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 2020

(2021-2025 BATCH)

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.

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

KUNIAMUTHUR, COIMBATORE-641008

DEPARTMENT OF INFORMATION TECHNOLOGY

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.

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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 PO's to PEO's

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.

SEMESTER I							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY CUM PRACTICAL							
1.	21MA101	Engineering Mathematics I	2/1/2	5	4	50/50	BSC
2.	21CH101	Engineering Chemistry	3/0/3	6	4.5	50/50	BSC
3.	21EN101	Technical Communication Skills	2/0/2	4	3	50/50	HSMC
4.	21IT101	Python Programming	3/0/2	5	4	50/50	PCC
5.	21CS101	Application Development Practices	2/0/2	4	3	50/50	PCC
PRACTICAL							
6.	21ME111	Engineering Graphics	1/0/3	4	2.5	40/60	ESC
MANDATORY COURSE							
7.	21MC101	Mandatory Course – I (Induction Programme)	3 Weeks			0/100	MC
			Total	**28**	**21**	**700**	

SEMESTER II							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1.	21GE201	Universal Human Values	3/0/0	3	3	60/40	HSMC
2.	21CS201	C and Data Structures	3/0/0	3	3	60/40	PCC
THEORY CUM PRACTICAL							
3.	21MA201	Engineering Mathematics II	2/1/2	5	4	50/50	BSC
4.	21PH104	Physics	3/0/3	6	4.5	50/50	BSC
5.	21EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	50/50	ESC
PRACTICAL							
6.	21CS202	Data Structures Laboratory	0/0/3	3	1.5	40/60	PCC
7.	21ME103	Engineering Practices Laboratory	0/0/3	3	1.5	40/60	ESC
MANDATORY COURSE							
8.	21MC102	Mandatory Course II (Environmental Sciences)	2/0/0	2	0	0/100	MC
			Total	**30**	**21.5**	**800**	

SEMESTER III							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1.	21MA302	Mathematical Structures	3/1/0	4	4	60/40	BSC
THEORY CUM PRACTICAL							
2.	21IT301	Web Development using React	3/0/2	5	4	50/50	PCC
3.	21CS301	Operating Systems	3/0/2	5	4	50/50	PCC
4.	21CS302	Java Programming	3/0/2	5	4	50/50	PCC
5.	21CS303	Managing Data using RDBMS	3/0/2	5	4	50/50	PCC
6.	21AD302	Analysis of Algorithms	3/0/2	5	4	50/50	PCC
MANDATORY COURSE							
7.	21MCXXX	Mandatory Course-III	2/0/0	2	0	0/100	MC
			Total	**31**	**24**	**700**	

SEMESTER IV							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1.	21EC411	Digital Principles and System Design	3/0/0	3	3	60/40	ESC
2.	21MA404	Random Variable & Statistics	3/1/0	4	4	60/40	BSC
3.	21IT401	Computer Architecture	3/0/0	3	3	60/40	PCC
4.	21IT402	Software Testing using Selenium	3/0/0	3	3	60/40	PCC
5.	21CS402	Web Frameworks	3/0/0	3	3	60/40	PCC
6.	21AD403	Cloud Computing	3/0/0	3	3	60/40	PCC
PRACTICAL							
7.	21CS403	Web Frameworks Laboratory	0/0/3	3	1.5	40/60	PCC
8.	21AD404	Cloud Computing Laboratory	0/0/3	3	1.5	40/60	PCC
MANDATORY COURSE							
9.	21MCXXX	Mandatory Course-IV	2/0/0	2	0	0/100	MC
			Total	**27**	**22**	**900**	

