document/6527783 - Lightweight cipher implementations on embedded processors.
7.	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3523710

	Online Resources:
1.	https://onlinecourses.nptel.ac.in/noc18_cs07/preview
2.	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html
3.	http://freevideolectures.com/Course/3027/Cryptography-and-Network-Security
4.	https://www.coursera.org/learn/crypto
5.	https://www.youtube.com/playlist?list=PL96A74njP_C8arW6NeU1o0e1NKjAWj0HA

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C602.1 & C602.2	Understand	Quiz	20
C602.3 & C602.4	Apply	Assignment	40
C602.5	Apply	Case Study	20

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

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA 1: [60 Marks]	**CIA 2: [60 Marks]**	
Remember	20	20	20
Understand	30	30	30
Apply	20	20	20
Analyze	30	30	30
Evaluate	-	-	-
Create	-	-	-

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C602.1	3	1										2			1
C602.2	3	2	1	2								2	2	2	1
C602.3	3	3	1	3	2							2	2	2	1
C602.4	3	3	1	3	2							2	3	2	1
C602.5	3	3	1	3	1							2	3	2	1
C602	**3**	**3**	**1**	**3**	**2**							**2**	**3**	**3**	**1**

22IT602	DATA SCIENCE USING PYTHON	3/0/2/4
Nature of Course:	F (Theory Programming)	
Prerequisites:	Problem Solving using C++	

Course Objectives:

1	To learn the fundamentals of program design including input, processing, and output phases.
2	To gain proficiency in string operations such as iteration, traversal, slicing, searching, and utilizing string functions and methods.
3	To develop competence in working with lists and tuples.
4	To explore sets and their operations, along with the basics of classes and dictionaries.
5	To introduce the basics of NumPy for handling data types, arrays, universal functions, aggregations, broadcasting, boolean logic, fancy indexing, sorting, and structured arrays and to develop skills in data manipulation using Pandas.
6	To demonstrate proficiency in data visualization using Matplotlib, including creating simple line plots and scatter plots.

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

C602.1	Demonstrate proficiency in programming with Python, including basic program design principles and control flow statements.	[U]
C602.2	Implement functions in Python, including both recursive and non-recursive functions.	[AP]
C602.3	Develop skills in handling different types of data structures such as strings, lists, tuples, sets, dictionaries, and arrays.	[AP]
C602.4	Use NumPy for numerical computing tasks and will be able to manipulate data using Pandas.	[AP]
C602.5	Apply various Matplotlib tools including line plots and scatter plots to visualize data effectively.	[AP]

Course Contents:

PYTHON FUNDAMENTALS - DATATYPES, EXPRESSIONS, STRINGS: **10 Hours**
Python Interpreter and Interactive Mode. Designing a Program - Input, Processing, and Output. Variables, expressions and statements - Values and types, Variables, Operators and operands, Order of operations, String operations - Iteration - Functions - Recursive functions, Fruitful and void functions, Strings: Immutability, Traversal with a for loop, String Slices, Searching, The in operator, String comparison, String Functions and Methods, String Module, Format Operator.

CONTROL FLOW, FUNCTIONS: **10 Hours**
Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters, List Comprehension, Lists as Arrays; Tuples: Tuple Assignment, Tuple as Return Value; Sets - Set Operations; Dictionaries; Files and Exception: Text Files, Reading and Writing Files; Command Line Arguments; Errors and Exceptions, Handling Exceptions.

PYTHON FOR DATA SCIENCE: **25 Hours**
Introduction to NumPy - Understanding Data Types in Python-The Basics of NumPy Arrays-Computation on NumPy-Arrays: Universal Functions-Aggregations- Computation on Arrays: Broadcasting-Comparisons, Masks, and Boolean Logic-Fancy Indexing-Sorting Arrays. Data Manipulation with Pandas: Introducing Pandas Objects-Data Indexing and Selection Handling Missing Data-Hierarchical Indexing-Combining Datasets: Concat and Append, Merge and Join-Aggregation and Grouping- Pivot Tables- Vectorized String Operations. Visualization with Matplotlib- Simple Line Plots-Simple Scatter Plots.

	Case Study: Inventory Management System for a Grocery store.	
	Total Hours (Theory):	**45**

Lab Component

S. No.	Lab Exercises
1	Implement a Python program that takes user input, performs a specified computation, and outputs the result.
2	Write a Python program to demonstrate various string operations such as iteration, traversal, slicing, searching, and using built-in string functions.
3	Develop Python programs to perform operations on lists including sorting, slicing, appending, removing elements, and using list methods.
4	Write Python programs to demonstrate knowledge on Python tuples.
5	Implement Python programs to perform set operations such as union, intersection, difference, and symmetric difference.
6	Develop Python programs to perform common dictionary operations such as adding, updating, deleting, and accessing key-value pairs.
7	Write Python scripts to create NumPy arrays and to perform basic array operations.
8	Develop Python scripts to manipulate data using Pandas, including data selection, filtering, aggregation, and merging datasets.
9	Create Python scripts to visualize data using Matplotlib, including plotting line graphs, scatter plots, and histograms.
10	**Mini Project**: A project where students need to apply their Python programming skills to solve a real-world problem, analyze data, and present their findings.

	Total Hours (Lab):	**30**
	Total Hours: (45+30)	**75**

Text Books:

1	Allen B. Downey, "Think Python. How to Think Like a Computer Scientist", Green Tea Press, 2016
2	Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 2nd Edition, O'Reilly Media, Inc., 2022.
3	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
4	Tony Gaddis, "Starting out with Python'', 6th Edition, Addison Wesley, Pearson, 2023.

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 Pythonǁ", 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.

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://numpy.org/doc/stable/user/absolute_beginners.html
2	https://pandas.pydata.org/docs/user_guide/index.html
3	https://matplotlib.org/stable/users/index.html
4	https://www.datacamp.com/cheat-sheet/getting-started-with-python-cheat-sheet
5	https://www.utc.fr/~jlaforet/Suppl/python-cheatsheets.pdf

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

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component	FA (10%) [80 Marks]
C602.1	Understand	Quiz	20
C602.2	Apply	Certification	20
C602.3	Apply		
C602.4	Apply	Project	40
C602.5	Apply		

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	10	10
Understand	40	40	40
Apply	40	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	30	40	40
Apply	60	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C602.1	3	3	2									1	3	1	1
C602.2	3	3	3	3	3				2	1		2	3	2	2
C602.3	3	3	3	3	3				2	1		2	3	2	2
C602.4	3	3	3	3	3				2	1		2	3	2	2
C602.5	3	3	3	3	3				2	1		2	3	2	2
C602	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**2**	**3**	**2**	**2**

	3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed	

22IT603	EMBEDDED SYSTEMS AND INTERNET OF THINGS LABORATORY	0/0/3/1.5
Nature of Course	M (Practical Application)	
Pre requisites	Nil	

Course Objectives:

1	To understand the fundamentals of IoT and Embedded systems.
2	To understand the design constraints of real world IoT applications
3	To build low-cost embedded system using Arduino/Raspberry Pi/Node MCU
4	To explain the interfacing of data, I/O devices with Arduino UNO
5	To apply the concept of Internet of Things in the real-world scenario.

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

C603.1	Demonstrate the concept of Internet of Things	[U]
C603.2	Develop IoT and Embedded Systems based application	[AP]
C603.3	Construct interfacing of various sensors with Arduino/Raspberry Pi.	[AP]
C603.4	Inspect the ability to transmit data wirelessly between different devices.	[A]
C603.5	Build IoT applications based on cloud environment	[AP]

List of Experiments:

1. Study and Configuration of Arduino kit / Node MCU / Raspberry PI.
2. Basic Programming using Arduino / Raspberry PI:
   a. LED and Switch Interface
   b. Analog & Digital Sensor Interface
   c. Serial Communication
   d. Local display of sensor data using LCD
   e. Display of Sensor values in Mobile handset using Bluetooth
3. Basic Programming using NodeMCU.
   a. Remote control of Electrical appliances using Mobile handset and Wi-Fi
   b. Local Web server using NodeMCU and displaying Sensor values.
4. Design and development of a System using LM35 temperature sensor.
5. Design and development of a System using MQ5 sensor.
6. Design and development of a System using Soil Moisture sensor.
7. Design and development of a System using PIR sensor.
8. Design and development of a System using Heart beat sensor.

	Total Hours	**45**

Text Books:

1	Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.
2	Dr. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", 2nd Edition, McGraw-Hill Education, 2016.

Reference Books:

1.	Adrian McEwen and Hakim Cassimally "Designing the Internet of Things", Wiley Publishers, 2013,
2.	Gaston C. Hillar "Internet of Things with Python", Packt Publishing, 2016.

Web References:

1	https://www.arduino.cc/reference/en/
2	https://www.raspberrypi.com/documentation/
3	https://nodemcu.readthedocs.io/en/release/

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

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

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
C603.1	3	1	2		1	2	1					1	3	3	1
C603.2	3	3	3	3	3	1	2			2		2	3	3	3
C603.3	3	2	3	3	2	2	2			1		1	2	3	2
C603.4	3	1	3	3	3		2		2	2		2	2	3	2
C603.5	3	3	3	3	3	2	1		2	1		1	2	3	2

22IT901	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3/0/0/3
Nature of Course	H (Theory Technology)	
Prerequisites	-	

Course Objectives:

1	To introduce different types of Machine Learning techniques
2	To provide insight on Artificial neural networks and its implementation using python
3	To practice classification problems on the given dataset
4	To involve the students in solving computer vision problems using openCV library
5	To deliver knowledge on Convolution Neural Network

Course Outcomes:

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

C901.1	Demonstrate supervised learning techniques	[AP]
C901.2	Illustrate unsupervised, semi-supervised and reinforcement learning algorithms	[AP]
C901.3	Build Artificial Neural network for the given classification problem	[AP]
C901.4	Apply CNN for solving image classification or recognition problems	[AP]
C901.5	Effectively present the significance of machine learning techniques in pattern classification	[A]

Course Contents:

MODULE I Introduction to Machine Learning and Artificial Intelligence   15 Hours

Introduction to Machine learning: AI vs ML vs DL vs DS - Introduction to Supervised, unsupervised, semi-supervised, and reinforcement learning - Train, test, and validation split - Performance metrics - Overfitting and underfitting - Bias vs. variance .Supervised Learning: Regression-Linear - Support vector regression - Decision Tree. Random Forest-Classification - Logistic - Support vector classification – KNN - naïve bayes

MODULE II Diving into Artificial Neural Networks   15 Hours

Overview of Perceptron - Implementing Perceptron using Python - Multilayer perceptron - Forward propagation - activation functions - backward propagation - chain rule for derivatives - updating rule - gradient descent - vanishing and exploding gradients – optimizers - loss functions – regularizations - dropout.

MODULE III Introduction to Computer Vision   15 Hours

OpenCV library - basic operations with images. ANN implementation on the dataset - CNN: ANN Vs CNN - the intuition of CNN – Kernels – Channels – padding – flattening - Receptive fields - image output dimensionality calculation - MNIST dataset exploration with CNN - Dropout implementation using dataset.

	Total Hours:	**45**

Text Books:

1	Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning, Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow", Packt Publication, 2nd Edition, 2017.
2	Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analysing images", O'REILLY Publications, 2012.
3	Jacek M. Zurada, "Introduction to Artificial Neural Systems", JAICO Publishing House 2006.
4	Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006

Reference Books:

1	Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach",4th Edition, Pearson Education,2021.
2	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence", 3rd Edition Mc Graw Hill- 2011.
3	E. Alpaydin, "Introduction to Machine Learning", MIT Press, 2nd Edition, 2010

Web References:	
1	https://people.eecs.berkeley.edu/~jrs/189/
2	http://www.stanford.edu/class/cs221/
Online Resources:	
1	https://nptel.ac.in/courses/106105152
2	https://viso.ai/computer-vision/image-recognition/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C901.1	Apply	Quiz	20
C901.2			
C901.3	Apply	Assignment	20
C901.4	Analyze	Mini Project Presentation	40
C901.5			

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C901.1	3	3	3	3	2								3		2
C901.2	3	3	3	2	2								3		2
C901.3	3	3	3	3	2								2		2
C901.4	3	3	3	2	2	2	2	2	2	2		2	2	2	2
C901.5										3	1	2	2	2	2
C901	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**2**
	3	Strongly agreed		2	Moderately agreed			1	Reasonably agreed						

22IT902	**NLP WITH PREDICTIVE ANALYSIS**	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Nil	

Course Objectives:

1.	To recognize and define core computer vision problems.
2.	To understand the principles behind the creation of the convolution neural network.
3.	To familiarize formal models to express natural language phenomenon
4.	To implement and debug large NLP systems in a clean and structured manner

Course Outcomes

Upon completion of the course, students shall have ability to

C902.1	Infer the different architectures of AI Computer Vision.	[U]
C902.2	Examine different methodologies to create application using LeNet-5, AlexNet, VGG, ResNet.	[A]
C902.3	Interpret state-of-the-art works of literature on Object detection and localization algorithms.	[U]
C902.4	Identify the appropriate deep learning models for analyzing the data for a variety of real world problems.	[AP]
C902.5	Develop computer vision applications.	[AP]
C902.6	Inspect the Transformer idea related to language modeling, sequence-to-sequence modeling, and googles's BERT model.	[A]

Course Contents:

Natural Language Processing (NLP)   **15 Hours**
NLP overview - NLP - RNN - NLP - LSTM - GRU - NLP Attention based models: Encoder - Decoder - attention mechanism - NLP Transfer learning: GPT and BERT.

Architectures of Computer Vision: **15 Hours**
Background - Requirements of Computer vision- Architectures: LeNet-5 and implementation-AlexNet and implementation-VGG and implementation-Inception and practical-ResNet and implementation.

Advance Computer Vision: **15 Hours**
Data Augmentation and its benefits - object detections: bounding boxes - bounding box regression - IoU - Precision and recall - Transfer Learning - Average precision - CNN: Architecture - implementations - Cons - FAST RCNN - FAST RCNN Architecture - FASTER RCNN - and its architecture - YOLO: Architecture and implementation Detectron and its implementation.

	Total Hours	**45**

Text Books:

1.	Lewis Tunstall, Leandro von Werra, Thomas Wolf, "Natural Language Processing with Transformers: Building Language Applications with Hugging Face", 1st Edition, O'Reilly 2022.
2.	I. Goodfellow, Y. Bengio and A. Courville, "Deep Learning: Algorithms and Applications", MIT Press Cambridge, 2017.
3.	S. Khan, H. Rahmani, S. Shah and M. Bennamoun, "A Guide to Convolutional Neural Networks for Computer Vision", Morgan & Claypool Publishers, 2018.
4.	Mohammed Elgendy, "Deep Learning for Vision Systems", Manning Publications Co., 2018.

Reference Books:		
1.	Seth Weidman , "Deep Learning from Scratch: Building with Python from First Principles" , O'Reilly, 2019.	
2.	Denis Rothman, "Transformers for Natural Language Processing: Build innovative deep neural network architectures for NLP with Python, PyTorch, TensorFlow, BERT, RoBERTa, and more", Packt, 2021.	

Web References:

1.	https://github.com/brianspiering/awesome-dl4nlp
2.	https://www.tutorialspoint.com/natural_language_processing/index.htm

Online Resources:

1.	http://cs231n.stanford.edu/slides/2017/cs231n_2017_lecture11.pdf
2.	https://towardsdatascience.com/what-is-average-precision-in-object-detection-localization-algorithms-and-how-to-calculate-it-3f330efe697b
3.	https://www.kaggle.com/code/colearninglounge/nlp-model-building-transformers-attention-more

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C902.1, C902.3	Understand	Assignment	20
C902.4	Apply	Quiz	20
C902.5	Apply	Assignment	20
C902.2 C902.6	Analyze	Case Study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	-	-	-
Understand	30	20	30
Apply	60	50	40
Analyse	10	30	30
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C902.1	2	2	2	2	2						2	2	2	2	2
C902.2	2	2		1	2						2	2	2	2	2
C902.3	2		1	1	3						2	2	2	2	2
C902.4	2	2	1	2	1						3	3	2	3	2
C902.5	1	2	2	1	2						2	3	3	2	2
C902.6	1	3	2	1	2						2	2	2	3	2

22IT903	DEEP LEARNING TECHNIQUES	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Artificial Intelligence and Machine Learning	

Course Objectives:		
1.	To understand the fundamentals of neural networks and deep networks.	
2.	To learn the different architectures of deep networks.	
3.	To examine the core concepts in deep learning.	
4.	To learn the applications of deep learning.	
5.	To understand the underlying implementations of deep learning models, and techniques for optimization	

Course Outcomes		
Upon completion of the course, students shall have ability to		
C903.1	Define the basics of Neural and Deep Networks.	[R]
C903.2	Summarize the CNN and RNN architectures that helps resolve complex problems.	[U]
C903.3	Experiment with the performance of a Deep Learning Network.	[AP]
C903.4	Apply Deep Learning for solving Real world problems.	[AP]
C903.5	Analyze appropriate neural network architectures and techniques for specific applications	[A]

Course Contents:
Foundations of Neural Networks   **15 Hours**
Neural Networks – Training Neural Networks – Activation Functions – Loss Functions – Hyper parameters. Fundamentals of Deep Networks-Introduction to Deep Learning-Generative Adversarial Networks- Image Segmentation –Reinforcement Learning and Deep Q-Networks (DQN)-Attention Mechanisms and Transformer Networks-Transfer Learning-Synthetic Data Creation.

CNN and RNN   **15 Hours**
CNN: Introduction-Convolution and Pooling Layers-CNN Architectures (LeNet, AlexNet, VGG, ResNet)- Object Detection and Localization with CNNs-Image Classification and Transfer Learning-Case Studies: Image Recognition and Analysis. RNN: Introduction- Vanishing and Exploding Gradients - LSTM (Long Short-Term Memory) NetworksGRU (Gated Recurrent Unit) Networks-Applications of RNNs: Sequence Prediction, Language Modeling-Time Series Analysis and Forecasting.

Applications   **15 Hours**
Autoencoders and Dimensionality Reduction-Implementing Neural Networks and Deep Learning Models using Frameworks like TensorFlow / PyTorch, Case Studies: Large-Scale deep learning-Computer Vision- Text Classification - Named Entity Recognition (using NLTK Library).

	Total Hours	**45**

Text Books:	
1.	Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2.	Rajalingappaa Shanmugamani, "Deep Learning for Computer Vision, Expert Techniques to Train Advanced Neural Networks using TensorFlow and Keras", Packt Publishing, 2018.
3.	Adam Gibson, Josh Patterson, "Deep Learning, A practitioner's approach", O'Reilly, 1st Edition, 2017.
4.	Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.

Reference Books:	
1.	Aurelien Geron, "Hands-On Learning with Scikit-Learn and Tensorflow", O'Reilly, 1st Edition, 2017.
2.	Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
3.	Francois Chollet, "Deep Learning with Python", Manning Publications, 2018
Web References:	
1.	https://home.cs.colorado.edu/~mozer/Teaching/syllabi/DeepLearningFall2017/
2.	http://www.cs.iit.edu/~agam/cs577/index.html
3.	https://online.stanford.edu/courses/cs230-deep-learning
Online Resources:	
1.	https://www.edx.org/course/deep-learning-with-tensorflow
2.	https://datascience.uci.edu/education/data-science-short-courses/
3.	https://onlinecourses.nptel.ac.in/noc19_cs81/preview

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C903.1	Remember	Assignment	20
C903.2	Understand	Quiz	30
C903.3 C903.4 C903.5	Apply, Analyze	Certification	30

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	-	20
Understand	20	20	20
Apply	70	50	40
Analyze	-	30	20
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C903.1	2	3	3	2	2			2	2	2	2	2	3	2	2
C903.2	2	2	2	3	2			2	2	2	2	2	2	3	3
C903.3	3	3	3	3	3			3		3	3	3	3	3	3
C903.4	2	2	2	3	2			2		2	2	2	3	2	3
C903.5	2	2	2	3	3			3		3	3	3	2	3	2

22IT904		**COGNITIVE SYSTEMS AND ANALYTICS**	3/0/0/3
Nature of Course		H (Theory Technology)	
Pre requisites		Nil	

Course Objectives:	
1.	To learn the history and fundamentals of cognitive science.
2.	To demonstrate learning, reasoning and design principles in cognitive systems.
3.	To illustrate the various analytics techniques in cognitive computing.
4.	To develop skills in analyzing, interpreting and assessing the empirical data and research techniques that contributes to cognitive science.