SEMESTER V							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1.	21IT501	Formal Languages and Automata Theory	3/0/0	3	3	60/40	PCC
2.	21IT502	Data Communications and Computer Networks	3/0/0	3	3	60/40	ESC
3.	21EC511	Fundamentals of Data and Mobile Communications	3/0/0	3	3	60/40	ESC
4.	21XX0XX	Open Elective – I	3/0/0	3	3	60/40	OEC
5.	21IT9XX	Professional Elective-I	3/0/0	3	3	60/40	PEC
PRACTICAL							
6.	21XX9XX	Professional Elective-II	0/0/6	6	3	40/60	PEC
7.	21IT503	Data Communications and Computer Networks Laboratory	0/0/3	3	1.5	40/60	ESC
PROJECT WORK							
8.	21IT504	Mini Project	0/0/2	2	1	40/60	PW
MANDATORY COURSE							
9.	21MCXXX	Mandatory Course - V	2/0/0	2	0	0/100	MC
			Total	**28**	**20.5**	**900**	

SEMESTER VI							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1.	21IT601	Embedded Systems and Internet of Things	3/0/0	3	3	60/40	PCC
2.	21CS601	Principles of Compiler Design	3/0/0	3	3	60/40	PCC
3.	21CS602	Cryptography and Network Security	3/0/0	3	3	60/40	PCC
4.	21XX0XX	Emerging Elective - I	3/0/0	3	3	60/40	EEC
5.	21IT9XX	Professional Elective-III	3/0/0	3	3	60/40	PEC
PRACTICAL							
6.	21IT9XX	Professional Elective-IV	0/0/6	6	3	40/60	PEC
7.	21IT602	Embedded Systems and Internet of Things Laboratory	0/0/3	3	1.5	40/60	PCC
8.	21CS604	Compiler Design Laboratory	0/0/3	3	1.5	40/60	PCC
			Total	**27**	**21**	**800**	

SEMESTER VII							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1.	21IT701	Computational Biology	3/0/0	3	3	60/40	PCC
2.	21XX0XX	Open Elective-II	3/0/0	3	3	60/40	OEC
3.	21XX0XX	Emerging Elective-II	3/0/0	3	3	60/40	EEC
4.	21IT9XX	Professional Elective-V	3/0/0	3	3	60/40	PEC
5.	21IT9XX	Professional Elective-VI	3/0/0	3	3	60/40	PEC
THEORY CUM PRACTICAL							
6.	21IT702	Big Data Analytics	3/0/2	5	4	50/50	PCC
EMPLOYABILITY ENHANCEMENT SKILLS							
7.	21EES01	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	21IT801	Project	0/0/24	24	12	40/60	PW
				Total	**24**	**12**	**100**	

HUMANITIES AND MANAGEMENT COURSES (6 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	21EN101	Technical Communication Skills	2/0/2	4	3	HSMC
2.	21GE201	Universal Human Values	3/0/0	3	3	HSMC

BASIC SCIENCE COURSES (25 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	21MA101	Engineering Mathematics I	2/1/2	5	4	BSC
2.	21CH101	Engineering Chemistry	3/0/3	6	4.5	BSC
3.	21MA201	Engineering Mathematics II	2/1/2	5	4	BSC
4.	21PH104	Physics	3/0/3	6	4.5	BSC
5.	21MA302	Mathematical Structures	3/1/0	4	4	BSC
6.	21MA404	Random Variable & Statistics	3/1/0	4	4	BSC

ENGINEERING SCIENCE COURSES (18.5 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	21ME111	Engineering Graphics	1/0/3	4	2.5	ESC
2.	21ME103	Engineering Practices Laboratory	0/0/3	3	1.5	ESC

3.	21EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	ESC
4.	21EC411	Digital Principles and System Design	3/0/0	3	3	ESC
5.	21EC511	Fundamentals of Data and Mobile Communications	3/0/0	3	3	ESC
6.	21IT502	Data Communications and Computer Networks	3/0/0	3	3	ESC
7.	21IT503	Data Communications and Computer Networks Laboratory	0/0/3	3	1.5	ESC

PROFESSIONAL CORE COURSES (68.5 Credits)

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	21CS101	Application Development Practices	2/0/2	4	3	PCC
2.	21IT101	Python Programming	3/0/2	5	4	PCC
3.	21CS201	C and Data Structures	3/0/0	3	3	PCC
4.	21CS202	Data Structures Laboratory	0/0/3	3	1.5	PCC
5.	21CS301	Operating Systems	3/0/2	5	4	PCC
6.	21AD302	Analysis of Algorithms	3/0/2	5	4	PCC
7.	21CS303	Managing Data using RDBMS	3/0/2	5	4	PCC
8.	21IT301	Web Development using React	3/0/2	5	4	PCC
9.	21CS302	Java Programming	3/0/2	5	4	PCC
10.	21IT401	Computer Architecture	3/0/0	3	3	PCC
11.	21IT402	Software Testing using Selenium	3/0/0	3	3	PCC
12.	21AD403	Cloud Computing	3/0/0	3	3	PCC
13.	21CS402	Web Frameworks	3/0/0	3	3	PCC
14.	21CS403	Web Frameworks Laboratory	0/0/3	3	1.5	PCC
15.	21AD404	Cloud Computing Laboratory	0/0/3	3	1.5	PCC
16.	21IT501	Formal Languages and Automata Theory	3/0/0	3	3	PCC
17.	21IT601	Embedded Systems and Internet of Things	3/0/0	3	3	PCC
18.	21IT602	Embedded Systems and Internet of Things Laboratory	0/0/3	3	1.5	PCC
19.	21CS601	Principles of Compiler Design	3/0/0	3	3	PCC
20	21CS602	Cryptography and Network Security	3/0/0	3	3	PCC
21.	21CS604	Compiler Design Laboratory	0/0/3	3	1.5	PCC
22.	21IT701	Computational Biology	3/0/0	3	3	PCC
23.	21IT702	Big Data Analytics	3/0/2	5	4	PCC

PROFESSIONAL ELECTIVE COURSES

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
Software Development						
1.	21CS901	API Development using MVC Architecture	3/0/0	3	3	PEC
2.	21IT901	UI/UX Application Development	3/0/0	3	3	PEC
3.	21CS902	Cloud Services and Integration	3/0/0	3	3	PEC
4.	21IT902	Advanced Application Development	0/0/6	6	3	PEC
5.	21IT903	R Programming	3/0/0	3	3	PEC
6.	21IT904	Professional Readiness for Innovation, Employability and Entrepreneurship	0/0/6	6	3	PEC

7.	21IT905	Open Source Systems	3/0/0	3	3	PEC
8.	21IT906	Software Engineering and Design	3/0/0	3	3	PEC
9.	21AD906	App Development	0/0/6	6	3	PEC
Data Science and Computational Intelligence						
1.	21CS914	Fundamentals of Data Science	3/0/0	3	3	PEC
2.	21CS911	Artificial Intelligence and Machine learning	3/0/0	3	3	PEC
3.	21AD911	Statistics and Machine Learning	3/0/0	3	3	PEC
4.	21IT911	NLP with Predictive Analysis	3/0/0	3	3	PEC
5.	21IT912	Data Warehousing and Data Mining	3/0/0	3	3	PEC
6.	21IT913	Streaming Analytics	3/0/0	3	3	PEC
7.	21IT914	Cognitive Systems and Analytics	3/0/0	3	3	PEC
Networks & Security						
1.	21IT921	Cyber Security	3/0/0	3	3	PEC
2.	21AD921	Ethical Hacking	3/0/0	3	3	PEC
3.	21CS921	Cyber Threats and Vulnerabilities	3/0/0	3	3	PEC
4.	21AD922	Ethical Hacking and Auditing Frameworks	3/0/0	3	3	PEC
5.	21IT922	Wireless Sensor Networks and its Applications	3/0/0	3	3	PEC
6.	21IT923	Mobile Adhoc Networks	3/0/0	3	3	PEC
7.	21IT924	Blockchain Technology	3/0/0	3	3	PEC