Course Outcomes:

Upon completion of the course, students shall have ability to

C904.1	Recall the basic concepts of cognitive science and its algorithms	[R]
C904.2	Understand the complexities of cognition using neural, social and technological approaches	[U]
C904.3	Practice the Learning, reasoning and designing methodologies in cognitive systems	[AP]
C904.4	Use various Analytics techniques in cognitive systems	[AP]
C904.5	Apply cognitive science theories, concepts to individual, social and cultural issues	[AP]
C904.6	Examine various cognitive applications for social issues	[A]

Course Contents:

Introduction to Cognitive Science   **15 Hours**
Introduction: Foundation of Cognitive Science and design principles - Natural language processing in support of a cognitive system - Role of cloud and distributed computing in cognitive computing - Relationship between big data and Cognitive computing - The Business Implications of Cognitive Computing – Case based Reasoning.

Cognitive Systems and Learning   **15 Hours**
Concept Learning-Classification Logic-Planning-Understanding Common Sense Reasoning-Scripts. Cognitive Systems and Reasoning- Explanation Based Learning - Analogical Reasoning-Version Spaces-Constraint Propagation Diagnosis-Meta Reasoning

Cognitive System Design Principles & Applications   **15 Hours**
Machine Learning Hypothesis -Generation and Scoring-Representing Knowledge taxonomies and Ontologies -Advanced Analytics- Predictive Analytics-Text Analytics - Image Analytics-Speech Analytics Case study- Sensitivity Analysis using AWS services. Applications of cognitive computing - Building a Cognitive Healthcare Application, Smarter cities in Government & Emerging cognitive computing areas.

	Total Hours	**45**

Text Books:	
1.	S.Hurwitz, M.Kaufman and A.Bowles, "Cognitive Computing and Big Data Analytics", Wiley Publishers, 2015.
2.	Herre van Oostendorp, "Cognition in a Digital World", Publishers: Lawrence Erlbaum Associates, 2003

Reference Books:	
1.	Felix Goodson "The Evolution and Function of Cognition" Publishers: Lawrence Erlbaum Associates, 2003
2.	Paul Thaugard, BradFord Book " Mind- Introduction to Cognitive Science", 2nd Edition, MIT Press, 2005.
Web References:	
1.	www.cognitivesciencesociety.org
2.	https://www.shortcoursesportal.conn/search/#q=di-2751lv-short
3.	https://cognitiveclass.ai/learn/cognitive-analytics-ibm
Online Resources:	
1.	https://www.edx.org/learn/cognitive-science
2.	https://ocw.mit.edu/courses/brain-and-cognitive-sciences/
3.	https://swayam.gov.in/course/267-cognitive-science
4.	https://www.coursera.org/courses?query=cognitive%20science
5.	https://www.coursera.org/learn/philosophy-cognitive-sciences

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C904.1	Understand	Online Quiz	20
C904.2	Understand	Assignment	20
C904.3, C904.4 & C904.5	Apply	Assignment	20
C904.6	Analyze	Case study	20

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C904.1	3		3		3		2					2	3		
C904.2	2			2			3				2	2		2	
C904.3		3			2				2			2	3		
C904.4	3		2			2	3			2		3			3
C904.5	3		2			2	3			2		3			3
C904.6	3		2			2	3			2		3			3

22CS903	BUSINESS ANALYTICS	3/0/0/3
Nature of Course	G (Theory Analytics)	
Prerequisites	Random Variables and Statistics	

Course Objectives:

1	To provide the fundamentals of business analytics concepts and apply them in the projects
2	To create business insights using statistical analysis methods
3	To effectively define the objectives of business analytics projects and execute them
4	To provide insight on making data-driven business decisions

Course Outcomes:

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

C903.1	Discuss the importance of business analytics in the industry	[U]
C903.2	Develop and test hypotheses to assess the impact of changes on an entire population.	[AP]
C903.3	Predict data trends and detect outliers using R programming	[AP]
C903.4	Create data-driven dashboards using visualization techniques	[AP]
C903.5	Categorize the hidden patterns and correlations in large business data sets using data mining techniques.	[A]

Course Contents:

MODULE I Foundations of Business Analytics   **15 Hours**

Introduction to Business Analytics - Business Analytics for Competitive Advantage - Fundamentals of R Programming. **Statistical Analysis for Business Decision Making:** Probability Models- Descriptive Analytics – Sampling - Hypothesis Testing & Statistical Inference - Analysis of Variance – Monte Carlo Simulations - Business Applications and insights.

MODULE II Exploratory Data Analysis and Visualization using R   **15 Hours**

Introduction to Exploratory Data Analysis: Descriptive Statistics -Graphical Methods - Data Preparation - Building data Models - Model Evaluation - Cross-Validation -Data Cleaning and Data Handling - Generating insights through Data Visualization. **Case Study: Modeling of Spot market.**

MODULE III Predictive Analytics for Business   **15 Hours**

Correlation - Linear and non-linear regression - Logistic Regression -**Data Mining for Predictive Analytics**: Decision trees – Bayes Theorem - Bayesian network – Ensemble Learning. Time Series and forecasting - Text Analytics - Market Basket Analysis - Apriori algorithm**.**
Case Study: Customer churn prediction with Bayesian network classifiers, Predicting online channel acceptance with social network data, Predicting Demand for Food in Hospitals

	Total Hours:	**45**

Text Books:

1	R N. Prasad and Seema Acharya, "Fundamental of Business Analytics" Wiley India Pvt Ltd. 2016.
2	Bharti Motwani, "Data Analytics with R", Wiley,2020.
3	Thomas A. Runkler, "Data Analytics – Models and Algorithms for Intelligent Data Analysis", 2nd Edition, Springer Vieweg, 2016.

Reference Books:

1	Conrad G. Carlberg, "Business Analysis with Microsoft Excel and Power BI, 5th Edition" Pearson, 2020
2	U. Dinesh Kumar, "Business Analytics –The Science of Data-Driven Decision Making", Wiley

	India Pvt. Ltd, 2017.
Web References:	
1	https://in.coursera.org/specializations/business-analytics
2	https://www.udemy.com/courses/business/analytics-and-intelligence/
3	https://www.edx.org/learn/business-analytics
Online Resources:	
1	https://online.hbs.edu/courses/business-analytics/
2	http://www.dataminingapps.com/wp-content/uploads/2015/04/PhDThesis-Thomas-Verbraken.pdf
3.	https://www.upgrad.com/ba-business-analytics-course/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C903.1	Understand	Quiz	20
C903.2	Apply	Assignment	40
C903.3			
C903.4			
C903.5	Analyze	Case Study	20

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C903.1	3	3	2							2		2	3	1	
C903.2	2	2	2	2	2	2			2	2	2	2	3	2	2
C903.3	3	2	2	2	2	2			2	2	2	2	3	2	2
C903.4	3	3	3	2	2	2			2	2	2	2	3	3	2
C903.5	3	3	3	3	3	3			3	3	3	3	3	3	3
C903	**3**	**3**	**3**	**3**	**3**	**3**			**3**	**3**	**3**	**3**	**3**	**3**	**3**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22CS904	SOCIAL NETWORK MINING AND ANALYSIS	3/0/0/3
Nature of Course	G (Theory Analytical)	
Pre requisites	Database Management Systems	

Course Objectives:

1	To explore the concept of semantic web technologies.
2	To illustrate the knowledge representation using ontology.
3	To examine human behavior in social web and related communities.
4	To discuss visualization of social networks.

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

C904.1	Describe the concepts in semantic web and social network.	[U]
C904.2	Interpret knowledge representation using ontology.	[AP]
C904.3	Examine the methods used in community detection and mining	[A]
C904.4	Extract human behavior in social web and related communities.	[AP]
C904.5	Identify different social network representations	[A]

Course Contents

MODULE I: Modelling, Aggregating and Knowledge Representation   15 Hours
Introduction to Social Network Analysis and Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis – Electronic sources for network analysis. **Ontology and their role in the Semantic Web**: Ontology-based knowledge Representation - **Ontology languages for the Semantic Web**: Resource Description Framework - Web Ontology Language - **Modelling and aggregating social network data**: Ontological representation of social individuals and relationships - Aggregating and reasoning with social network data.

MODULE II Extraction, Mining Communities and Predicting Human Behaviour   15 Hours
Extracting Evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Methods for community detection and mining - Applications of community mining algorithms - Node Classification in Social Networks- Tools for detecting communities in social network.
Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons

MODULE III Visualization and Applications of Social Networks   15 Hours
Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks - **Visualizing social networks with matrix-based representations:** - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Covert networks - Community welfare - Collaboration networks - Co-Citation networks.

	Total Hours:	**45**

Text Books:

1.	Buni Balabantaray, Chiai Al Atroshi, Mohammad Gouse Galety, Sachi Nandan Mohanty, "Social Network Analysis Theory and Applications", Wiley 2022.
2.	Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2011.
3.	Newman, M.E.J, "Networks: An Introduction", 1st Edition, Oxford University Press. 2010.

Reference Books:		
1.	Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", 1st Edition Springer, 2012.	
2.	Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.	
3.	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling", IGI Global Snippet, 2009.	
4.	Tope Omitola, Sebastián A. Ríos, John G. Breslin, "Social Semantic Web mining", Springer, 2022.	
5.	Peter Mika, "Social Networks and the Semantic Web", 1st Edition, Springer 2007.	
Web References:		
1.	https://www.cl.cam.ac.uk/teaching/1415/L109/materials.html	
2.	https://www.youtube.com/watch?v=IiUDKDxScxI	
Online Video Resources:		
1.	https://nptel.ac.in/courses/106106169	
2.	https://www.coursera.org/learn/social-network-analysis	

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

Assessment based on Continuous and End Semester Examination

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C904.1	Understand	Quiz	20
C904.2	Apply	Assignment	40
C904.3			
C904.4			
C904.5	Analyze	Case Study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	30	30	30
Apply	50	20	50
Analyse	-	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**
C904.1	3	2	2									1	1		
C904.2	3	2	2									1	1		
C904.3	3	2	3	1	1							2	3	2	1
C904.4	2	2	3	2	2						1	2	3	3	2
C904.5	2	2	2	2	1						1	2	2	2	1

22IT911		**OPEN SOURCE SYSTEMS**	3/0/0/3
Nature of Course		F (Theory programming)	
Pre requisites		Nil	
Course Objectives:			
	1.	To study the evolution of the open source movement, and its technical and societal impact and to understand the differences between proprietary software and open source software.	
	2.	To understand the essential Linux Command line operations and to manage user services with file access.	
	3.	To learn PHP language fundamentals and to apply common web application techniques, such as form processing and data validation.	
	4.	To obtain a strong understanding of Ruby Language's fundamentals andfunctionality.	
	5.	To gain an understanding of programming using Perl.	
Course Outcomes			
Upon completion of the course, students shall have ability to			
C911.1	Summarize the theoretical foundation and practices associated with modern Free and open source software (FOSS) projects.		[U]
C911.2	Demonstrate the knowledge of the fundamental concepts of open source linux operating system.		[U]
C911.3	Apply the various options in PHP to develop solutions and will be able to integrate HTML controls, text fields, forms, radio buttons, and checkboxes.		[AP]
C911.4	Build efficient and simplified code by incorporating the object oriented tools in PHP, Perl, Ruby.		[AP]
C911.5	Code solutions using various concepts of Perl including data and variable types, Subroutines, File operations, String manipulation, Lists,etc.		[AP]
C911.6	Apply the techniques available in Ruby for text processing, numeric manipulations, and other input/output operations.		[AP]

Course Contents:

INTRODUCTION to FOSS and Linux   **15 Hours**
Introduction to Open sources - Need of Open Sources -Advantages of Open Sources FOSS-FOSS usage Free Software Movement, Commercial aspects of Open Source movementCertification courses issues global and Indian. Application of Open Sources. LINUX-Introduction - General Overview- Kernel mode and User mode process Scheduling - TimeAccounting- Personalities - Cloning and Backup your Linux System.

OSS for Web Development - PHP, Perl   **15 Hours**
Essential PHP, Operators and flow control, strings and arrays, Creating Functions, Working with Objects, Processing Web forms, Using PHP to access a database. PERL - Overview, Parsing Rules, Variables and Data, Statements and Control Structures, Subroutines, Object Oriented Programming, Working with Files, Data Manipulation.
Case Study: Eclipse and Netbeans.

Web Application Framework - Ruby   **15 Hours**
Ruby Fundamentals - Datatypes, Variables, Functions and Control flow, Data Structures, Classes, Models and Forms. Introduction to Ruby on rails. **Case Study:** Git and Github.

	Total Hours	**45**

Text Books:	
1.	Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", 6th Edition, OReilly Media, 2009.
2.	Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre, "Programming PHP", O'ReillyMedia, Inc., 3rd Edition, February 2013.
3.	Martin C. Brown, "Perl: The Complete Reference", McGraw Hill, 2nd Edition, 2001
4.	David Flanagan, Yukihiro Matsumoto, "The Ruby Programming Language", O'Reilly Media, Inc., 2008

Reference Books:	
1.	Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", WileyPublications, 2003.
2.	David Sklar "Learning PHP", O'Reilly Media, Inc., 2016.
3.	Andy Harris, "PHP 5 / MySQL Programming for the Absolute Beginner", CengageLearning PTR, 2004.

Web References:	
1.	http://ruby-for-beginners.rubymonstas.org/variables.html
2.	https://www.perl.org/books/beginning-perl/
3.	https://www.railstutorial.org/book

Online Resources:	
1.	https://www.coursera.org/learn/web-applications-php
2.	https://www.coursera.org/learn/introduction-git-github
3.	https://onlinecourses.swayam2.ac.in/aic20_sp31/preview

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C911.1	Remember	Quiz	20
C911.2	Understand	Assignment	20
C911.3, C911.4	Understand	Assignment	20
C911.5, C911.6	Apply	Coding Assessment	20

Assessment based on Summative and End Semester Examination			
Revised Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	50	30	20
Apply	40	60	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C911.1	2	3	2	-	-	3	-	3	2	1	-	2	1	1	2
C911.2	1	2	1	-	1	-	-	-	-	-	-	2	1	1	2
C911.3	2	3	2	-	3	-	-	-	-	-	-	-	2	3	3
C911.4	1	3	3	2	3	-	-	-	2	-	2	-	3	3	3
C911.5	2	3	3	2	3	-	-	-	2	-	2	2	3	3	3
C911.6	2	3	3	2	3	-	-	-	2	-	2	2	3	3	3

22AD901	APP DEVELOPMENT	0/0/6/3
Nature of Course	F (Theory Programming)	
Pre-Requisite	Cloud Computing	

Course Objectives:		
1	To discuss the essence of front-end development skills.	
2	To impart the knowledge of React components used in Spring boot development platforms.	
3	Ability to understand and use Setup Cloud API.	
4	To deploy and test the React App used in Spring Boot.	
5	To learn the Spring Cloud concepts using Docker.	

Course Outcomes:

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

C901.1	Identify the basic concepts and design issues of React.	[R]
C901.2	Understand the principles of process and Spring boot.	[U]
C901.3	Illustrate the approaches in scheduling and Spring Cloud to apply in real world problems.	[AP]
C901.4	Apply concepts of Micro services Communication to the issues that occur in Real time applications.	[AP]
C901.5	Identify issues related to Docker, API Gateway.	[AP]
C901.6	Examine common React, Availability and Scalability.	[A]

Course Contents:

MODULE 1 REACT INTRODUCTION   **15 Hours**

Components, Routes, State, Props, hooks, Higher Order Functions, Axios and Services, Ant Design. **Redux:** Core Concept, Data Flow, Store, Actions, Pure function, Reducers, Devtools, Middleware, Webpack, Redux Integration. **Spring boot: Annotations**, Beans, Configuration, HTTP Methods, Crud, Postman Overview. Spring Security: Authentication, Authorization, Security Implementation. Configure Security, Authentication Manager, HTTP Security, Circular Reference Error.JWT Implementation: JWT Overview, JWT Libraries, Helper Methods, Token Generation and Validation, Implementing JWT Authorization, Filter. **OAUTH Implementation** : Introduction, Sample flow, Authorization code grant type flow,Implicit grant flow,Password Grant Type flow, Client, Credential Grand type flow, Refresh token Grand type flow,Validating token,Oauth2 integration with Spring Security. **Building Micro services :** Monolith Architecture   and   Challenges   of   Monolith   Architecture, What is Micro services & How It Solves the Challenges of Monolith Architecture, Micro services Architecture Benefits and Best Practices, Understanding Spring Cloud and It's Important Modules, Micro service Applications and It's Port Mapping

MODULE II   MICROSERVISES COMMUNICATION OVERVIEW   **15 Hours**
Micro services Communication using Rest Template, Micro services Communication using Web Client, Micro services Communication using Spring Cloud Open Feign - Understanding service Registry – Spring Cloud Netflix Eureka Server Implementation, Update on Using Spring Boot 3 Version, Register Micro service as Eureka Client, Update on using Spring Boot 3 Version, Register Micro service as Eureka Client, Running Multiple Instances of Micro service, Load Balancing with Eureka, Open Feign and Spring Cloud Load Balancer API gateway using Spring Cloud gateway: Understanding API Gateway - Create and Set up API Gateway Micro service, Update on Using Spring Boot 3 Version, Register API-Gateway as Eureka Client to Eureka Server, Configuring API Gateway Routes and Test using Postman Client, Using Spring Cloud Gateway to Automatically Create Rout.

MODULE 3 CENTRALIZED CONFIGURATIONS USING SPRING CLOUD CONFIG SERVER 15 Hours

How to Use Spring Cloud Config Server, Create and Setup Spring Cloud Config Server Project in IntelliJ IDEA, Update on Using Spring Boot 3 Version, Register Config-Server as Eureka Client, Set up Git

Location for Config Server, Refactor Department-Service to use Config Server, Refactor Employee-Service to use Config Server, Refresh Use case - No Restart Required After Config Changes,REACT Frontend Micro service: Create React App using Create React App Tool, Adding Bootstrap in React Using NPM, Write HTTP Client Code to Connect React App with API-Gateway (REST API Call), Create a React Component and Integrate with API Gateway Microservice, RabbitMQ Core Concepts: RabbitMQ Architecture, Install and Setup RabbitMQ using Docker, Explore RabbitMQ using RabbitMQ Management UI, Create and Setup Spring Boot 3 Project in IntelliJ, Connection Between Spring Boot and RabbitMQ, Configure RabbitMQ in Spring Boot Application, Create RabbitMQ Producer, Create REST API to Send Message, Create RabbitMQ Consumer, Configure RabbitMQ for JSON Message Communication, Create RabbitMQ Producer to Produce JSON Message, Create REST API to Send JSON Object, Create RabbitMQ Consumer to Consume JSON Message, Dockering Spriing boot App : Install Docker Desktop, General Docker Workflow, Create Spring Boot Project and Build Simple REST API, Create Docker file to Build Docker Image, Build Docker Image from Dockerfile, Run Docker Image in a Docker Container, Push Docker Image to Docker Hub, Pulll Docker Image from DockerHub

	Total Hours:	**45**

Text Books:

1	Merih Taze,"Engineers Survival Guide: Advice, tactics, and tricks After a decade of working at Facebook, Snapchat", Microsoft Paperback, 2021.
2	Gerardus Blokdyk, "Secure Microservices A Complete Guide", Edition Paperback, 2021.
3	Theo H King, "Aws: The Ultimate Guide from Beginners to Advanced For the Amazon Web Services", (2020 Edition), Paperback – Import, 2019.

Reference Books:

1	Craig zacker, "Exam ref pl-900 Microsoft power platform", paperback, 2021

Web References:

1	https://awscloud.in/

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

Assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	-	-	-
Understand	20	20	20
Apply	40	40	40
Analyse	40	40	40
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
C901.1	3	3	3	2	3	2						2	2	2	2
C901.2	3	3	3	2	3	2						2	2	2	2
C901.3	3	3	3	3	3	2						2	2	2	2
C901.4	3	3	3	2	3	2						2	2	3	3
C901.5	3	3	3	3	3	3						3	3	2	2
C901.6	3	3	3	2	3	2						2	2	3	3

22IT912	ADVANCED APPLICATION DEVELOPMENT	0/0/6/3
Nature of Course	M (Practical Application)	
Pre-Requisite	App Development	

Course Objectives:

1.	To discuss the essence of front-end development skills in real world applications
2.	To impart the knowledge of creating backend business logics for business scenarios
3.	To integrate frontend and backend applications with security features
4.	Ability to understand and use Setup Cloud API, Docker services, etc

Course Outcomes

Upon completion of the course, students shall have ability to

C912.1	Apply the basic concepts and design Front End for real world applications	[AP]
C912.2	Apply the basic concepts and implement Backend business logic for real world applications	[AP]
C912.3	Illustrate the security related features and apply security concepts in real world business applications	[U]
C912.4	Illustrate the process of Integrating front end and back-end application and deploy them in Cloud	[U]
C912.5	Apply EC2 instances, configuring networking, and deploying Dockerized applications and also apply insights into DevOps practices related to continuous integration and deployment	[AP]
C912.6	Demonstrate the ability to create private routes, manage user sessions, and integrate various features like user profiles, job applications, and skills panels.	[AP]

Course Contents:

MODULE I Front End   **15 Hours**
Setting up React Project Environment using Vite Template, Folder Structure, and GitHub.Setting up React Project Environment using Vite Template, Folder Structure, and GitHub.Design and Component Analysis, along with the Frontend Module Report. Implement the preloader concept using React's <Suspense>Design the side bar and top bar components for the admin and user panels using TailwindCSS. Designing unprotected routes for the front landing page, search, login, register, terms and conditions, privacy, 404 policies, and contact. Designing the Navbar and Footer, as well components for job listings (Landing page design), and Login & Register. Designing components for tracking applied jobs and job history. Designing components for editing phone number, email, and password. Designing a Skills Panel for adding and editing skills related to education, certifications, experience, Git links, etc. Designing components for a Premium Job Suggestions panel, Payment, and Membership & Subscriptions. Designing components for User Listing (Premium/Normal) & Applicants Listing, as well as History Tables. Create User CRUD (Create, Read, Update, Delete) Components. Designing components for Jobs Listing and History Tables based on job listing type (Premium/Normal). Create Job CRUD (Create, Read, Update, Delete) Components. Designing CRUD components for Membership Plans.Designing components for Admin Profile & Password, Payment Methods, and Site Settings.

MODULE II Back End   **15 Hours**
Planning and setting up required modules, workspace, and an online PostgreSQL database (SQL DB). Planning the database schema based on requirements. Implementing User & Admin, Jobs, and Membership models along with their relationship definitions. Implementing Roles (User & Admin), Request & Response DTOs for all models, and Auth DTO. Setting up HTTP filters, session policies, CORS, and CSRF configurations. Configuring JWT Filter Chain and JWT Token (Secret, Expiry, Token Body) configurations. Implementing services for all models, including business logic, data validation, and interaction with the database. Implementing CRUD controllers and authentication controllers with endpoint security based on role-based access control. Setting up Swagger Tags for all Endpoints

MODULE III Integration and Deployment   **15 Hours**
Writing API services with Axios in React. Implementing private routes using React Router or another routing library. Storing user data in Local Storage and managing session tokens in Session Storage. Integrating job listing components into the landing page with the assistance of Redux & Redux Toolkit. Integrating Login &

Register, managing User Sessions using Session Tokens Integrating Profile & Membership Integrating Job Application Integrating Skills component Integrating Admin Authentication, managing Admin Sessions using Session Tokens Integrating User Components Integrating Jobs Components Integrating Membership Components Integrating Admin Profile Integrating payment gateways like Razor pay and CCAvenue in the Admin Panel. Creating a network security group and setting inbound and outbound rules Setting up an EC2 instance with either an AMI or Ubuntu micro instance. Installing and configuring Docker inside the EC2 instance. Adding PostgreSQL drivers in the POM file and updating local database properties to Neon credentials. Setting up a Dockerfile containing Java version and Spring Boot version configurations for the backend. Building the Docker image inside the EC2 instance using the Dockerfile and starting the backend container with the Dockerfile. Setting up a Dockerfile containing Node.js version and Nginx version configurations for the frontend. Building the Docker image inside the EC2 instance using the Dockerfile and starting the frontend container with the Dockerfile.

Total Hours	**45**

Text Books:	
1	Merih Taze, "Engineers Survival Guide: Advice, tactics, and tricks After a decade of workingat Facebook, Snapchat", Microsoft Paperback, 2021.
2	Nigel Poulton, "Docker Deep Dive: Zero to Docker in a Single Book" - 2023 Edition (Full Colour Print), 2023
3	Theo H King, "Aws: The Ultimate Guide from Beginners to Advanced For the Amazon WebServices", (2020 Edition), Paperback – Import, 2019.

Reference Books:	
1	Craig zacker, "Exam ref pl-900 Microsoft power platform", paperback, 2021

Web References:	
1.	https://awscloud.in/
2.	https://jwt.io/introduction/
3.	https://spring.io/guides
4.	https://redux.js.org/
5.	https://www.postgresql.org/docs/

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

Assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	-	-	-
Understand	40	40	40
Apply	60	60	60
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
C912.1	3	3	3	3	3	2		2	2	2	2	2	3	3	3
C912.2	3	3	3	3	3	2		2	2	2	2	2	2	2	3
C912.3	3	3	3	3	3	2		2	2	2	2	2	3	3	3
C912.4	3	3	3	3	3	2		2	2	2	2	2	2	3	3
C912.5	3	3	3	3	3	2		2	2	2	2	2	3	2	3
C912.6	3	3	3	3	3	2		2	2	2	2	2	3	2	3

22CS911	API DEVELOPMENT USING MVC ARCHITECTURE	3/0/0/3
Nature of Course	C (Theory Concepts)	
Prerequisite	Web Technology	

Course Objectives:

1.	To identify entities and attributes and draw schema diagram.
2.	To illustrate how to configure the application in spring boot framework.
3.	To work with REST controller and API.
4.	To create repository and apply CRUD operations in it.

Course Outcomes:

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

C911.1	Identify the entities and attributes in ER design and discover the relationship among them and interpret a schema diagram using MYSQL workbench.	[U]
C911.2	Construct a SpringBoot application using VSCode.	[AP]
C911.3	Apply REST API methods to administer business entity services.	[AP]
C911.4	Apply the concept of CRUD operations with Repository.	[AP]
C911.5	Create Data Repositories using JPA and SonarCloud	[AP]

Course Contents:

Module I: Problem identification and MVC Design patterns   **15 Hours**
Use Case definition – Requirements Analysis – ER Design – Entities -attributes definition – Mapping entities with cardinality – One to One – One to many – Many to one – Many to Many relationship – designing a Schema using MySQL workbench.

Module II: Rest API – CRUD operations   **15 Hours**
SpringBoot and its architecture – Spring Boot CLI -Maven Introduction-Setting up Spring Boot development Environment using VSCode-Creating a Spring Boot project – Starting a spring Boot Application -Spring Boot Startup Steps – Adding a REST Controller – Returning objects from the controller -Spring MVC Introduction – REST API – POST, PATCH, PUT, DELETE-UPDATE Creating a Business service -Difference between PATCH and PUT with best practices.

Module III: Spring JPA and Security   **15 Hours**
Adding JPA to Spring Boot application – Creating a Spring Data JPA repository – Making CRUD operations with Repository – Adding APIs with the repository -ORM application properties- Adding Entity Relationship and Extending Repository-Understanding JSON JDBC Authentication. Creating GitHub repository and maintain source code of the application – Sonar cloud integration for code Quality Analysis.

	Total Hours:	**45**

Text Books:

1.	Richard Walsh Bagui, Sikha Saha , " Database Design Using Entity-Relationship Diagrams (Foundations of Database Design) ", Kindle Edition 2022.
2.	Sourabh Sharma, "Modern API Development with Spring and Spring Boot: Design Highly Scalable and Maintainable APIs with REST, GRPC, GraphQL, and the Reactive Paradigm", Kindle Edition 2021.

Reference Books:

1.	Elmasri Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2021.
2.	Craig Walls, "Spring in Action" , 6th Edition, Manning Publication, 2022.

Web References:

1.	https://www.simplilearn.com/java-full-stack-developer-certification-training-course
2.	https://www.udemy.com/course/spring-web-services-tutorial

Online Resources:

1.	https://docs.spring.io/spring-ws/site/reference/pdf/spring-ws-reference.pdf

2. https://www.springbyexample.org/pdf/SpringByExample.pdf

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C911.1	Apply	Quiz	20
C911.2			
C911.3	Apply	Assignment	20
C911.4	Create	Case Study	40
C911.5			

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C911.1	2	3	2	-	-	-	-	-	-	-	-	2	1	1	2
C911.2	3	2	1	-	1	-	-	-	-	-	-	2	1	1	2
C911.3	2	3	2	-	3	-	-	-	-	-	-	-	2	3	3
C911.4	3	3	3	2	3	-	-	-	2	-	2	-	3	3	3
C911.5	2	3	3	2	3	-	-	-	2	-	2	2	3	3	3
C911	3	3	3	2	3	3	-	-	2	-	2	2	3	3	3

	3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22CS912	SOFTWARE PROJECT MANAGEMENT	3/0/0/3
Nature of Course:	D (Theory Applications)	
Prerequisites:	Application Development Practices	

Course Objectives:

1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and project schedule.
4. To analyze risk management and cost schedules.

Course Outcomes:

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

C912.1	Identify project management concepts and techniques to develop a project	[U]
C912.2	Interpret evaluation techniques and project planning.	[U]
C912.3	Illustrate project life cycle process models and effort estimation.	[AP]
C912.4	Apply project management concepts through activity planning.	[AP]
C912.5	Predict the different risk identification methods and cost schedules.	[A]

Course Contents:

MODULE I PROJECT EVALUATION AND PROJECT PLANNING   **15 Hours**

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project Portfolio Management – Cost-Benefit Evaluation Technology – Risk evaluation – Strategic Program Management – Stepwise Project Planning.

MODULE II PROJECT LIFE CYCLE AND EFFORT ESTIMATION   **15 Hours**

Phases of the Project Management Lifecycle -Personal Software Process (PSP) - Team Software Process (TSP) - Choice of Process Models - Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing Interactive Processes – Estimation — LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model.

MODULE III ACTIVITY PLANNING AND RISK MANAGEMENT   **15 Hours**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical Path (CPM) Method – Risk identification – Assessment – Monitoring – PERT Technique – Monte Carlo simulation – Resource Allocation – Creation of Critical Patterns – Cost Schedules.

	Total Hours:	**45**

Text Books:

1	Harshad Acharya, "New Age Software project Management: Navigating the Technological revolution" **,** Adhyyan Books, 2023
2	Bruce R. Maxim, Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, 8th Edition, 2019.
3	Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management, 6th Edition, Tata McGraw Hill, New Delhi, 2018.

Reference Books:

1	Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.
2	Roger. S. Pressman "Software Engineering: A Practitioner's approach" – TMH, 2010.
3	Applied software project management Stellman & Greene SPD - O'Reilly Media, Inc 2005
4	Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education

5	(India), Fourteenth Reprint 2013.
	Prof. Vishwajit K. Barbudhe, Software Project Management, Notion Press- 1st Edition, 2020.

Web References:

1	https://www.javatpoint.com/software-project-management
2	https://www.geeksforgeeks.org/software-engineering-software-project-management-spm/
3	https://www.tutorialspoint.com/software_engineering/software_project_management.htm

Online Resources:

1	https://www.coursera.org/courses?query=software%20project%20management
2	https://www.udemy.com/course/software-project-management-the-complete-course/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C912.1	Understand	Quiz	20
C912.2	Apply	Assignment	20
C912.3			
C912.4	Apply	Assignment	40
C912.5			

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C912.1	3	2	2	-	-	1	2	2	2	2	2	3	3	2	3
C912.2	3	2	2	-	-	2	2	2	2	2	2	2	3	2	2
C912.3	3	2	2	2	-	2	2	2	2	2	2	2	3	2	2
C912.4	3	2	2	-	-	2	2	2	2	2	2	3	3	2	3
C912.5	3	2	2	2	-	2	2	2	2	2	2	3	3	2	3
C912	**3**	**2**	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**

22CS913	DESIGN OF SOFTWARE AGENTS	3/0/0/3

Nature of Course	G (Theory Concept)
Prerequisites	Nil

Course Objectives:

1.	To introduce the concept of agents and their design.
2.	To explain about different types of agents and agent-oriented programming.
3.	To observe the communication language of agent and their role in information sharing.
4.	To explore Security Challenges in Agent Systems.

Course Outcomes

Upon completion of the course, students shall have ability to

C913.1	Illustrate the concepts of software agents.	[U]
C913.2	Explain the architecture models for designing software agents.	[U]
C913.3	Discover the approaches for building software agents.	[U]
C913.4	Construct agents using agent-oriented programming for the societal benefits.	[AP]
C913.5	Infer the significance of information-gathering agents in various domains and Agent Security issues.	[A]

Course Contents:

MODULE I Introduction to Software Agents   **15 Hours**

Introduction, Incorporating Agents as Resource Managers, Overcoming user Interface Problems, Toward Agent-Enabled System Architectures. Interfaces Agents Metaphors with Character.

Designing Agents: Adaptive Functionality: Three Design Issues, The Agent Metaphor, Direct Manipulation versus Agents, Agents for Information Sharing and Coordination, Semiformal Systems and Radical Tailorability, An Addendum: The Relationship between Oval and Objects Lens

MODULE II Building Software Agents and Agent-Oriented Programming   **15 Hours**

Approaches to Building Agents, Training a Personal Digital Assistant, Software Agents for Cooperative Learning, Developing an Agent.

Agent-Oriented Programming: Overview, AGENT-0: A Simple Language and its Interpreter, KQML as an Agent Communication Language: The approach of knowledge sharing effort (KSE), The Solution of the knowledge sharing efforts, knowledge Query Manipulation Language (KQML) - Implementation and Application, Other Communication Language, The Approach of Knowledge-Sharing Effect (KSE), The Solutions of the Sharing Effect.

Case Study: Utilizing KSE and KQML for Efficient Communication in Smart Manufacturing.

MODULE III Information Gathering Agents & Agent Security   **15 Hours**

Agent Organization, The Knowledge of an Agent, The Domain Model of an Agent, Modeling other Agent, communication language and protocol, query processing, Mobile Agents: Enabling Mobile Agents, Programming Mobile Agents, Using Mobile Agents.

Agent Security: Issues, mobile agents security, protecting agents against malicious hosts, untrusted agent, black box security, authentication for agents, security issues for aglets.

Case Study: Software Agent Security in Self-Driving Cars.

	Total Hours:	**45**

Text Books:	
1.	Jeffrey M. Bradshaw, "Software Agents", PHI (MIT Press) 2012.
2.	Bart Willem Schermer, "Software Agents, Surveillance, and the Right to Privacy: A Legislative Framework for Agent-enabled Surveillance", Leiden University Press, 2007.
Reference Books:	
1.	G. Jezic, J. Chen-Burger, Lakhmi C. Jain, M. Kusek, R. J. Howlett, R. Sperka, "Agents and Multi-Agent Systems: Technologies and Applications", Springer Nature, 2022.
2.	Brenner, Walter; Zarnekow, Rüdiger; Wittig, Hartmut, "Intelligent Software Agents: Foundations and Applications", Springer, 2011.
3.	Steven F. Rails Back and Volker Grimm, "Agent-Based and Individual Based modeling: A Practical Introduction" Princeton University Press, 2012.
4.	Alex Hayzelden, John Bigham, "Software Agents for Future Communication Systems", Springer, 2012.
5.	Lin Padgham and Michael Winikoff, "Developing Intelligent Agent Systems: A Practical Guide", John Wiley & sons Publication, 2004.
6.	Bigus & Bigus, "Constructing Intelligent Agents Using JAVA", Wiley, 2001.
7.	Richard Murch, Tony Johnson, "Intelligent Software Agents", Prentice Hall, 2000.
Web References:	
1.	https://www.sciencedirect.com/science/article/abs/pii/B9780128003411000012
2.	https://www.media.mit.edu/groups/software-agents/overview/
3.	https://www.sciencedirect.com/topics/computer-science/software-agent
4.	https://ieeexplore.ieee.org/document/612220
Online Resources:	
1.	https://www.coursera.org/learn/ccai-virtual-agent-development-in-dialogflow-cx-for-software-developers
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01329501348520755242295_shared/overview

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C913.1 & 2	Understand	Quiz	20
C913.3 & 4	Understand & Apply	Assignment	20
C913.5	Analyze	Case Study	40

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	20
Understand	50	40	40
Apply	30	30	30
Analyse	-	10	10
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
C913.1	3	3										2	3	1	1
C913.2	3	3	3									2	3	2	2
C913.3	3	3	3		3			2	2	2		2	3	2	2
C913.4	3	3	3		3			2	2	2	2	2	3	3	2
C913.5	3	3	3		3	2		2	2	2	2	2	3	3	2
C913	**3**	**3**	**3**		**3**	**2**		**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**

	3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed	

22IT921	CLOUD SERVICES AND INTEGRATION	3/0/0/3

Nature of Course	F (Theory Programming)	
Prerequisites:	Operating Systems	

Course Objectives:

1	To understand the evolution of AWS from the existing technologies.
2	To practice PuttyGen Environment Setup and Configuration.
3	To team the necessary skills for design, develop and deploy services in core cloud services.
4	To learn basic and advanced linux commands.
5	To provide the perfect security for the entire infrastructure.

Course Outcomes:

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

C921.1	Illustrate cloud benefits using Amazon Web Services.	[U]
C921.2	Deploy applications using PuttyGen Environment set up.	[AP]
C921.3	Identify an appropriate solution using AWS Cloud services for various use cases.	[AP]
C921.4	Explain the concept of Virtual Network Configuration , IAM , load balancing and scaling.	[AP]
C921.5	Practice basic and advanced Linux commands and Interpret the network security concepts in NAT,VPC and Routing policies.	[AP]

Course Contents:

Module I: Introduction to Cloud and Application deployment   **15 Hours**

Use case definition and application design-Introduction to cloud –Benefits of Cloud- Environmental Setup - Amazon Web services Overview – creating an AWS free account – AWS free tier features – AWS Management Console – Accessing AWS Management console -Regions and Availability Zones -AWS support-Application deployment-WinSCP – Putty-PuttyGen-ppk – pem -Application Environment Setup – nginx/httpd -web server configuration.

Module II: Core cloud service   **15 Hours**

Elastic Compute Cloud (EC2) Service - EC2 Instance life cycle hooks - Amazon Elastic Block Store (Amazon EBS) : Features - data services -optimized instances - Amazon Cloud Watch metrics for Amazon EBS - Event Bridge for Amazon EBS. Supply Chain Management (SCM) **-** Functions of Supply Chain Management - Elements - Model Types - Instance of SCM. Introduction to Simple Storage Service – Static web site hosting.

Module III: Linux basics and Network Security   **15 Hours**

Virtual Network Configuration/Setup - Identity and Access Management - load balancing - scaling - Linux basics and advanced commands -grep commands-NAT Instance – NAT Gateway- Virtual private Cloud (VPC) - VPC Peering and VPC End Points - VPC Flow Logs-Security Groups-Cloud Front-Registering a domain-Weighted Routing Policy-Latent Routing policy -Application integration and setup SSM parameter.

	Total Hours:	**45**

Text Books:

1	Mark Wilkins,"Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud", 1st Kindle Edition,2019.

2	Andrew Mallett Mokhtar Ebrahim ,"Mastering Linux Shell Scripting - Second Edition: A practical guide to Linux command-line, Bash scripting, and Shell programming", 2nd Edition Paperback ,2018.
Reference Books:	
1	John Culkin, Mike Zazon ,"AWS Cookbook: Recipes for Success on AWS ",1st Edition 2022.
2	Daniel J. Barrett,"Linux Pocket Guide", O'Reilly Media, 3rd edition.2016.
Web References:	
1	https://www.cloudflare.com/learning/cloud/what-is-a-virtual-private-cloud/
2	https://docs.aws.amazon.com/whitepapers/latest/aws-overview/introduction.html
3	https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/AmazonEBS.html

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C921.1	Apply	Quiz	20
C921.2	Understand	Tutorial	20
C921.3	Apply	Presentation	20
C921.4	Analyze		
C921.5	Apply	Case Study	20

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C921.1	2	1	3	3	3	2						3	2	3	3
C921.2	1	2	3	3	3	2		2			2	3	2	3	3
C921.3	2	2	3	3	2	2		2			2	3	2	3	3
C921.4	2	1	3	3		2						3	2	3	3
C921.5	2	1	2	3	2	2		2				3	2	3	3
C921	**2**	**2**	**3**	**3**	**3**	**2**		**2**			**2**	**3**	**2**	**3**	**3**

	3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed	

22IT922	DATA WAREHOUSING AND DATA MINING	3/0/0/3

Nature of Course	D (Theory Application)
Pre requisites	Nil

Course Objectives:

1.	To learn the fundamentals of data warehousing and mining.
2.	To acquire knowledge in data pre-processing and association rule mining.
3.	To perform data classification and clustering.
4.	To gain knowledge about the emerging trends in data mining.
5.	To perform classification and prediction of data.

Course Outcomes

Upon completion of the course, students shall have ability to

C922.1	Understand basics of data warehousing and mining.	[U]
C922.2	Perform data pre-processing.	[AP]
C922.3	Apply association, classification and clustering methods.	[AP]
C922.4	Compare between classification and clustering solutions.	[AP]
C922.5	Analyze data mining techniques for real world problems.	[A]
C922.6	Apply association rule mining techniques for data analysis.	[AP]

Course Contents:

Data Warehousing and Online Analytical Processing: **15 Hours**
Basic Concepts, Warehouse Modeling, Schemas, Data cube, Multidimensional data model, Concept hierarchy, Dimension, Measures, OLAP operations, Starnet query model, Data warehouse design process, Data cube computation, OLAP Indexing, OLAP server architectures, OLAP and OLTP.

Introduction to Data Mining: **15 Hours**
Describe data mining, Related technologies - Machine Learning, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, and Applications. **Data preprocessing**: Experiments with H2O and Orange tools. **Data mining knowledge representation**: Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques. **Attribute-oriented analysis**: Attribute generalization, Attribute relevance, Class comparison, Statistical measures.

Data Mining Algorithms: **15 Hours**
Association rule mining: Apriori, FP Growth algorithms. Classification: Inferring rudimentary rules: 1R algorithm, Decision trees, covering rules. Prediction: The prediction task, Bayesian classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models. Descriptive analytics: Data Modeling, Trend Analysis, Simple Linear Regression Analysis. Clustering: Partitioning methods and Hierarchical methods.

	Total Hours	**45**

Text Books:

1.	Jiawei Han, Jian Pei and Hanghang Tong, "Data Mining Concepts and Techniques", 4th Edition, Elsevier, 2022
2.	Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, "Introduction to Data Mining", 2nd Edition, Pearson Education, 2021.

Reference Books:	
1.	M. Kantardzic, "Data Mining: Concepts, Models, Methods, and Algorithms", 3rd Edition, Wiley-IEEE Press, 2019.
2.	Alex Berson, Stephen J Smith, "Data Warehousing, Data Mining, & OLAP", Tata McGraw-Hill Education, 2017.
3.	K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2014.
4.	Colleen McCue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Butterworth-Heinemann, 2007.
Web References:	
1.	https://www.kdnuggets.com/
2.	https://www.datasciencecentral.com/
3.	https://ocw.mit.edu/courses/sloan-school-of-management/15-062-data-mining-spring-2003/lecture-notes/
Online Resources:	
1.	https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2.	https://www.edx.org/course/data-science-wrangling-2
3.	https://www.coursera.org/specializations/data-mining

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C922.1	Understand	Online Quiz	20
C922.2, C922.3	Apply	Presentation	20
C922.4, C922.6	Apply	Assignment	20
C922.5	Analyze	Case Study	20

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

Apply	30	30	30
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C922.1	2	3	1		1								1	2	2
C922.2	1	2	2		2	2							2	1	1
C922.3	3	3	3	3	3	1							3	3	1
C922.4	1	1	2		1								1	1	1
C922.5	2	1	2	2	1	3							2	1	2
C922.6	1	2	2	3	3	3							2	2	3

22CS921	SOFTWARE DEFINED NETWORKS	3/0/0/3
Nature of Course	D (Theory Application)	
Pre requisites	Computer Networks, Data Communication and Computer Networks	

Course Objectives:

1.	To outline the fundamentals of software defined networks.
2.	To identify the separation of the data center and controller of SDN.
3.	To examine the SDN Programming.
4.	To demonstrate the various applications using SDN Framework.
5.	To gain knowledge about the languages and tools used for SDN.

Course Outcomes:

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

C921.1	Analyze the evolution of software defined networks.	[AP]
C921.2	Illustrate the various components of SDN data center networks.	[U]
C921.3	Design and develop various applications using SDN programming.	[AP]
C921.4	Construct the knowledge about various controllers of SDN.	[AP]
C921.5	Analyze real time networks using Virtual Programming Tools and SDN Frameworks.	[A]

Course Contents:

MODULE I Introduction 15 Hours

History of Software Defined Networking (SDN) - Modern Data Center - Traditional Switch Architecture-Why SDN - Evolution of SDN - How SDN Works - Centralized and Distributed Control and Date Planes-Open Flow Specification - Drawbacks of Open SDN - SDN via APIs - SDN via Hypervisor- Based Overlays - SDN via Opening up the Device - SDN Controllers - General Concepts.

MODULE II Data Center and Programming 15 Hours

Multitenant and Virtualized Multitenant Data Center - SDN Solutions for the Data Center Network - VLANs - EVPN - VxLAN - NVGRE - **Programming SDNs:** Northbound Application Programming Interface - Current Languages and Tools - Composition of SDNs.

MODULE III Applications 15 Hours

Implementation and Applications-Juniper SDN Framework - IETF SDN Framework - Open Daylight Controller - Floodlight Controller - Bandwidth Calendaring - Data Center Orchestration. **Case Study:** Performance of an OpenFlow Controller using Mininet.

	Total Hours:	45

Text Books:

1.	Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, 2nd Edition, Morgan Kaufmann, 2016.
2.	William Stallings, Foundations of Modern Networkingǁ, Pearson Ltd., 2016.
3.	Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013.

Reference Books:

1.	Siamak Azodolmolky, Software Defined Networking with Open Flow, Packet Publishing, 2013.
2.	Vivek Tiwari, "SDN and OpenFlow for Beginners", Amazon Digital Services, Inc., ASIN: 2013.
3.	Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

Web References:	
1.	https://cse.iitkgp.ac.in/~smisra/theme_pages/sdn/index.html
2.	http://www.openflow.org, 2015.
3.	https://www.cs.fsu.edu/~xyuan/cis5930/
Online Resources:	
1.	https://www.coursera.org/learn/sdn
2.	https://www.edx.org/course/introduction-to-software-defined-networking

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C921.1	Apply	Quiz	20
C921.2			
C921.3	Apply	Assignment	20
C921.4		Case Study	40
C921.5	Create		

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C921.1	3	3	3	2	1							1	3	2	1
C921.2	3	3	3	2	1							1	3	2	1
C921.3	3	3	3	2	1							1	3	2	1
C921.4	3	3	3	2	1							1	3	2	1
C921.5	3	3	3	2	1							1	3	2	1
C921	**3**	**3**	**3**	**2**	**1**							**1**	**3**	**2**	**1**
	3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed							

22CY935	SECURITY AND PRIVACY IN CLOUD	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Nil	

Course Objectives:

1.	To give an outline on the components of cloud
2.	To understand the types of security in cloud
3.	To understand the various privacy issues in cloud

Course Outcomes

C935.1	Understand the basic components of cloud & Security in the cloud .	[U]
C935.2	Illustrate the Infrastructure Security and Data Security in cloud	[U]
C935.3	Understand the concepts of Identity and Access Management	[U]
C935.4	Identify the storage and security management in the cloud.	[AN]
C935.5	Illustrate the privacy issues in could environment	[AP]

Course Contents:

MODULE 1 Introduction to cloud and Infrastructure security   **15 Hours**

What Is Cloud Computing: Cloud Computing Defined, The SPI Framework for Cloud Computing, Relevant Technologies in Cloud Computing, The Traditional Software Model,The Cloud Services Delivery Model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise. Infrastructure Security: Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level

MODULE 2   Data Security and Access Management   **15 Hours**

Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security Trust Boundaries and IAM, Why IAM?,IAM Challenges, IAM Definitions, IAM Architecture and Practice, Getting Ready for the Cloud, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice

MODULE 3 Security Management and Privacy Issues in the Cloud   **15 Hours**

Security Management Standards, Security Management in the Cloud Availability Management, SaaS Availability Management PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management. What Is Privacy, What Is the Data Life Cycle, What Are the Key Privacy Concerns in the Cloud, Who Is Responsible for Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing. Laws and Regulations

	Total Hours	**45**

Text Books:

1.	Tim Mather, Subra Kumara swamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1st Edition, 2009

Reference Books:

1.	Ronald L. Krutz, Russell Dean Vines, "Cloud Security", 2010.
2.	John Ritting house, James Ransome, "Cloud Computing" CRC Press; 1st Edition, 2009.

Web References:

1.	https://cloud.google.com/learn/what-is-cloud-data-security
2.	https://www.flexential.com/resources/blog/cloud-data-privacy

Online Resources:

1.	https://www.coursera.org/courses?query=cloud%20security

2.	https://iisecurity.in/courses/cloud-computing-security-course

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C935.1	Remember	Assignment	20
C935.2	Analyze	Case Study	20
C935.3	Analyze	Assignment	20
C935.5	Apply	Quiz	20

Assessment based on Summative and End Semester Examination

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

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C935.1	2	1	1	2	1	2	2	2	2	2	2	1	2	2	3
C935.2	1	1	1	2	2	1	2	1	3	2	2	3	1	2	2
C935.3	1	1	2	2	1	2	1	2	3	1	1	1	2	3	2
C935.4	2	1	1	1	2	1	2	1	2	2	2	2	3	1	1
C935.5	1	1	2	1	3	1	1	2	1	3	1	2	1	2	1

22IT931	**CYBER THREATS AND VULNERABILITIES**	**3/0/0/3**

Nature of Course:	F (Theory Programming)
Pre requisites:	Cryptography and Networks Security

Course Objectives:

1	To express the concepts of cyber security and the importance of cyber intelligence.
2	To illustrate the common Cyber threats.
3	To practice the concepts of applying various tools in cyber security
4	To describe the process of the encryption and vulnerability tools
5	To identify the network exploration and web vulnerabilities.

Course Outcomes

Upon completion of the course, students shall have ability to

C931.1	Explain the fundamentals of Cyber security and understand the importance of Cyber Intelligence.	[U]
C931.2	Identify the malware, ransomware attacks and the key elements of the cyber threats.	[U]
C931.3	Categorize the tools of cyber security.	[AN]
C931.4	Illustrate role of encryption tools and web vulnerability scanning tools.	[AP]
C931.5	Articulate the Concept of network exploration and web vulnerabilities.	[AP]

Course Contents:

MODULE I Application of Cyber Security   **15 Hours**

Introduction to Cyber security: Overview of Cyber security principles and concepts – Threat landscape and current trends – Importance of cyber threat intelligence. **Common Cyber Threats:** Malware: types, characteristics and propagation techniques – Social Engineering: Phishing – spear phishing and social media attacks - Ransomware attacks - Man in the middle attacks-Denial of Service (DoS) and Distributed denial of service attacks (DDoS) - Password attacks-drive by download attacks – Keylogging - Packet Sniffing-Bug Bounties-Breaking Caesar Cipher-SQL Injection - Password Strength – Advanced Persistent Threats (APTs) and Targeted Attacks.

MODULE II Applying Tools in Cyber Security   **15 Hours**
Tools and Techniques to perform Packet Sniffing, SQL Injection, Password Strength Analysis, Discovery and risk detection in remote hosts by listening open ports – Network Security Vulnerabilities: Network Protocols and vulnerabilities – Wireless Network Vulnerabilities and attacks – Network Scanning and reconnaissance techniques - Network security monitoring tools - Encryption tools - Web vulnerability scanning tools.

MODULE III Network Exploration and Web Vulnerabilities   **15 Hours**
HTTP methods enumeration, HTTP proxy check, Discovering directories in web servers, User account enumeration, Detecting XST vulnerabilities and Detecting XSS vulnerabilities-Brute forcing DNS records – **Web Application Security:** Common vulnerabilities in web applications - Session hijacking and Cross-Site Request Forgery (CSRF) attacks - Security best practices for web development - Web application firewalls and security testing tools – **Case Study:** SQL injection, Cross-Site Scripting in real time applications.

	Total Hours: 45

Text Books:		
1.	Diogenes Y, Ozkaya E, "Cybersecurity–Attack and Defense Strategies: Counter modern threats and employ state-of-the-art tools and techniques to protect your organization against cybercriminals", Packt Publishing Ltd, 2019.	
2.	Vladlena Benson and John McAlaney, "Emerging Cyber Threats and Cognitive Vulnerabilities", Academic Press, Elsevier, 2020	
Reference Books:		
1.	Hacking: Computer Hacking, "Security Testing, Penetration Testing, and Basic Security" Gary Hall, Erin Watson 2012.	
2.	Hadis Karimipour, Pirathayini Srikantha, Hany Farag, Jin Wei-Kocsis, "Security of Cyber-Physical Systems-Vulnerability and Impact", Springer Nature, 2020.	
3.	Fiedelholtz, " The Cyber Security Network Guide", Springer Nature, 2021	
4.	Ciza Thomas, Paula Fraga – Lamas and Tiago M. Fernandez-Carames, "Computer Security Threats", Intechopen, 2020.	
5.	Information Resources Management Association USA,"Cyber Security and Threats: Concepts, Methodologies, Tools, and Applications", IGI Global 2018.	
Web References:		
1.	https://www.celerium.com/50-cybersecurity-resources	
2.	https://www.geeksforgeeks.org/cyber-security-types-and-importance/	
Online Resources:		
1.	https://onlinecourses.nptel.ac.in/noc23_cs127/preview	
2.	https://onlinecourses.swayam2.ac.in/cec22_lw07/preview	
3.	https://onlinecourses.nptel.ac.in/noc22_cs23/preview	
4.	https://onlinecourses.nptel.ac.in/noc23_cs44/preview	
5.	https://www.udemy.com/topic/cyber-security/free/	
6.	https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-cyber-security	

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

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C931.1	Understand	Quiz	20
C931.2	Understand	Assignment	20
C931.3	Analyze	Presentation	20
C931.4 & C931.5	Apply	Case Study	20

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

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	40	20	20
Understand	60	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
C931.1	3	3	3									3	3		3
C931.2	3	3	3	2								3	3		3
C931.3	3	3	3	2	2				1	1		3	3	2	3
C931.4	3	3	3	2	2				1	1		3	3	2	3
C931.5	3	3	3	3	3				1	1	3	3	3	3	3
C931	**3**	**3**	**3**	**3**	**3**				**1**	**1**	**3**	**3**	**3**	**3**	**3**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

22IT932	**BLOCKCHAIN TECHNOLOGY**	3/0/0/3
Nature of Course	C (Theory Concept)	
Prerequisites	Data Communications and Computer Networks	

Course Objectives:

1.	To provide an understanding skill of blockchain technologies
2.	To introduce the technical aspects of cryptocurrencies, blockchain technologies, and distributed consensus.
3.	To enable the students to be aware of Bitcoin and its security features
4.	To make students understand the innovative application models using Blockchain technology. How these systems work and how to engineer secure software that interacts with the Bitcoin network and other cryptocurrencies.

Course Outcomes

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

C932.1	Extend the emerging abstract models for Blockchain Technology	[U]
C932.2	Build new applications with different tiers of blockchain technology	[AP]
C932.3	Understand the concept of bitcoin and the technological background behind it	[U]
C932.4	Utilize the Bitcoin Security features and its implementation	[AP]
C932.5	Categorize Ethereum and Hyperledger technology	[A]
C932.6	Apply Blockchain concepts in the latest advances and their applications	[AP]

Course Contents:

Introduction to Blockchain   **15 Hours**
Introduction to Blockchain- Features of Block Chain-Applications of Blockchain Technology-Types of Block Chain - Benefits and Limitations of Block Chain - Decentralization in Block Chain -Tiers of Blockchain Technology - Blockchain 1.0: Currency - Blockchain 2.0: Contracts - Blockchain 3.0: Justice Applications Beyond Currency, Economics, and Markets.

Bitcoin Security   **15 Hours**
Introduction to Bitcoin, History, Transactions, Bitcoin Address-Bit coin Wallet- Bitcoin Network- How to store and use Bitcoin- Structure of a Block, Linking Blocks in the Blockchain, Merkle Trees, Bitcoin's Test Blockchains - Bitcoin Mining- Mining the Block - Mining and the Hashing Race -Bitcoin Security- Security Principles, User Security Best Practices.

Ethereum - Hyperledger and Blockchain Applications   **15 Hours**
Introduction to Ethereum Blockchain - Ethereum Virtual Machine (EVM), Transaction-Mining-Ethereum Network -Ethereum Wallets for Ethereum Smart Contracts, Ricardian Contracts- Introduction to Hyperledger- Hyperledger as a Protocol-Fabric- Blockchain Applications - Blockchain in Government -Applications from Building Blocks - Colored Coins - Payment Channels and State Channels. Case Study: Wazirx trading tool.

	Total Hours	**45**

Text Books:

1.	Melanie Swan, "Block Chain: Blueprint for a New Economy", O"Reilly, 1st Edition, 2015.

2.	Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain", O'Reilly, 2016
3.	Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, Cryptography, Bitcoin", Packt Publishing, 2017.

Reference Books:	
1.	Daniel Drescher, "Block Chain Basics", Apress; 1st Edition, 2017
2.	Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi, 2018
3.	S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press,2019
4.	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda "Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions", Apress, 2018.

Web References:	
1.	https://en.wikipedia.org/wiki/Blockchain
2.	http://bitcoinbook.cs.princeton.edu/
3.	https://builtin.com/blockchain
4.	https://j2-capital.com/wp-content/uploads/2017/11/AIR-2016-Blockchain.pdf

Online Resources:	
1.	https://www.tutorialandexample.com/blockchain/
2.	https://faculty.fuqua.duke.edu/~charvey/Teaching/898_2017/syl898.htm
3.	https://www.coursera.org/learn/cryptocurrency
4.	https://onlinecourses.nptel.ac.in/noc22_cs44/preview
5.	https://builtin.com/blockchain/blockchain-applications
6.	https://dl.acm.org/doi/fullHtml/10.1145/3427097
7.	https://j2-capital.com/wp-content/uploads/2017/11/AIR-2016-Blockchain.pdf
8.	https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
9.	https://ethereum.org/en/
10	https://www.hyperledger.org/use/tutorials

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C932.1, C932.2	Understand, Apply	Online Quiz	20
C932.3, C932.4	Understand, Apply	Assignment	20
C932.5	Analyse	Assignment	20

C932.6	Apply	Case Study		20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	25	20
Understand	40	25	30
Apply	40	30	30
Analyse	-	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C932.1	3	3	1									1	2	2	2
C932.2	3	2	2									2	-	2	2
C932.3	3	3	2									2	2	1	2
C932.4	3	2	2									-	-	1	1
C932.5	3	2	3									2	-	2	2
C932.6	3	2	3									2	2	1	1

22IT933	ETHICAL HACKING AND AUDITING FRAMEWORKS	3/0/0/3
Nature of Course	F (Theory Programming)	
Prerequisites	Nil	

Course Objectives:

1	To understand the basics of Network in security.
2	To understand Sniffing and Spoofing tools.
3	To develop the fundamental understanding of OS environment setup.
4	To apply the concepts of Auditing frameworks.
5	To learn different techniques of penetration testing.

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

C933.1	Understanding the basics of networking with the introduction on the system attacks	[U]
C933.2	Explain the foundations of attacks in terms of industry, society and information systems	[U]
C933.3	Apply appropriate methods, securities and vulnerabilities.	[AP]
C933.4	Explore the methods of services of a remote host.	[A]
C933.5	Design and implement innovative features in NSE scripts.	[AP]
C933.6	Design and implement an insecure login mechanisms system.	[AP]

Course Contents:

Module I: Introduction to Network presence   **15 Hours**
Network in security - Sniffing and spoofing - sniffing tools - spoofing crypto and Wi-Fi - **Case study** on tcp dump - Wire shark - Burp Site.

Module II: Introduction to Auditing Frameworks   **15 Hours**
Introduction to Nmap - Nmap Environment setup in linux / windows - scanning remote host and listing open ports - Identifying services of a remote host - Identifying live hosts in local networks - scanning using specific port ranges - NSE scripts.

Module III: Penetration testing   **15 Hours**
Introduction to OWASP top vulnerabilities - Identifying insecure login mechanisms - Insecure credential storage - insecure logging.

	Total Hours:	**45**

Text Books:

1	Lester Evans, Ethical Hacking: The Ultimate Guide to Using Penetration Testing to Audit and Improve the Cyber security of Computer Networks for Beginners, Including Tips on Social Engineering Paperback – Import, 2019.
2.	Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.
3.	Rassoul Ghaznavi-zadeh, Ethical Hacking and Penetration, Step by Step with Kali Linux, 2014.

Reference Books:

1	Kevin Beaver, "Ethical Hacking for Dummies", 6th Edition, Wiley, 2018.
2	Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, Rogunix, 2007.

Web References:

1	https://owasp.org/www-project-top-ten/
2	https://www.coursera.org/courses?query=ethical%20hacking
3	https://www.udemy.com/course/ethical-hacking-professional/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C933.1	Understand	Quiz	20
C933.2	Apply	Tutorial	20
C933.3	Apply	Assignment	20
C933.4	Understand		
C933.5 & C933.6	Apply	Presentation	20

Assessment based on Summative and End Semester Examination

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C933.1	3	3	3	2	2							2	3	3	2
C933.2	3	3	2	2	2							2	2	2	2
C933.3	3	3	3	3	2							2	2	2	3
C933.4	3	3	3	2	3							2	2	2	3
C933.5	3	3	3	3	2							2	2	2	2
C933.6	3	3	3	3	3							2	2	2	2

22CY921	DATA PRIVACY AND SECURITY	3/0/0/3
Nature of Course:	(Theory, Analytical)	
Prerequisites:	Nil	

Course Objectives:

1.	Acquisition of new knowledge and skills from research literature
2.	Quantitative and qualitative analysis of problems
3.	Evaluate proposed technical mechanisms for privacy protection
4.	Identify privacy related aspects of data uses
5.	Apply differentially private mechanisms when the sensitivity to requested information to changes in data is readily available

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

C921.1	Describe the concept of privacy including personally private information.	[U]
C921.2	Describe how an attacker can infer a secret by interacting with a database	[A]
C921.3	Explain how to set a data backup policy or password refresh policy.	[U]
C921.4	Discuss how to set a breach disclosure policy	[U]
C921.5	Identify the risks of relying on outsourced manufacturing	[AP]

Course Contents:

Module I **15 Hours**
Fundamentals of Data Privacy & Security- Databases and Exploratory Data Analysis, Data Representation and Storage, Authentication and Authorization, Database Security Anonymization-Linkage and re-identification attacks, k-anonymity, l-diversity, t-closeness, Implementing anonymization, Anonymizing complex data

Module II **15 Hours**
Differential Privacy (DP) Privacy and anonymity in mobile environments, Formalism and interpretation of DP, Fundamental DP mechanisms and properties, Interactive and non-interactive DP, DP for complex data, Local Differential Privacy (LDP)

Module III **15 Hours**
Security and Privacy in AI and Machine Learning (AI/ML) : Machine Learning (ML) background, Adversary modeling in AI/ML, Poisoning, evasion, and backdoor attacks, Test-time attacks: Model inversion, model stealing, membership inference, adversarial examples, Architectures and algorithms for privacy-preserving machine learning

	Total Hours:	**45**

Text Books:

1	David Salomon, "Data Privacy and Security" Springer Professional Computing , 2003

Reference Books:

1	Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", Wiley, 1995
2	Kevin Mitnick, The Art of Invisibility Little brown and company 2019

Web References:

1	https://online.york.ac.uk/resources/introduction-to-cyber-security-data-protection/

Online Resources:

1	https://www.coursera.org/learn/privacy-law-data-protection
2	https://online-learning.harvard.edu/course/cybersecurity-managing-risk-information-age

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C921.1	Understand	Case Study	20
C921.2	Apply	Quiz	20
C921.3	Understand	Assignment	20
C921.4 &C921.5	Apply	Assignment	20

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C921.1	3	2	2	1	1						1	2	1	1	1
C921.2	3	2	1	1	1						1	2	1	1	1
C921.3	3	2	1	1	1						1	2	2	2	2
C921.4	3	2	1	1	1						1	3	2	3	2
C921.5	3	2	1	1	1						1	3	2	3	2

22CY944	CYBER CRIME AND FORENSICS	3/0/0/3

Nature of Course:	E (Theory Technology)

Pre requisites:	Nil

Course Objectives:

1.	To understand the nature and scope of cybercrime and its impact on individuals, organizations, and society
2.	To develop the skills and knowledge necessary for the investigation and analysis of digital evidence.
3.	To explore advanced techniques and tools related to cybercrime investigations and digital forensics

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

C944.1	Summarize the concept of cybercrime and the attacks	[U]
C944.2	Understand the legal, regulatory frameworks and jurisdictional challenges	[U]
C944.3	Apply digital forensics principles, tools and techniques	[AP]
C944.4	Apply forensic analysis methodologies to reconstruct cybercrime incidents	[AP]
C944.5	Analyze and respond to malware, network-based attacks and emerging trends	[A]

Course Contents:

Module I   INTRODUCTION TO CYBER CRIME   **15 Hours**

Overview of cybercrime- classification- Cybercriminal motivations and attack vectors- Impact of cybercrime on individuals, organizations, and society- Cybercrime laws and regulations in India- Privacy and data protection laws

Module II   DIGITAL EVIDENCE AND ANALYSIS   **15 Hours**

Digital Evidence - Identification, collection, and handling of digital evidence- Chain of custody and evidence- documentation- Legal considerations for evidence admissibility- Digital Forensics Tools Forensic acquisition and imaging-File system analysis and recovery- Network traffic analysis and log examination-Mobile device and cloud forensics- Investigation Process- Incident response and evidence triage- Forensic analysis methodologies- Reconstruction and analysis of digital evidence- Reporting and presenting findings

Module III   CYBER FORENSIC ANALYSIS TECHNIQUES   **15 Hours**

Forensic analysis techniques- Intrusion detection and prevention systems- Network traffic capture and analysis- Introduction to malware analysis- Static and dynamic malware analysis techniques- Reverse engineering of malicious software-Analysis of real-world cybercrime cases- Investigation challenges in advanced persistent threats- Emerging trends- case studies in cybercrime and digital forensics

	Total Hours	**45**

Text Books:

1	Marjie T. Britz, "Digital Forensics and Cyber Crime: An Introduction", 3rd Edition, Pearson Education, 2013
2	Nilakshi Jain, Dhananjay R. Kalbande "Digital Forensics", Wiley Publishers, 2019

Reference Books:

1	Thomas J. Holt, Adam M. Bossler, and Kathryn C. Seigfried-Spellar, "Cybercrime: Investigation and the Digital Forensic" , 2nd Edition, Routledge Publishers,2017
2	Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", 3rd Edition, Academic Press, 2011

Web References:

1	https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2	https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

Online Resources:	
1	https://www.geeksforgeeks.org/cyber-crime/
2	https://www.geeksforgeeks.org/introduction-of-computer-forensics/
3	https://www.guru99.com/digital-forensics.html

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C944.1	Apply	Quiz	20
C944.2	Apply	Assignment	20
C944.3	Apply	Case study	20
C944.4	Analyze	Assignment	20
C944.5	Analyze		

Assessment based on Summative and End Semester Examination

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

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C944.1	3	2	2	1	1						1	2	1	1	1
C944.2	3	2	1	1	1						1	2	1	1	1
C944.3	3	2	1	1	1						1	2	2	2	2
C944.4	3	2	1	1	1						1	3	2	3	2
C944.5	3	2	1	1	1						1	3	2	3	2

22CY945	DIGITAL AND MOBILE FORENSICS	3/0/0/3

Nature of Course:	E (Theory Technology)
Pre requisites:	Nil

Course Objectives:

1.	To understand the basics of mobile device forensics, mobile operating systems and architectures
2.	To acquire skills in the acquisition, preservation, and analysis of mobile device data.
3.	To analyze and interpret mobile device for forensic investigations.

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

C945.1	Summarize the fundamental concepts and principles of mobile device forensics	[U]
C945.2	Demonstrate knowledge of mobile device file systems, data structures, and artifacts	[U]
C945.3	Apply forensic methodologies to extract types of data from mobile devices	[AP]
C945.4	Apply mobile device data acquisition, preservation, and analysis using industry-standard forensic tools and techniques	[AP]
C945.5	Analyze the legal and ethical considerations in mobile device forensics	[A]

Course Contents:

Module I   MOBILE DEVICE DATA ACQUISITION   **15 Hours**

Overview of mobile device forensics- Mobile operating systems and architectures- Device types and their implications in forensic analysis- Mobile Device Acquisition and Preservation- Physical and logical acquisition methods for mobile devices- Data extraction tools and techniques- Preservation and documentation of mobile device evidence- case study on android and iOS mobile devices

Module II MOBILE APPLICATION AND MOBILE NETWOK ANALYSIS   **15 Hours**

Overview of file systems used in mobile devices- file system artifacts, metadata, and timestamps- storage locations and encryption mechanisms- Mobile Device Application Analysis and Network Analysis- Examination of application data- app artifacts, databases, and user-generated content- Mobile device communication protocols- network traffic analysis- mobile device connections- mobile browsing data- Wi-Fi data, and Bluetooth interactions- case study on mobile device applications

Module III MOBILE DEVICE FORENSIC TECHNIQUES AND PRIVACY   **15 Hours**

Challenges in Mobile Device Forensics- Analysis of locked and damaged devices- findings and forensic reports- evidence in legal proceedings- Legal framework and regulations- Privacy and data protection laws- Ethical considerations- professional responsibilities- case study on mobile data privacy

	Total Hours	**45**

Text Books:

1	Lee Reiber, "Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation", 2nd Edition, McGraw Hill Education, 2019
2	Filipo Sharevski, "Mobile Network Forensics: Emerging Research and Opportunities" (Advances in Digital Crime, Forensics, and Cyber Terrorism), IGI Global publisher, 2018

Reference Books:

1	Kim-Kwang Raymond Choo and Ali Dehghantanha, "Contemporary Digital Forensic Investigations of Cloud and Mobile Applications", Syngress Publishers, 2016
2	Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", 3rd Edition, Academic Press, 2011

Web References:

	https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

2	https://www.coursera.org/learn/forensic-science
Online Resources:	
1	https://mchow01.github.io/docs/android_forensics.pdf
2	https://baou.edu.in/assets/pdf/PGDCL_104_slm.pdf

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C945.1	Apply	Quiz	20
C945.2	Apply	Assignment	20
C945.3	Apply	Case study	20
C945.4	Analyze	Assignment	20
C945.5	Analyze		

Assessment based on Summative and End Semester Examination

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

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C945.1	3	2	2	1	1						1	2	1	1	1
C945.2	3	2	1	1	1						1	2	1	1	1
C945.3	3	2	1	1	1						1	2	2	2	2
C945.4	3	2	1	1	1						1	3	2	3	2
C945.5	3	2	1	1	1						1	3	2	3	2

22IT941	**WIRELESS SENSOR NETWORKS AND ITS APPLICATIONS**	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Nil	

Course Objectives:		
1.	To obtain a broad understanding of wireless sensor networks	
2.	To study the challenges and design issues in wireless sensor networks	
3.	To focus on routing protocols and operating systems	
4.	To study the concept of time synchronization and localization	
5.	To study the design issues and applications in wireless sensor networks	

Course Outcomes		
Upon completion of the course, students shall have ability to		
C941.1	Learn the basics of wireless sensor networks and Embedded Operating system.	[R]
C941.2	Understand the architecture and elements of wireless sensor networks	[U]
C941.3	Understand the various routing protocols of wireless sensor networks	[U]
C941.4	Apply the concept of Synchronization and Localization for sensor networks	[AP]
C941.5	Understand various applications, standards and application field specific support	[A]

Course Contents:

Overview of Wireless Sensor Networks: **15 Hours**
Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot - Physical layer and transceiver design considerations in WSNs - Hardware Components - Energy Consumption of Sensor Nodes - Optimization Goals and Figures of Merit - Gateway Concepts.

Time Synchronization and Routing Protocols: **15 Hours**
Introduction to the time synchronization problem - Protocols based on sender/receiver synchronization - Single-hop localization - Positioning in multi-hop environments - Topology-control: Aspects of topology-control algorithms - Energy-Efficient unicast - Broadcast and multicast - Geographic Routing - Operating Systems for Wireless Sensor Networks: Operating System Design Issue - Examples of Embedded OS: TinyOS, Mate, MagnetOS and OSPM.

Applications of WSN: **15 Hours**
WSN Applications - Home Control – Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications - Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

	Total Hours	**45**

Text Books:	
1.	Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 1st Edition, 2015.

2.	F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.
Reference Books:	
1.	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks – Theory and Practice", John Wiley, 1st Edition, 2017.
2.	Ibrahiem M.M. El Emary, Ramakrishnan.S, "Wireless Sensor Networks from Theory to Applications", CRC Press, 2013.
3.	C.S. Raghavendra, Krishna M. Sivalingam, TaiebZnati, "Wireless Sensor Networks", Springer,1st Edition, 2010.
Web References:	
1.	https://cse.iitkgp.ac.in/~smisra/course/wasn.html
2.	https://ijcttjournal.org/Volume4/issue-8/IJCTT-V4I8P194.pdf
3.	https://profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf
4.	https://www.semanticscholar.org/paper/Protocols-and-Architectures-for-Wireless-Sensor-Karl-Willig/d223f7f7b11c10a7e3fd84bad731acda5277378d?p2df
Online Resources:	
1.	https://archive.nptel.ac.in/courses/106/105/106105160/
2.	https://www.coursera.org/learn/wireless-communications
3.	https://alison.com/course/introduction-to-connectivity-technologies-and-sensor-networks

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C941.2, C941.3	Understand	Assignment	20
C941.5	Analyse	Quiz	20
C941.1 C941.4	Apply	Case Study	20
C941.5	Analyse	Certification	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	10	-	10
Understand	20	20	20
Apply	60	50	40
Analyse	10	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C941.1	2	2	2	2	1	2	2	-	-	-	-	1	2	2	2
C941.2	3	3	2	3	1	1	3	-	-	-	-	1	2	2	2
C941.3	3	3	2	2	1	1	2	-	-	-	-	1	2	2	2
C941.4	3	3	2	3	1	2	2	-	-	-	-	1	2	3	2
C941.5	3	2	2	2	1	2	3	-	-	-	-	1	3	2	2
C941.6	3	3	2	2	1	1	2	-	-	-	-	1	2	3	2

22IT942		**MOBILE ADHOC NETWORKS**	**3/0/0/3**
Nature of Course		C (Theory Concept)	
Pre requisites		Data Communications and Computer Networks	
Course Objectives:			
1.		Analyse the features and challenges in ad-hoc networks.	
2.		Understand the protocols and scheduling mechanisms used at the MAC layer.	
3.		Summarize the types of routing protocols used in network and transport layer.	
4.		Evaluate the energy management and QoS schemes used in ad hoc networks.	
5.		Identify the security issues and cross layer integration used in ad-hoc networks.	
Course Outcomes			
Upon completion of the course, students shall have ability to			
C942.1	Outline the challenges in ad-hoc networks.		[U]
C942.2	Analyze the protocols and scheduling mechanisms used at the MAC layer.		[A]
C942.3	Summarize the different routing protocols used in network and transport layers.		[U]
C942.4	Apply the energy management and QoS techniques in various real time environments.		[AP]
C942.5	Identify the issues related to security and cross layer integration.		[AP]
C942.6	Analyze the current technology trends for the implementation and deployment of ad-hoc networks.		[A]

Course Contents:

Introduction to Ad Hoc networks and MAC Protocols   15 Hours
Definition, characteristics- features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.MAC Protocols: design issues, goals and classification. Contention based protocols; Reservation based protocols, Scheduling algorithms-MAC protocols using directional antennas; IEEE standards: 802.11g, 802.15, HIPERLAN.

Network and Transport Layer Protocols   15 Hours
Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, Broadcast routing, Geocast routing in MANET, hybrid routing algorithm, Power/ Energy aware routing algorithm, Hierarchical Routing, QoS aware routing, AODV routing protocol, Routing path discovery. Transport layer: Issues in designing- Transport layer classification, ADHOC transport protocols.

Security Issues and Cross layer Integration   15 Hours
Security issues in Ad hoc networks: issues and challenges, network security attacks- Black hole, warm hole, grey hole, secure routing protocols. Need for cross layer design, cross layer optimization, parameter optimization techniques, Co-operative networks: - Architecture, methods of cooperation, co-operative antennas, Integration of Ad hoc network with other wired and wireless networks. Case study on Intrusion Detection Techniques in MANET, Case study on Hostile Environment, Case Study on Disaster Scenarios.

	Total Hours	**45**

Text Books:	
1.	C.Siva Ram Murthy, B.S.Manoj, "Adhoc Wireless Networks Architectures and protocols", 2nd Edition, Pearson Education. Fourteenth Impression, 2012.

2.	Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2011.
3.	Mohammad Ilyas, "The Handbook of Ad Hoc Wireless Networks", CRC Press,2017.
4.	Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, "Mobile adhoc networking", Wiley-IEEE press, 2004.
5.	Xiuzhen Cheng, Xiao Huang, Ding Zhu DU," Ad hoc Wireless Networking", Kluwer Academic Publishers, 2004.

Reference Books:

1.	Ozan K. Tonguz and Gianguigi Ferrari, John Wiley, "Ad hoc Wireless Networks", Wiley Publications, 2006.
2.	Jaime Lloret Mauri, Jesús Hamilton Ortiz, Jonathan Loo, "Mobile Ad Hoc Networks Current Status and Future Trends" CRC Press, 2016.
3.	T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad Hoc Network Research," Wireless Communication and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.
4.	Prasant Mohapatra, Srikanth Krishnamurthy, "AD HOC NETWORKS Technologies and Protocols", Springer US, 2005.
5.	V.Kawadia and P.P.Kumar, "A cautionary perspective on Cross-Layer design", IEEE Wireless commn.,vol 12, no 1, 2005.

Web References:

1.	https://www.it.iitb.ac.in/~sri/talks/manet.pdf
2.	https://www.geeksforgeeks.org/introduction-of-mobile-ad-hoc-network-manet/
3.	https://www.javatpoint.com/mobile-adhoc-network
4.	https://www.sciencedirect.com/topics/computer-science/mobile-ad-hoc-network

Online Resources:

1.	https://www.coursera.org/lecture/iot/lecture-3-2-manets-ED6nz
2.	https://nptel.ac.in/courses/106105160/
3.	https://www.classcentral.com/course/swayam-wireless-ad-hoc-and-sensor-networks-7888

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C942.1	Understand	Quiz	20
C942.2, C942.6	Analyze	Assignment – 1	20

C942.5, C942.4, C942.3	Apply	Assignment - 2	40

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	-	-	-
Understand	30	-	20
Apply	70	80	60
Analyse	-	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C942.1	3	3	2	2	2						3	2	3	3	2
C942.2	3	3	3	3	2						2	2	2	3	1
C942.3	3	3	3	3	2						2	2	2	3	2
C942.4	3	3	3	2	2						2	1	1	2	2
C942.5	3	3	3	2	2						2	2	2	2	2
C942.6	3	3	3	3	2						2	2	2	3	1

22CS941	**WIRELESS NETWORKS**	3/0/0/3
Nature of Course	G (Theory Concept)	
Prerequisites	Nil	

Course Objectives:

1.	To examine the evolving Wireless technologies and standards.
2.	To illustrate the fundamentals of mobile network layer and applications.
3.	To explore the architectures of various access technologies such as 3G and 4G
4.	To understand various protocols and services for wireless wide area network.

Course Outcomes

Upon completion of the course, students shall have ability to

C941.1	Identify and choose wireless transmission standard, physical layer protocol and MAC layer protocol on the basis of various network applications.	[U]
C941.2	Explore the mobile IP and emerging networking technologies.	[U]
C941.3	Examine the TCP protocol for wireless networks and different types of applications for mobile devices with latest network strategies	[A]
C941.4	Interpret the 3G and 4G network architecture.	[AP]
C941.5	Develop wireless network environment using wireless protocols	[AP]

Course Contents:

MODULE I Wireless LAN and Mobile Network Layer   **15 Hours**
Introduction - **WLAN Technologies**: Infrared - UHF narrowband - Spread Spectrum. **IEEE802.11**: System architecture - Protocol architecture - Physical layer -MAC layer- 802.11a - 802.11b- IEEE 802.1 - IEEE 802.1 -**Hiper LAN**: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security, WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX. **Mobile IP:** IP Packet Delivery - Agent discovery - Tunneling and Encapsulation- IPV6 - Network layer in the internet - Mobile IP session initiation protocol.

Module II Mobile Transport Layer   **15 Hours**
Mobile Transport Layer: Traditional TCP. **Classical TCP improvements**: Indirect TCP -Snooping TCP - Mobile TCP - Time out freezing - Selective retransmission - Transaction oriented TCP-TCP over 3G Wireless Networks. **Mobile Application**: Challenges of Mobile Application – PC and Web based Applications - Mobile computing platforms - Android - Energy efficiency of apps.

Module III Wireless Network Technologies   **15 Hours**
Overview of UMTS Terrestrial Radio access network. **UMTS Core network Architecture**: 3G-MSC, 3G-SGSN, 3G-GGSN - High speed Downlink packet access (HSDPA) - LTE network architecture and protocol. **4G Networks**: 4G vision - 4G features and challenges. Applications of 4G Technologies: Multicarrier Modulation - Smart antenna techniques. **Case Study:** 5G Networks in Health Care and Smart Cities.

	Total Hours	**45**

Text Books:	
1.	Jochen Schiller, Mobile Communications, 2nd Edition, Pearson Education 2012.
2.	Vijay Garg, Wireless Communications and Networking, 1st Edition, Elsevier 2008.

3.	Afif Osseiran, Jose.F.Monserrat, Patrick Marsch, 5G Mobile and Wireless Communications Technology, 1st Edition, Cambridge University Press, 2016

Reference Books:

1.	Erik Dahlman, Stefan Pakvall, Johan Skold and Per Beming, "3G Evolution HSPA and LET for Mobile Broadband", 2nd Edition, Academic Press,2008.
2.	Anurag Kumar, D.Manjunath, Joykuri, "Wireless Networking",1st Edition, Elsevier, 2011
3.	Simon Haykin,Michael Mother, David Koilpillai, "Modern Wireless Communications", 1st Edition, Pearson education,2013.
4.	William Stallings, "5G Wireless: A Comprehensive Review" ,1st Edition, Pearson, 2021
5.	Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", 1st Edition, John Wiley & Sons, 2015.
6.	Andreas F. Molisch Andreas F. Molisch, "Wireless Communications", 2nd Edition (WSE), 2013

Web References:

1.	https://www.tutorialspoint.com/wireless_communication
2.	https://egyankosh.ac.in/bitstream/123456789/70872/1/Unit-1.pdf
3.	http://www.itrainonline.org/itrainonline/mmtk/wireless.shtml
4.	https://www.cse.wustl.edu/~jain/cse574-18/index.html

Online Resources:

1.	https://nptel.ac.in/courses/108/106/106106167/
2.	https://nptel.ac.in/courses/117/102/117102062/
3.	https://www.coursera.org/learn/wireless-communications
4.	http://www.wireless-nets.com/resources/tutorials.htm

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

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C941.1	Understand	Quiz	20
C941.2			
C941.3	Apply	Assignment	20
C941.4, C941.5	Analyze	Case Study	40

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C941.1	3	3										3	3	2	2
C941.2	3	3	3	2	2			2	2			2	3	2	2
C941.3	3	3	3	2	2			2	2			2	3	2	2
C941.4	3	3	3	2	2			2	2			2	3	2	2
C941.5	3	3	3	2	2			2	2			2	3	2	2
C941	**3**	**3**	**3**	**2**	**2**			**2**	**2**			**3**	**3**	**2**	**2**
	3	Strongly agreed		2	Moderately agreed		1	Reasonably agreed							

22CY926	SOCIAL NETWORK SECURITY	3/0/0/3
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

1.	To develop semantic web related simple applications
2.	To explain Privacy and Security issues in Social Networking
3.	To explain the data extraction and mining of social networks
4.	To discuss the prediction of human behavior in social communities
5.	To describe the Access Control, Privacy and Security management of social networks

Course Outcomes

Upon completion of the course, students shall have ability to

C926.1	Recall semantic web related simple applications	[R]
C926.2	Interpret Address Privacy and Security issues in Social Networking	[U]
C926.3	Associate the data extraction and mining of social networks.	[U]
C926.4	Predict the human behavior in social communities	[A]
C926.5	Illustrate the applications of social networks	[A]

Course Contents:

Module I Fundamentals of Social Networking **15 Hours**
Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security.

Module II Security Issues in Social Networks and Mining in Social Networking Data **15 Hours**
The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy

Module III Predicting Human Behavior and Privacy Issues an Identity Management **15 Hours**
Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, properties. Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

	Total Hours	**45**

Text Books:

1.	Peter Mika, "Social Networks and the Semantic Web, 1st Edition, Springer 2007
2.	BorkoFurht, "Handbook of Social Network Technologies and Application, 1st Edition, Springer, 2010
3.	Learning Neo4j 3.x "Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
4.	David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected Worldll, First Edition, Cambridge University Press, 2010

	Reference Books:
1.	Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press, 2010.
2.	Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.
3.	GuandongXu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", 1st Edition, Springer, 2011
4.	Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
5.	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling", IGI Global Snippet, 2009
6.	John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Webǁ, Springer, 2009

	Web References:
1.	https://social-network-analysis.in/
2.	https://www.kernix.com/article/community-detection-in-social-networks/
3.	https://neo4j.com/
4.	https://www.cloudflare.com/learning/access-management/what-is-sso/

	Online Resources:
1.	https://www.publichealth.columbia.edu/research/population-health-methods/social-network-analysis
2.	https://library.concordia.ca/research/digital-preservation/web-archiving/diy.php?guid=tools
3.	https://auth0.com/blog/what-is-and-how-does-single-sign-on-work/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C926.1	Remember	Assignment	20
C926.2	Understand	Quiz	20
C926.3	Understand	Seminar	20
C926.4, C926.5	Analyze	Assignment	20

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

Bloom's Level	Assessment based on Summative and End Semester Examination		
	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	-	20
Understand	60	20	40
Apply	-	-	-
Analyze	20	80	40
Evaluate	-	-	-
Create	-	-	-

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C926.1	2	2	2	2	2	-	-	-	-	-	2	2	2	2	2
C926.2	2	2	-	1	2	-	-	-	-	-	2	2	2	2	2
C926.3	2	-	1	1	3	-	-	-	-	-	2	2	2	2	2
C926.4	2	2	1	2	1	-	-	-	-	-	3	3	2	3	2
C926.5	1	2	2	1	2	-	-	-	-	-	2	3	3	2	2

22IT951	USER EXPERIENCE DESIGN	3/0/0/3
Nature of Course	C (Theory Concept)	
Prerequisites	Java Programming, Web Technology	

Course Objectives:	
1.	To create responsive one page web application using front-end technologies.
2.	To develop JavaScript based web application.
3.	To integrate the knowledge of React components and NodeJS.
4.	To understand the purpose of JSON package creation.
5.	To explore the knowledge of REST services and integration of Sonar Cloud.

Course Outcomes		
Upon completion of the course, students shall have ability to		
C951.1	Demonstrate the client-side HTML application development using REACT	[U]
C951.2	Illustrate the use of JavaScript in REACT applications.	[U]
C951.3	Apply CSS for designing REACT applications.	[AP]
C951.4	Develop simple applications using JSON packages.	[AP]
C951.5	Create simple applications using REST API	[AP]
C951.6	Analyze Code Quality by integrating Sonar Cloud.	[A]

Course Contents:

Front End Development Environment Setup   **15 Hours**
Use Case Definition – Requirement Analysis -Overview on HTML, CSS-Overview of JavaScript – Introduction to NodeJS Installation of NodeJS-Introduction to React -ReactCLI -React Overview- Integrating Front-end with Backend

React and its components   **15 Hours**
Virtual DOM – Components -Child Components-Namespace Components-Node Setup-NPM utility -JSON package creation and its purpose -ES6 features

Integrating RestAPI and SonarCloud   **15 Hours**
Component Props – Component state with Hooks-Decomposing Components-Editable table -Class based Components – Integrating Rest Services –GET, POST, PATCH, PUT, DELETE Component Rendering-Component state -component Updating-Component Error Handling-Testing -Deployment in Heroku and Netlify.GitHub repository and maintain source code of the application – Sonar cloud integration for code Quality Analysis

	Total Hours	**45**

Text Books:	
1.	Shama Hoque, "Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js", 2nd Edition, Packt Publishing, 2020.

Reference Books:	
1.	Andrea Chiarelli, "Beginning React: Simplify your frontend development workflow and enhance the user experience of your applications with React", Packt Publishing, 2018.
2.	Somnath Mukherjee, "RESTfulness: Easy and Quick way to understand REST, Web API, with practical examples and coding", Notion Press, 2020

Web References:	
1.	https://cloudinary.com/guides/front-end-development/front-end-development-the-complete-guide
2.	https://www.coursera.org/learn/html-css-javascript-for-web-developers
3.	https://www.udemy.com/course/react-the-complete-guide-incl-redux/
4.	https://developer.mozilla.org/en-US/docs/Learn/JavaScript/Objects/JSON
5.	https://github.com/apps/sonarcloud
Online Resources:	
1.	https://www.freecodecamp.org/news/html-css-and-javascript-explained-for-beginners/
2.	https://www.tutorialsteacher.com/nodejs
3.	https://www.w3schools.com/REACT/DEFAULT.ASP
4.	https://www.astera.com/type/blog/rest-api-integration/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C951.1	Understand	Assignment	20
C951.2, C951.3	Understand, Apply	Case Study	20
C951.4, C951.5	Apply	Online Quiz	20
C951.6	Analyse	Case Study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	10
Understand	50	30	40
Apply	30	40	40
Analyse	-	10	10
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C951.1	3	3	3	3	2							2	3	2	2
C951.2	3	3	3	2	3							2	2	3	2
C951.3	3	3	2	3	3							3	3	3	2
C951.4	3	3	2	2	3							2	3	3	3
C951.5	3	2	3	2	3							2	2	2	2
C951.6	3	2	2	2	2							2	3	2	2

22IT952		**STREAMING ANALYTICS**	3/0/0/3
Nature of Course		G (Theory Analytical)	
Pre requisites		Nil	
Course Objectives:			
1.		Determine the difference between stream and batch processing.	
2.		Implement the different types of message ingestion techniques for stream data.	
3.		Implement various stream processing techniques	
4.		Understand the storage platform for stream data.	
Course Outcomes			
Upon completion of the course, students shall have ability to			
C952.1		Identify the attributes of data streams that render them valuable for addressing practical challenges in the real world.	[AP]
C952.2		Recognize and implement suitable algorithms to analyze data streams across a range of problems.	[A]
C952.3		Apply diverse algorithms to analyze the data streams.	[AP]
C952.4		Identify the relevant metrics and procedures that contribute to a comprehensive evaluation of the model.	[AP]
C952.5		Discover the storage platform for stream data and utilize various visualization tools for stream data.	[AP]
C952.6		Apply concepts learned to real-world scenarios and evaluate consumer device capabilities and limitations when accessing streamed data.	[AP]

Course Contents:

Introduction to Data Streams: **15 Hours**
Real-time system – Real-time vs streaming systems – Architecture – Security – Scaling – Data Ingestion: Common Interaction Patterns – Scaling the Interaction Patterns – Fault Tolerance. Decoupling the data pipeline: Message queueing tier – core concepts – security – fault tolerance – Applying to business problems.

Analyzing streaming data: **15 Hours**
In-flight data analysis - Distributed stream-processing architecture - Key features of stream-processing frameworks. Algorithms for data analysis: Accepting constraints and relaxing – Stream-time vs Event time - Summarization techniques. Storing the analyzed or collected data: Long-term storage - Keeping it in-memory - Use case Shopping cart

Data Availability and Case Study: **15 Hours**
Communications patterns - Protocols to use to send data to the client - Filtering the stream - Use case: building a Meetup RSVP streaming API. Consumer device capabilities and limitations accessing the data: The core concepts - Making it real: SuperMediaMarkets - Introducing the web client - The move toward a query language. Use case: The collection tier - Message queuing tier using Kafka - Analysis tier using Storm - In-memory data store - Data access tier using Netty.

	Total Hours	**45**

Text Books:	
1.	Andrew G. Psaltis," Streaming Data: Understanding the real-time pipeline" Manning Publications, 1st Edition, 2017

2.	Byron Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 1st Edition, 2014.
3.	Anthony Aragues, "Visualizing Streaming Data: Interactive Analysis Beyond Static Limits ", O'Reilly, 1st Edition, 2018.

Reference Books:

1.	Sayan Putatunda, "Practical Machine Learning for Streaming Data with Python", Apress Publishers, 2021
2.	Bill Franks, "Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics", Wiley, 2019.
3.	Albert Bifet, Ricard Gavaldà, Geoffrey Holmes, Bernhard Pfahringer, "Machine Learning for Data Streams", The MIT Press, 2018.

Web References:

1.	https://www.coursera.org/learn/streaming-analytics-systems-gcp
2.	https://www.edx.org/learn/apache-spark/ibm-apache-spark-for-data-engineering-and-machine-learning
3.	https://onlinecourses.nptel.ac.in/noc24_cs65/preview
4.	https://streamsets.com/blog/what-is-streaming-analytics/
5.	https://www.confluent.io/learn/streaming-analytics/

Online Resources:

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

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C952.1	Understand	Assignment	20
C952.2 C952.3	Analyse	Assignment	20
C952.4 C952.5	Apply	Quiz	20
C952.6	Apply	Case Study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	20	10	10
Apply	70	50	60
Analyse	10	40	30
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C952.1	3	3	3	2	2						2	2	3	3	2
C952.2	3	3	3	3	2		1				1	2	3	3	2
C952.3	3	3	3	3	3		1	1	1	1	2	2	3	3	2
C952.4	3	3	3	2	2						1	1	3	3	2
C952.5	3	3	3	3	3		1		2	2	2	1	3	3	2
C952.6	3	3	3	3	3	2	2	1	2	2	2	2	3	3	2

22CD903	**MULTIMEDIA AND ANIMATION**	3/0/0/3

Nature of Course:	D (Theory Application)
Prerequisites:	-

Course Objectives:

1.	To grasp the fundamental knowledge of Multimedia elements and systems
2.	To get familiar with Multimedia file formats and standards
3.	To learn the process of Authoring multimedia presentations
4.	To learn the techniques of animation in 2D and 3D
5.	To explore different popular applications of multimedia

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

C903.1	Understand the context of Multimedia and its standards	[U]
C903.2	Examine the different types of media elements of different formats on content pages	[AP]
C903.3	Illustrate 2D and 3D creative and interactive presentations for different target multimedia applications.	[AP]
C903.4	Analyze the complexity of multimedia applications in the context of cloud, security and social networking	[A]
C903.5	Apply different standard animation techniques for real time applications	[AP]

Course Contents:

Module I MULTIMEDIA FILE FORMATS AND STANDARDS **15 Hours**
Definitions – Elements - Multimedia Hardware and Software - Distributed multimedia systems – Challenges - Multimedia metadata - Multimedia databases – Hypermedia - Multimedia Learning - File formats – Text and Image file formats - Graphic and animation file formats - Digital audio and Video file formats - Color in image and video - Color Models - Multimedia data and file formats for the web.

Module II MULTIMEDIA AUTHORING AND APPLICATIONS **15 Hours**
Authoring metaphors - Card and Page Based Tools - Icon and Object Based Tools - Time Based Tools - Cross Platform Authoring Tools - 3D Modeling and Animation Tools – Image, Audio Editing, Movie Tools - Creating interactive presentations - Multimedia Big data computing, social networks, surveillance - Multimedia Cloud Computing - Multimedia ontology.

Module III ANIMATION **15 Hours**
Principles of animation - staging, squash and stretch - Timing, onion skinning, secondary action - 2D, 2 ½ D and 3D animation - Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, Vector animation, Stop motion, Motion graphics - Fluid Simulation - Skeletal animation - Skinning Virtual Reality and Augmented Reality.

Total Hours: 45

Text Books:	
1.	Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia", 3rd Edition, Springer, 2021.
2.	John M Blain, "The Complete Guide to Blender Graphics: Computer Modeling & Animation", CRC press, 3rd Edition, 2016.
3.	Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.

Reference Books:	
1.	Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015
2.	Mark Gaimbruno, "3D Graphics and Animation", 2nd Edition, New Riders, 2002.
3.	Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
4.	Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.

Web References:	
1.	https://www.ucl.ac.uk/slade/know/3396
2.	https://developer.android.com/training/animation/overview
3.	https://opensource.com/article/18/2/open-source-audio-visual-production-tools
4.	https://camstudio.org//

Online Resources:	
1.	https://www.coursera.org/learn/digitalmedia
2.	https://nptel.ac.in/courses/117105083
3.	https://onlinecourses.swayam2.ac.in/ntr20_ed15/preview

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C903.1, C903.2	Understand	Quiz	20
C903.3	Apply	Assignment	20
C903.4	Analyze	Case study	20
C903.5	Apply	Assignment	20

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

Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C903.1	3	2	2	2								2	2	2	2
C903.2	3	2	2	2								2	2	2	2
C903.3	3	2	2	2	2	2	2	2				2	2	2	2
C903.4	3	2	2	2		2	2	2				2	2	2	2
C903.5	3	2	2	2	2	2	2	2				2	2	2	2

22CD904	VIDEO CREATION AND EDITING	3/0/0/3

Nature of Course:	D (Theory Application)
Prerequisites:	-

Course Objectives:

1.	To introduce the broad perspective of linear and nonlinear editing concepts
2.	To understand the concept of Storytelling styles
3.	To be familiar with audio and video recording
4.	To apply different media tools
5.	To learn and understand the concepts of editing tools

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

C904.1	Understand the linear and nonlinear editing concepts	[U]
C904.2	Examine the infrastructure and significance of storytelling	[AP]
C904.3	Apply suitable methods for recording to CDs and VCDs.	[AP]
C904.4	Analyze the core issues of advanced editing and training techniques	[A]
C904.5	Design projects using editing tools	[A]

Course Contents:

Module I STORYTELLING **15 Hours**
Evolution of filmmaking - linear editing - non-linear digital video - Economy of expression – Altering reality through editing - Storytelling styles in digital world - Jump cuts - L-cuts - match cuts – cutaways – dissolves - split edits - Consumer and pro NLE systems - Digitizing images - Managing resolutions - Mechanics of digital editing - Pointer files - Media management

Module II RECORDING **15 Hours**
Capturing digital and analog video - Importing audio – Basic Editing in Movie – Transitions and tiles – Advanced Video editing – Still Photos and graphics - Digital video to tape, CDs and DVDs - Working with clips and viewer - Working with sequences, timeline and canvas – Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Using Media Tools - Viewing and Setting Preferences

Module III EDITING **15 Hours**
Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

Total Hours: 45

Text Books:		
1.	Wallace Jackson, "Digital Video Editing Fundamentals", Apress Publisher, 2016.	
2.	Blain Brown, "The Basics of Filmmaking: Screenwriting, Producing, Directing, Cinematography, Audio, & Editing", Focal Press, 2020.	
3.	John Bucher, "Storytelling for Virtual Reality: Methods and Principles for Crafting Immersive Narratives", Focal Press, 2017.	
Reference Books:		
1.	Bryan Michael Stoller, "Filmmaking for Dummies", 3rd Edition, Dummy Series, 2019	
2.	Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", McGraw Hill, 2003	
3.	Keith Underdahl, "Digital Video for Dummies", 3rd Edition, Dummy Series, 2001.	
Web References:		
1.	https://www.kapwing.com/video-editor	
2.	https://www.veed.io/tools/video-editor	
3.	https://www.canva.com/video-editor/	
Online Resources:		
1.	https://www.coursera.org/learn/how-to-create-video-for-online-courses	
2.	https://onlinecourses.swayam2.ac.in/cec22_ge32/preview	

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C904.1, C904.2	Understand	Quiz	20
C904.3	Apply	Assignment	20
C904.4	Analyze	Case study	20
C904.5	Analyze	Assignment	20

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C904.1	3	2	2	2								2	2	2	2
C904.2	3	2	2	2								2	2	2	2
C904.3	3	2	2	2	2	2	2	2				2	2	2	2
C904.4	3	2	2	2	2	2	2	2				2	2	2	2
C904.5	3	2	2	2	2	2	2	2				2	2	2	2

22CY954	AUGMENTED AND VIRTUAL REALITY TECHNOLOGIES	3/0/0/3
Nature of Course	H (Theory Technology)	
Pre requisites	Nil	

Course Objectives:

1.	To impart the fundamental aspects and principles of AR/VR technologies.
2.	To know the internals of the hardware and software components involved in thedevelopment of AR/VR enabled applications.
3.	To learn about the graphical processing units and their architectures.
4.	To gain knowledge about AR/VR application development.
5.	To know the technologies involved in the development of AR/VR based applications.

Course Outcomes

C954.1	Describe the basic concepts of AR and VR	[U]
C954.2	Understand the tools and technologies related to AR/VR	[U]
C954.3	Identify the working principle of AR/VR related Sensor devices	[AP]
C954.4	Apply of various models using modeling techniques	[AP]
C954.5	Examine AR/VR applications in different domains	[A]

Course Contents:

Module I: Introduction to Virtual Reality and Augmented Reality: **15 Hours**

Definition – Introduction to Trajectories and Hybrid Space - Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR - AR Technologies - Input Devices – 3D Position Trackers – Types of Trackers – Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Human VisualSystem – Personal Graphics Displays – Large Volume Displays – Sound Displays**.**

Module II: VR Modeling: **15 Hours**

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection - Behavior Modeling – Model Management. VR Programming – Toolkits and Scene Graphs – World ToolKit.

Module III: APPLICATIONS **15 Hours**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society- Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications –Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

	Total Hours	**45**

Text Books:

1.	Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VRexperiences for mobile", Packt Publisher, 2018
2.	Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", AddisonWesley, 2016

Reference Books:

1.	John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004
2.	William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application,Design", Morgan Kaufmann, 2003

Web References:

1. https://www.uc.edu/content/dam/uc/ce/docs/OLLI/Page%20Content/VIRTUAL%20AND%20AUGMENTIVE%20REALITY.pdf

2. https://library.oapen.org › bitstream

3. https://dokumen.pub/augmented-reality-and-virtual-reality-new-trends-in-immersive-technology-9783030680855-9783030680862.html

4. https://www.perlego.com/book/960443/complete-virtual-reality-and-augmented-reality-development-with-unity-leverage-the-power-of-unity-and-become-a-pro-at-creating-mixed-reality-applications

5. https://books.google.co.in/books?id=3UbhDwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Online Resources:

1. https://www.coursera.org/learn/ar

2. https://www.edx.org/learn/augmented-reality

3. https://www.shiksha.com/online-courses/ar-vr-and-gaming-courses-certification-training-st559

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C954.1	Remembering	Assignment	20
C954.2	Understand	Quiz	20
C954.3 & C954.5	Analyze	Seminar	20
C954.4	Apply	Assignment	20

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C954.1	2	2	2	2	2	-	-	-	-	-	2	2	2	2	2
C954.2	2	2	-	1	2	-	-	-	-	-	2	2	2	2	2
C954.3	2	-	1	1	3	-	-	-	-	-	2	2	2	2	2
C954.4	2	2	1	2	1	-	-	-	-	-	3	3	2	3	2
C954.5	1	2	2	1	2	-	-	-	-	-	2	3	3	2	2

22IT001	MOBILE APPLICATIONS DEVELOPMENT USING ANDROID	3/0/0/3

Nature of Course	D (Theory Application)
Pre requisites	Nil

Course Objectives:

1.	To understand the Java concepts required for mobile application development.
2.	To understand the system requirements for mobile applications
3.	To generate suitable design using Android studio.
4.	To create and deploy an application in marketplace for distribution.

Course Outcomes

Upon completion of the course, students shall have ability to

C001.1	Recall the knowledge on basic java programming for mobile application development.	[R]
C001.2	Summarize the framework of android application and interpret simpleuser interfaces.	[U]
C001.3	Build an android application using multimedia components.	[AP]
C001.4	Develop application with server-side connectivity.	[AP]
C001.5	Construct the mobile application to work with the database to storedata locally.	[AP]
C001.6	Examine and deploy mobile applications to the Android marketplace for distribution	[A]

Course Contents:

Introduction: **15 Hours**
Introduction to mobile application-System requirements for mobile application-Mobile application development architecture-Anatomy of Android Project. **Java for Android:** Classes and Objects - Loops, Lists, Variables and Control structures - Access specifiers and modifiers - Interfaces and Abstract classes - Inheritance - GUI in Java - Event handling.

Activities, Intent and User Interface: **15 Hours**
Activity- Life Cycle of an Activity - Creating an Activity - Intents - Internal/External/Pending, Intent Filters - Fragments-Developing user interfaces Notifications and Toasts. **Multimedia & Services:** Lifecycle of a Service - Location Based Services - GPS, Android location API and Google Maps using Google API -WIFI-Playing audio, video- Messaging and Telephony services.

Persistent Data Storage: **15 Hours**
Introduction to SQLite - Necessity of SQLite, Creation and Connection of Database, Extracting values from cursors, Transactions - Android Database API- Connection and Operations - APK Conversion Process. **Sensors & Application Deployment:** Sensors - Motion sensors, Environmental, Position sensors, Touch sensors. Application Deployment - Creating and signing of application, Deploying app on Google Play Store, Become a publisher. **Case study:** Design, Create and deploy android applications using various sensors.

	Total Hours	**45**

Text Books:	
1.	K. Saravanan, L. Srinivasan, R. J. Anandhi "Mobile Application Development using Android ", Walnut Publication, 2021.
2.	Paul Deitel, Harvey Deitel, "Java How to Program", 10th Edition, Prentice Hall Publications, 2014.

3.	Jeff McWherter, Scott Gowell, "Professional Mobile Application Development",John Wiley & Sons, 2012.

Reference Books:

1.	Barry Burd, John Paul Mueller, "Android Application Development All in one for Dummies", 2020.
2.	John Horton, "Android Programming for Beginners", Packt Publishing, 2015.
3.	Reto Meier, "Professional Android 4 Application Development", Wrox Professional Guides, 2012.
4.	Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice",DreamTech, 2012.

Web References

1.	https://developer.android.com/docs
2.	https://www.tutorialspoint.com/android/
3.	https://developer.android.com/ndk/reference

Online Resources:

1.	https://www.androidhive.info/
2.	https://developer.android.com/courses
3.	https://www.coursera.org/specializations/android-app-development

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C001.1	Remember	Quiz	20
C001.2	Understand	Assignment	20
C001.3	Apply	Assignment	20
C001.6	Analyze		
C001.4,5	Apply	Case Study Presentation	20

Assessment based on Summative and End Semester Examination

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

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C001.1	3	1	3	2	2	1				2	1		3	3	2
C001.2	3	3	2	2	3	2	1			2	2		2	3	2
C001.3	3	3	3	2	3	2	2	1		1	2	3	3	3	2
C001.4	3	2	3	2	3	2	2	1	1	1	2	2	3	3	2
C001.5	3	2	3	2	3	2	2	1	1	1	2	3	3	2	3
C001.6	3	3	3	2	3	2	2	1	1	1	2	3	3	2	3

22IT002		**PHP AND MYSQL**	**3/0/0/3**
Nature of Course		F (Theory Programming)	
Pre requisites		C Programming	

Course Objectives:	
1.	To Understand Scripting Language Power in Portal Development.
2.	To analyze the usage of Object-Oriented Techniques in Web Server interaction.
3.	To Apply Session and transaction management in MYSQL.
4.	To learn the intricacies in Client Server Management and Data Storage.

Course Outcomes

Upon completion of the course, students shall have ability to

C002.1	Interpret the object-oriented parameters required for web development	[U]
C002.2	Demonstrate the Session Management between various Clients effectively	[AP]
C002.3	Integrating the Security mechanisms in Database Transaction Management	[A]
C002.4	Illustrate the Concept of Code Reusability B2B and B2C Application Development.	[AP]
C002.5	Investigate the Database Security rules and ensure Backup and Restoration of MYSQL Data	[A]
C002.6	Apply Software Architecture and Design Specifications in PHP for portal development	[AP]

Course Contents:

Introduction to PHP **15 Hours**
Installing PHP (WAMP SERVER/XAMPP SERVER), Lexical Structure, Data Types, Variables, Expressions and Operators, Flow Control Statements, Including Code, Embedding PHP in Web Pages, Functions-Calling a Function, Defining Function, Function Parameters, Return Values, Variable Scope, Variable Functions, Built-in Functions, Anonymous Functions.

Strings, Arrays and Classes: **15 Hours**
Strings-Accessing Individual Characters, Encoding and Escaping, Regular Expressions, Arrays-Identifying elements in Array, Single and Multi-Dimensional Arrays, converting between Arrays and Variables, Sorting Arrays, Class-Declaring Class, Accessing Methods and Properties, Inheritance in class, Introspection and Serialization

Accessing MYSQL Databases using PHP: **15 Hours**
Global variables and Form Data, concealing PHP libraries, File Permissions and File Uploads, Using PHP to Access Databases-connection establishment, Basic SQL Commands, Creating Database, Accessing Record Set, Updating records, MYSQL functions. CASE STUDY-Design an Online Examination System, Design an interactive Marketing Portal for Customer Business Interaction

	Total Hours	**45**

Text Books:	
1.	Rasmus Lerdorf, Kevin Tatroe, "Programming PHP", O'REILLY Publications, 2020.
2.	Steven Holzner, "PHP: The Complete Reference", McGraw Hill Education, 2017.

Reference Books:		
1.	Mario Lurig, "PHP Reference: Beginner to Intermediate PHP5", 2008.	
2.	Larry Ullman, "PHP and MYSQL for Dynamic web sites", Pearson Education India, 2017.	
3.	Kevin Tatroe, Peter MacIntyre, "Programming PHP: Creating Dynamic web pages", O'Reilly Media, Inc, 2020.	
Web References:		
1.	http://www.nptelvideos.com/php/php_video_tutorials.php	
2.	https://www.w3schools.com/php	
3.	https://www.javatpoint.com/php-tutorial	
4.	https://www.studytonight.com/php/	
Online Resources:		
1.	https://onlinecourses.swayam2.ac.in/aic20_sp32/preview	
2.	https://www.coursera.org/projects/dynamic-web-app-php-mysql	

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C002.1	Understand	Assignment	20
C002.2, C002.3	Apply, Analyze	Online Quiz	20
C002.4, C002.5	Apply, Analyze	Online Quiz	20
C002.6	Apply	Case Study	20

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

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C002.1	3	3	2	2	3	2	2	-	-	-	2	2	2	3	3
C002.2	3	3	2	3	1	2	2	-	-	-	2	3	3	3	2
C002.3	3	3	2	2	3	1	1	-	-	-	2	2	3	2	2
C002.4	3	3	3	3	2	2	2	-	-	-	2	3	2	2	3
C002.5	3	3	1	2	3	2	1	-	2	-	2	2	3	3	2
C002.6	3	3	2	3	2	1	1	-	2	-	3	2	3	2	2

22IT003		**BLOCKCHAIN ESSENTIALS**	3/0/0/3
Nature of Course		C (Theory Concept)	
Prerequisites		-	

Course Objectives:

1.		To Provide an understanding skill of blockchain technologies
2.		To introduce the technical aspects of cryptocurrencies, blockchain technologies, and distributed consensus.
3.		To enable the students to be aware of Bitcoin and its security features
4.		To make students understand the innovative application models using Blockchain technology., how these systems work and how to engineer secure software that interacts with the Bitcoin network and other cryptocurrencies.

Course Outcomes

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

C003.1	Relate cryptography concepts in emerging abstract models for Blockchain Technology	[R]
C003.2	Demonstrate the working principles of blockchain, bitcoin, and cryptocurrency in a real-time environment	[U]
C003.3	Classify the concept of bitcoin and the technological background behind it	[A]
C003.4	Make use of the Bitcoin transaction and its implementation	[AP]
C003.5	Relate the concept of Hyperledger to blockchain	[U]
C003.6	Apply Blockchain concepts in the latest advances and their applications	[AP]

Course Contents:

Introduction **15 Hours**

Introduction to Cryptography and Network Security- Classical Encryption Techniques-Block Cipher and Data Encryption Standards- Authentications and Hash Functions- SHA3- Introduction to Block Chain- Features of Blockchain- -Types of Block Chain-Decentralization in Block Chain-Tiers of Blockchain Technology. Blockchain 1.0: Currency

Block Chain and Cryptocurrency **15 Hours**

Blockchain 2.0: Contracts. Blockchain 3.0: Justice Applications Beyond Currency, Economics, and Markets- Name coin: Decentralized Domain Name System- Digital Identity Verification- Introduction to Bitcoin, Transactions, Bitcoin Address-Wallet- Network- How to store and use Bitcoin- Legal aspects of Bitcoin.

Hyperledger **15 Hours**

Structure of a Block, Linking Blocks in the Blockchain, Merkle Trees, Bitcoin's Test Blockchains - Bitcoin Mining- Mining the Block - Mining and the Hashing Race-Altcoin and cryptocurrency ecosystem- Introduction to Hyperledger- Hyperledger as a Protocol-Fabric- Applications of Blockchain Technology - Blockchain in Government - Colored Coins- Payment Channels and State Channels. Case study- Wazirx trading tool.

	Total Hours	**45**

Text Books:

1	William Stallings," Cryptography and Network Security- Principles and Practices", 7th Edition, Prentice Hall of India, 2017
2.	Melanie Swan, "Block Chain: Blueprint for a New Economy", O"Reilly, 1st Edition – 2015.
3.	Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain", O'Reilly, 2016

4.	Imran Bashir, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, 2017.
Reference Books:	
1.	Daniel Drescher, "Block Chain Basics", Apress; 1st Edition, 2017
2.	Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi, 2018
3.	S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019
4.	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, "Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions", Apress, 2018.
Web References:	
1.	https://en.wikipedia.org/wiki/Blockchain
2.	http://bitcoinbook.cs.princeton.edu/
3.	https://builtin.com/blockchain
4.	https://j2-capital.com/wp-content/uploads/2017/11/AIR-2016-Blockchain.pdf
Online Resources:	
1.	https://builtin.com/blockchain/blockchain-applications
2.	https://dl.acm.org/doi/fullHtml/10.1145/3427097
3.	https://j2-capital.com/wp-content/uploads/2017/11/AIR-2016-Blockchain.pdf
4.	https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
5.	https://ethereum.org/en/
6.	https://www.hyperledger.org/use/tutorials

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C003.1	Remember	Quiz	20
C003.2	Understand	Assignment	20
C003.3	Analyse		
C003.4	Understand	Assignment	20
C003.5	Apply		
C003.6	Apply	Case Study	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	20	20	10
Understand	80	40	40
Apply	-	20	30
Analyze	-	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C003.1	3	3	1									1	2	2	2
C003.2	3	2	2									2	1	2	2
C003.3	3	3	2									2	2	1	2
C003.4	3	2	2									1	1	1	1
C003.5	3	2	3									2	1	2	2
C003.6	3	2	3									2	2	1	1

22IT004	CLOUD AND VIRTUALIZATION	3/0/0/3
Nature of Course	C (Theory Concept)	
Prerequisites	Nil	

Course Objectives:

1.	To understand the fundamentals of Networking Concepts.
2.	To understand the evolution of cloud from the existing technologies and knowledge on the various issues with the lead players in cloud
3.	To learn the necessary tools, technologies, and skills for design, develop and deploy services in a virtualized cloud computing paradigm.
4.	To identify the best suit IT architecture, infrastructure and delivery models of Cloud Computing for a small to medium scale business scenarios.
5.	To expose the students to the frontier areas of Cloud Service Platforms with next generation computing technologies

Course Outcomes

Upon completion of the course, students shall have ability to

C004.1	Understand and explain the basic concepts of networking.	[U]
C004.2	Demonstrate the broad perspective of cloud architecture and model, computing solutions and recommendations.	[U]
C004.3	Analyze the best virtualization tools and mechanisms to design, develop and deploy services.	[A]
C004.4	Illustrate virtual management of IT resources and its provisioning	[U]
C004.5	Select, Configure and enable a private cloud using virtualization for a small scale business environment.	[AP]
C004.6	Identify the best real time storage environments suitable for the next generation integrated technologies.	[AP]

Course Contents:

Introduction to Networking Concepts and Cloud: **15 Hours**
Introduction to Networks and Internet: Protocol and Standards – Communication Models - Network Models – OSI Reference Model – Transmission Media - Network Devices – Network Types and topologies – Ethernet standards - IPV4 and IPV6 addressing. Introduction to Cloud Computing and its Evolution - Introduction to Grid, Utility, Cluster, Parallel and Distributed Computing - System Models for Distributed and Cloud Computing - NIST Layered Cloud Computing Reference Model - Architectural Design Challenges – Cloud Computing : Characteristics, Drivers, Challenges, Benefits - Deployment Models: Public, Private, Community and Hybrid Clouds – Service models: IaaS- PaaS-SaaS
Case study: Anything as a service (XaaS)

Fundamentals of Virtualization: **15 Hours**
Introduction to Virtualization – Virtual Machines and its resources – Hypervisors and its types - Types of Virtualization - Tools and Mechanisms - **CPU Virtualization** (process & benefits) - **Storage Virtualization** (Process, benefits, Storage for VMs, Block level and file level storage, NAS, FC SAN, iSCSI,FCIP, & FCoE, Resource management and Virtual Provisioning) - **Network Virtualization** (Process, benefits, infrastructure components, VLANs, traffic Management Techniques) - **Application Virtualization** - **Desktop Virtualization**.

Real Time Public Cloud Platform: **15 Hours**
Public Cloud Services: Working with Amazon AWS – AWS Compute and its types- AWS Storages: S3, Glacier, EBS, and EFS - Big data on AWS. Working on Azure – Azure compute - Azure storages: File, Blob, Queue and Table
Case Study: Google Cloud Solutions, Open Stack, Alibaba Cloud and IBM cloud.

		Total Hours	45

Text Books:

1.	Behrouz A. Forouzan, "Data communication and Networking", 5th Edition, Tata McGraw- Hill, 2013.
2.	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
3.	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
4.	Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy an Enterprise Perspective on Risks and Compliance", O'Reilly, 2009

Reference Books:

1.	A S Tanenbaum, DJ Wetherall, "Computer Networks", 6th Edition, Prentice-Hall, 2021.
2.	William Stallings, "Data and Computer Communications", 10th Edition, PHI, 2013.
3.	Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press,1st Edition, 2017.
4.	Toby Velte, Anthony Velte, Robert Elsenpeter, " Cloud Computing - A Practical Approach ‖", Tata McGraw Hill, 2009.
5.	Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010

Web References:

1.	https://aws.amazon.com/
2.	https://azure.microsoft.com/en-in/
3.	https://nptel.ac.in/courses/106/105/106105167/
4.	https://explore.skillbuilder.aws/learn/public/learning_plan/view/82/cloud-foundations-learning-plan?cta=lacp_topbanner
5.	https://cloud.google.com/training/cloud-infrastructure

Online Resources:

1.	https://www.edx.org/course/introduction-cloud-infrastructure-linuxfoundationx-lfsl51-x
2.	https://www.aws.training/training.com
3.	https://www.qwiklabs.com/
4.	https://www.gslab.com/cloud
5.	https://www.cloudshare.com/

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C004.1	Understand	Assignment	20
C004.2, C004.4	Understand	Online Quiz	20
C004.3	Analyse	Online Quiz	20
C004.5, C004.6	Apply	Case Study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	20	20	10
Apply	80	40	40
Analyse	-	40	50
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C004.1	3	2	1	2	1	1	2				2	2	3	2	2
C004.2	3	3	1	1	2	1	1				2	2	3	2	2
C004.3	3	3	3	3	3	1	1				2	2	3	2	1
C004.4	3	3	3	2	3	1	1				2	3	3	2	1
C004.5	3	3	3	3	3	1	1				3	3	3	2	1
C004.6	3	3	2	3	3	1	1				3	3	3	2	1

22IT005		**REST API USING SPRING BOOT**	0/0/6/3
Nature of Course		M (Practical Application)	
Pre requisites		Java Programming	
Course Objectives:			
1.		To impart the knowledge of REST API and HTTP methods used in Spring Boot Framework.	
2.		To discuss LIKE queries using JPA and handle CRUD operations with JPQL.	
3.		To explore the various relational mapping with JPA.	
Course Outcomes			
Upon completion of the course, students shall have ability to			
C005.1	Create simple applications with REST API and handle HTTP methods.		[AP]
C005.2	Apply LIKE queries using JPA.		[AP]
C005.3	Build application using Spring Boot and handle CRUD operations with JPQL.		[AP]
C005.4	Analyze various relational mapping with JPA.		[A]
C005.5	Examine the Spring AOP-Annotation based Application.		[A]

Course Contents:

Module I REST API   **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 SpringBoot   **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, LIKE Queries using JPA, Starts and Ends with query using JPA, JPQL with @Query Annotation, Select, Update, Delete with JPQL.

Module III JPA Mapping   **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.

	Total Hours	**45**

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

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

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

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

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

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

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
C005.1	2	2	2									1	2		1
C005.2	3	3	3	2	2				2	1		3	3	1	2
C005.3	3	3	3	3	3				2	1		3	3	2	2
C005.4	3	3	3	3	3				2	1		3	3	2	2
C005.5	3	3	3						1	1		3	3		1

22IT006	**INTRODUCTION TO CYBER SECURITY**	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Computer Networks	

Course Objectives:	
1.	To understand the fundamental concepts of cyber security.
2.	To learn various hacking techniques and attacks.
3.	To assess and measure threats to information assets.
4.	To learn intrusion detection mechanism.
5.	To design various security policies.

Course Outcomes		
Upon completion of the course, students shall have ability to		
C006.1	Understand the fundamentals of network and security concepts.	[U]
C006.2	Implement various techniques to protect system from security attacks.	[AP]
C006.3	Relate the hacking and security concepts in cyber security.	[R]
C006.4	Apply various cyber security techniques in real time applications.	[AP]
C006.5	Apply various detection mechanism for intrusion detection.	[AP]
C006.6	Infer suitable security policies for the given requirements.	[A]

Course Contents:

Introduction **15 Hours**
Network and security concepts: Information assurance – Cryptography – DNS - Firewalls – Virtualization, Microsoft windows security principles – Define boundary of trust – Tunneling and fraud Techniques-Threat infrastructure- Exploitation: Techniques to gain a foothold Misdirection, Reconnaissance and disruption methods, Malicious code: Self-replicating codes –Man-in-the-Middle Attacks - DLL Injection.

Ethical Hacking and Security **15 Hours**
System Hacking: Hacking windows – Hacking Unix – Remote Connectivity and VoIP Hacking – Network Hacking: Network Devices – Wireless Hacking – Firewalls – Denial of Service Attacks – Software Hacking: Hacking Code – Web Hacking – Hacking the Internet User – Design for physical protection- Physical access control – Measures to control access – Process Evaluation – Case Study on Colonial Pipeline Ransomware attack and Ukraine Power Grid Hack

Intrusion Detection System and Policies **15 Hours**
Detection mechanism, Signatures, Traffic analysis, Intrusion detection project life cycle: Project phases - Resource estimates - Project planning - Acquisition - Deployment phase - Tuning - Deployment issues - Maintenance. Cyber security policies -Policy needs- Writing security policies – Internet and email security policies – Compliance and Enforcement Policies –Anomaly detection and IT Act 2000- Case study on GDPR and Information security management system

	Total Hours	**45 hours**

Text Books:	
1.	James Graham, Richard Howard and Ryan Olson, "Cyber Security Essentials", Auerbach Publications, USA, 2017.
2.	Stuart McClure, Joel Scambray and George Kurtz, "Hacking Exposed Network Security Secrets and Solutions", Tata Mcgraw Hill Publishers 2012.

3.	Scott Barman, "Writing Information Security Policies", New Riders Publications, 2002.

Reference Books:

1.	Ben Smith and Brain Komer, "Microsoft Windows Security Resource Kit" Prentice Hall of India, 2010.
2.	Ankit Fadia and Manu Zacharia, "Network Intrusion Alert: An Ethical Hacking Guide to Intrusion Detection", Thomson Course Technology, USA, 2010.
3.	George K. Kostopoulous, "Cyber Space and Cyber Security", CRC Press, 2017.
4.	Martti Lehto, Pekka Neittaanmaki, "Cyber Security: Analytics, Technology and Automation", Springer International Publishing Switzerland 2015.

Web References:

1.	https://en.wikipedia.org/wiki/Colonial_Pipeline_ransomware_attack
2.	https://en.wikipedia.org/wiki/Ukraine_power_grid_hack
3.	https://gdpr-info.eu/
4.	https://www.isms.online/information-security-management-system-isms/

Online Resources:

1.	https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
2.	https://www.edx.org/course/cybersecurity-fundamentals
3.	https://www.coursera.org/specializations/intro-cyber-security
4.	https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks

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

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	Bloom's Level	Assessment Component	FA (16%) [80 Marks]
C006.1	Understand	Quiz	20
C006.2	Apply		
C006.3	Remember	Assignment	20
C006.4	Apply		
C006.5	Apply	Assignment	20
C006.6	Analyze	Case Study	20

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

Apply	30	30	30
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C006.1	2	3	3	3	-	-	-	-	-	-	-	3	2	2	2
C006.2	2	3	3	3	-	-	-	-	-	-	-	3	2	1	2
C006.3	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
C006.4	3	2	2	3	-	-	-	-	-	-	-	2	2	2	2
C006.5	3	3	3	3	-	-	-	-	-	-	-	2	2	2	1
C006.6	3	2	3	2	-	-	-	-	-	-	-	2	2	2	1

22MC103		SOFT SKILLS		2/0/0/0
Nature of Course:		Theory Concept		
Pre requisites:		Technical Communication Skills		

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

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

C103.1	Remember the principles of soft skills required for their profession.	[R]
C103.2	Understand the importance of Interpersonal communication Skills among individuals, groups and cultures.	[U]
C103.3	Apply verbal and non-verbal communication skills in corporate environment.	[AP]
C103.4	Analyse and apply creativity skills, critical thinking skills and problem solving skills.	[A]
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]

Course Contents:

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

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

Module 2: Interpersonal Communication   **10 Hours**

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

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

Industry Expectations- Universal Hiring Rule- Personal Application/Action Taken. Importance of Human Values-Importance of Team Work- Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player- Personal Application/Action Taken. Planning- Prioritization - Delegation- Conflict Management-

Decision and its necessity in crucial situations- Group Discussion- Personal Application/Action Taken. Essential Skills in working Strategies- Presentation and Interaction Skills- What to Present and How- Being Assertive- Multimedia Presentation-Making Effective Presentations. Interview Skills- Do's and Don'ts - Body Language – Answering the Common Questions of Interview- Performance Evaluation 2- Mock Interview

	Total Hours:	30

Text Books:

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

Reference Books:

1.	Peter Davson-Galle, "Reason and Professional Ethics", Ashgate Publishing, Ltd., 2009.
2.	William B. Gudykunst, "Cross Cultural and Inter Cultural Communication", Sage Publications India Pvt Ltd, New Delhi, 2003.
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

Summative assessment based on Continuous Assessment	
Revised Bloom's Level	Term End Assessment [60 marks]
Remember	30
Understand	40
Apply	20
Analyse	10
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	1
C103.2							1	1	3	3	2	2		1	1
C103.3									2	3	2	2		1	1
C103.4						1	1	1	2	3	3	2		1	1
C103.5						1	1		2	3	2	2		1	1
C103.6							1	2	3	3	2	2		1	1

22MC105	GENERAL APTITUDE	2/0/0/0
Nature of Course	Problem analytical	
Pre requisites	Basic Mathematical calculations	

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

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

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

Module 2: Logic and Decision Making   **8 Hours**

Analogy – Classification – Series completion – Coding and Decoding – Blood Relations – Puzzle Test – Direction Sense test – Logical Venn Diagrams - Number Ranking and Time Sequence Test – Decision Making – Assertion and Reason– Inserting the missing one – Logical Sequence of words – Syllogisms.

Module 3: Reasoning   **8 Hours**

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

	Total Hours:	**30**

Text Books:

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

Reference Books:

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

Web References:

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

4	https://nptel.ac.in/courses/111103020/2
Online Resources:	
1	http://aptitudetraining.in/home/index.php
2	https://www.udemy.com/vedicmaths/
3	https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true

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

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

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

Summative assessment based on Continuous Assessment

Bloom's Level	Term End Assessment [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										2		
C105.2	3	2	1										2		
C105.3	3	3	1										2		
C105.4	3	2	1										2		
C105.5	3	3	1										2		
C105.6	3	2	1										2		

22MC106	LIFE SKILLS AND ETHICS	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

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

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

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

	Total Hours:	**30**

Reference Books:

1	Barun K. Mitra, "Personality Development & Soft Skills", First Edition, Oxford Publishers, 2011.
2	Kalyana, "Soft Skill for Managers", 1st Edition, Wiley Publishing Ltd, 2015.
3	Larry James, "The First Book of Life Skills", 1st Edition, Embassy Books, 2016
4	Shalini Verma, "Development of Life Skills and Professional Practice", 1st Edition, Sultan Chand (G/L) & Company, 2014
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	20
Analyse	10
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		1
C106.2								1	2	1		2	1		1
C106.3								2	2	3		1	1		1
C106.4								1	1	1		1	3		1
C106.5								1	3	2		2	1		1

22MC107	STRESS MANAGEMENT	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

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

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

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

	Total Hours:	**30**

Reference Books:

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

Web References:

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

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

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

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

Summative assessment based on Continuous Assessment	
Revised Bloom's Level	**Term End Assessment [60 marks]**
Remember	30
Understand	40
Apply	20
Analyse	10
Evaluate	-
Create	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C107.1								1	3			1	1		
C107.2								1	2	1		1	1		
C107.3								1	3	1		2	2		
C107.4								1	3	1		3	2		

22MC108	CONSTITUTION OF INDIA	2/0/0/0

Nature of Course : Theory

Pre Requisites   : Nil

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

Module 1   **10 Hours**

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

Module 2   **10 Hours**

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

Module 3   **10 Hours**

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

	Total Hours:	**30**

Text Books:

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

Reference Books:

1	Subhash. C. Kashyap, "Our Constitution: An Introduction to India's Constitution and Constitutional Law", National Book Trust, India, 5th Edition, 2019.
2	M. Laxmikanth, "Constitution of India", Cengage Learning India, 1st Edition 2018.

Web References:

1	https://unacademy.com/course/the-indian-constitution/NSKQ8XXQ
2	https://unacademy.com/goal/upsc-civil-services-examination-ias-preparation/KSCGY

Assessment Methods & Levels (based on Blooms' Taxonomy)

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

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	Assignment	10

Summative assessment based on Continuous Assessment	
Revised Bloom's Level	**Term End Assessment [60 marks]**
Remember	30
Understand	40
Apply	30
Analyse	-
Evaluate	-
Create	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C108.1						3	1	1	1			1	1	1	
C108.2						3	1	1	1			1	1	2	
C108.3						3	2	2	1			1	1	2	
C108.4						3	1	1	1			2	1	1	

22MC109	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2/0/0/0

Nature of Course : Theory

Pre Requisites : Nil

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

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:40)

Course Outcome	Bloom's Level	Assessment Component	Marks
C109.1	Remember	Quiz	10
C109.2	Understand	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	

22VA900	APPLICATION DEVELOPMENT USING FLUTTER	1/0/0/1
Nature of Course	Theory Practical	
Prerequisites	-	

Course Objectives:

1.	To be able to build any IOS and Android Application using Flutter.
2.	To learn how to code using dart programming and build beautiful, fast applications for all operating systems
3.	To understand the basics of Flutter including building a UI, using animations, and creating a database app.
4.	To effectively utilize fully-Customizable Flutter Widgets to make Native App Interfaces.

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

C900.1	Understand the principles of high quality, high-performance mobile applications across mobile operating systems	[U]
C900.2	Understand the architecture of the Flutter framework and develop all types of mobile applications using the Flutter framework.	[AP]
C900.3	Understand Android and iOS System	[U]
C900.4	Design mobile applications using android and flutter database concepts.	[AP]
C900.5	Acquire the ability to design and build apps on Android and iOS using only one programming language (Dart)	[AP]
C900.6	Learn all about Interactive App Development.	[U]

Course Contents:

Module 1:   **5 Hours**
Installation – Understanding why Flutter uses Dart- Flutter – Architecture of Flutter Application_ Introduction to Dart Programming, Dart Operators, Dart types and variables.

Module 2:   **5 Hours**
Dart Control Statements and Collections, Dart classes and constructors, Interfaces, Understanding Dart libraries and packages.

Module 3:   **5 Hours**
Introduction to Widgets, Flutter Animation, Animated Icon, Writing Android Specific Code Package.

	Total Hours:	**15**

Text Books:

1.	Alessandro Biessek, "Flutter for Beginners", Packt Publishing, September, 2019
2.	Marco L. Napoli, "Beginning Flutter: A Hands On Guide to App Development", Wiley Publications, October 2019.

Suggested Readings:

1.	https://flutter.dev/learn
2.	https://fluttercrashcourse.com/

Web References:

1.	https://www.youtube.com/watch?v=VPvVD8t02U8
2.	https://www.youtube.com/playlist?list=PLjxrf2q8roU3wk7CDw4RfV3mEwOJbjx1k
3.	https://www.youtube.com/watch?v=x0uinJvhNxI

Online Resources:

1.	https://www.tutorialkart.com/pdf/flutter.pdf
2.	https://www.freecodecamp.org/news/learn-flutter-full-course/

22VA901	RUBY ON RAILS	1/0/0/1

Nature of Course	Theory Practical
Prerequisites	C Programming

Course Objectives:

1.	To introduce Programming techniques based on object oriented programming
2.	To introduce the development of components and how they interact
3.	To make the students to develop standalone and web based applications
4.	To make the students to design client and server modules in programming

Course Outcomes:

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

C901.1	Understand the working of Ruby Scripts based on interpretation techniques	[U]
C901.2	Analyze the MVC framework which facilitates Rails execution	[AN]
C901.3	Interpret the behavior of objects and properties	[AP]
C901.4	Apply the concepts of Classes and way of organizing data	[AP]
C901.5	Establish control flow structures to solve complicated problems	[AP]
C901.6	Apply advanced data structures for access and maintenance of data	[AP]

Course Contents:

Module 1: Ruby Introduction **5 Hours**
The mechanics of writing Ruby program-Navigation of Ruby Installation-Interactive Ruby-method calls and Ruby objects-writing and saving the program-Feeding the program to Ruby-keyboard and file input-The layout of Ruby Source code-control flow techniques-repeating action with loops

Module 2: Objects and Classes **5 Hours**
Introduction to object oriented programming-unique identification of objects-Querying an object-sending messages to objects-required, optional and default valued arguments-local variables and variable assignment-classes and instances-getter and setter methods-attributes-class methods-constants-inheritance-modules

Module 3: Error handling and collections **5 Hours**
Error handling and exceptions-Scalar objects-working with strings-Numerical objects-Arrays-Hashes-Enumerable module-sorting collections-Regular expressions-Writing regular expressions-Regular expression techniques

	Total Hours:	**15**

Text Books:

1.	David A. Black, "Ruby for Rails", Dream Tech Press, 2006
2.	Elliot Smith, Rob Nichols, "Ruby on Rails Enterprise Application Development", Shroff Publishers and Distributers Pvt Ltd, 2008
3.	Michael Harti, "Ruby on Rails 2.3 tutorial", Addison-Wesley Professional, 2010

Suggested Readings:

1.	Tim Warren, "Ruby Programming for Beginners", Ingram Publishing, 2019
2.	David A. Black, "Ruby Programming", 2nd Edition, Dreamtech Press,2015

| 3. | Wintermeyer, "Learn Rails 5.2", Apress, 2019 |

Web References:

| 1. | https://www.tutorialspoint.com/ruby-on-rails/index.htm |
| 2. | https://www.javatpoint.com/ruby-on-rails-tutorial |

Online Resources:

| 1. | https://onlinecourses.swayam2.ac.in/aic20_sp37/preview |
| 2. | https://www.udemy.com/course/the-complete-ruby-on-rails-developer-course/ |

22VA130	EFFECTIVE COMMUNICATION SKILLS (MECH/MCT/AI&DS/CIVIL/CYBER/ECE/IT/EEE)	2/0/0/2

Nature of Course	E (Theory skill based)
Pre-Requisites	Basics of English Language

Course Objectives:

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

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

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

Course Contents:

Module I   **10 Hours**
Pre-Test - Vocabulary Building- Connecting Phrases- Exercises and **Activities-Conversation Practices-** Greetings-exchanging ideas - Asking for information - questioning techniques / answering techniques - Getting people to do things - requesting/agreeing/refusing – **Activity-Common Expressions** (Individual)- Talking about Favorites - Talk Show **Activity** - **Impromptu Speaking**- Personal Interest - Talking about Past Events and Future/Talking about Everyday Life (Family, Hobbies, Work, Travel and Current Events) – **Activity.**

Module II   **10 Hours**
Listening- Trials of a Good Listener- Listening to Texts, Listening for Specific Purpose-**Activity**- **21st Century Skills**– Communication with Critical Thinking and Creativity-Role Play-**Activity**-**Personality Development**- Manners and Etiquettes. Building Confidence and Developing Presentation Skills-**Activity**- **Singing a Song (Group)**- **Activity**.

Module III   **10 Hours**
Story Telling- Use of Charts and Graphs-**Activity -Persuasive Speech**- Handling Criticism-Justifying Opinions-Conflict-Resolution-Situational Role Play **Activity**--**News reading and Pronunciation**- **Activity** -**Satori**- Intuitive Approach-**Activity**-**Post Test.**

	Total Hours:	**30**

Text Books:

1	English and Soft skills Orient Black Swan Publishers (S. P. Dhanavel) 2010
2	Remedial English Grammar. F.T. Wood. Macmillan. 2007
3	On Writing Well. William Zinsser. Harper Resource Book. 2001
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.

Reference Books:

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

3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Web References:

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

Online Resources:

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

Summative assessment based on Continuous and End Semester Examination

Internal Components - 10

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C130.1										3			1	2	1
C130.2										3			1	2	1
C130.3										3	3		1	2	1
C130.4										3			1	2	1
C130.5										3			1	2	1