OPEN ELECTIVE COURSES

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
1.	21IT001	Mobile Applications Development using Android	3/0/0	3	3	OEC
2.	21IT002	PHP and MySQL	3/0/0	3	3	OEC
3.	21IT003	Blockchain Essentials	3/0/0	3	3	OEC
4.	21IT004	Cloud and Virtualization	3/0/0	3	3	OEC
5.	21IT005	REST API using Spring Boot	0/0/6	6	3	OEC
6.	21IT006	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.	21IT008	Kotlin for Cross-platform Application Development	3/0/0	3	3	EEC
2.	21IT009	Extended Reality	3/0/0	3	3	EEC
3.	21IT011	Principles of Industry 4.0	3/0/0	3	3	EEC
Emerging Elective Courses – Stream 2						
4.	21IT007	Open-Source Deep Learning Frameworks	3/0/0	3	3	EEC
5.	21IT010	Explainable AI	3/0/0	3	3	EEC
6.	21IT012	Fog and Edge Computing	3/0/0	3	3	EEC

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

S. No	Course Code	Course Title	Credits	Category
1.	21EES01	Employability Enhancement Skills	2	EES

MANDATORY COURSES

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

VALUE ADDED COURSES

S.No	Course Code	Course Title	Credits	Category
1.	21VA900	Application Development using Flutter	1	VAC
2.	21VA901	Ruby on Rails	1	VAC

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

S. No	Stream	Credits / Semester								Credits	AICTE Norms
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities (HSMC)	3	3							6	**12**
2.	Basic Sciences (BSC)	8.5	8.5	4	4					25	**24**
3.	Engineering Sciences (ESC)	2.5	5.5		3	7.5				18.5	**29**
4.	Professional Core (PCC)	7	4.5	20	15	3	12	7		68.5	**49**
5.	Professional Electives (PEC)					6	6	6		18	**18**
6.	Open Electives (OEC)					3		3		6	**12**
7.	Emerging Elective (EEC)						3	3		6	
8.	Project Work (PW)					1			12	13	**15**
9.	Employability Enhancement Skills (EES)							2		2	
10.	Mandatory Course (MC)										**Non-Credit**
Total		21	21.5	24	22	20.5	21	21	12	**163**	
AICTE (CSE)		**17.5**	**20.5**	**23**	**22**	**21**	**22**	**18**	**15**		**159**

21MA101	ENGINEERING MATHEMATICS I *(COMMON TO MECH / MCT / CIVIL / ECE / EEE / CSE, IT / AI&DS)*	2/1/2/4

Nature of Course	J (Problem analytical)
Pre requisites	Concept of Differentiation and Matrices

Course Objectives:

1.	To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2.	To know about system of linear equations and its solution set and how to write down the coefficient matrix and augmented matrix of a linear system
3.	To familiarize with functions of several variables applicable in many branches of engineering.
4.	To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Recall the concepts of matrices, ordinary and partial derivatives.	[R]
C101.2	Express square matrix in the diagonal form.	[U]
C101.3	Solve systems of linear equations numerically and to find inverse matrices.	[AP]
C101.4	Apply numerical techniques effectively to analyse and visualize data to solve basic engineering-related problems.	[AP]
C101.5	Find the extreme values of the given functions to solve the engineering problems.	[AP]
C101.6	Find the solution of second and higher order differential equations connected with electric circuits and simple harmonic motion.	[AP]

Course Contents:

MATRICES **14 Hours**

Definition – Types of matrices – Characteristic equation – Eigenvalues and eigenvectors of a real matrices and their properties (statement only) – Cayley-Hamilton theorem (statement only) – Verification and application to find inverse and powers of real matrices – Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by Orthogonal transformation.

SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **16 Hours**

Newton-Raphson method – Fixed point iteration method – Gauss-Elimination method – Gauss-Jordan method – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigenvalue of a matrix by Power method and Jacobi method.

CALCULUS **18 Hours**

Concepts of limits and continuity – Functions of several variables – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion – Maxima and Minima – Method of Lagrangian multipliers – Ordinary differential equations – Higher order linear differential equations with constant coefficients –Euler Cauchy's equations – Applications of ODE: Solving electrical circuits and simple harmonic motion.

Lab Component

1. Entering row vector, column vector, accessing blocks of elements in MATLAB.
2. Entering matrices, to locate matrix elements and Correcting any entry through indexing in MATLAB.
3. Sum, product, transpose, inverse, determinant and rank of a matrices using MATLAB.
4. Eigenvalues and eigenvectors of a matrix using MATLAB.
5. System of linear equations in MATLAB using Gaussian elimination.
6. System of linear equations in MATLAB using matrix inverse method.
7. System of linear equations in MATLAB using linsolve.
8. First and second derivative of single variable functions using MATLAB.
9. Maxima and Minima of a function using MATLAB.
10. Higher Order Equations of constant coefficients using MATLAB.

Total Hours: (48+12)	**60**

Text Books:	
1.	G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 14th Edition, Pearson, Reprint, 2018
2.	Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.
3.	Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2018.
Reference Books:	
1.	Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
2.	Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2012.
3.	N.P.Bali and Dr.Manish Goyal, "A Text book of Engineering Mathematics" 9th Edition, Laxmi publications ltd, 2014.
Web References:	
1.	http://www.nptel.ac.in/courses/111105035
2.	http://www.nptel.ac.in/courses/122104017
3.	http://nptel.ac.in/courses/122102009
4.	http://nptel.ac.in/courses/111107063
Online Resources:	
1.	https://www.coursera.org/learn/linearalgebra2
2.	https://www.coursera.org/learn/differentiation-calculus
3.	https://www.coursera.org/learn/single-variable-calculus
4.	https://alison.com/courses/Algebra-Functions-Expressions-and-Equations

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

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory				
Formative assessment based on Capstone Model (8%)				
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)		Marks
C101.1	Remember	Component – I	Quiz	2
C101.2	Understand	Component - II	Assignment	2
C101.3	Apply	Component - III	Seminar	2
C101.4	Apply			
C101.5	Apply	Component - IV	Tutorial	2

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA1 [6 Marks]	CIA2 [6 Marks]	
Remember	30	30	20
Understand	50	40	50
Apply	20	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

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

21CH101	ENGINEERING CHEMISTRY *(COMMON TO ALL I YEAR B.E. / B.Tech.)*	3/0/3/4.5

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

Course Objectives:

1	To make the students conversant with water treatment, boiler feed water techniques.
2	To learn the effect of corrosion in materials and the methods for prevention of corrosion.
3	To understand the principles and applications of electrochemistry and to learn electroanalytical methods.
4	To understand the basic concepts, synthesis, and applications of nanomaterials.
5	To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules.
6	To understand the concepts of photophysical and photochemical processes in spectroscopy.

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

C101.1	Recall the requirements of water treatment procedures and boiler feed water for industries.	[R]
C101.2	Apply the various corrosion control techniques in real time industrial environments.	[AP]
C101.3	Understand the principle and working of reference electrodes and conductivity meters as an analyzer.	[U]
C101.4	Understand the basic concepts and applications of Nanochemistry.	[U]
C101.5	Use the knowledge of polymers, various energy sources and storage devices in engineering field.	[AP]
C101.6	Understand the principle and working of certain analytical techniques, and synthesis of some common drug molecules.	[U]

Course Contents:

Water Chemistry and Corrosion: **15 Hours**

Water treatment-characteristics of water-hardness-types and estimation by EDTA method with numerical problems. Boiler feed water–requirements-disadvantages of hard water. Domestic water treatment-disinfection methods (chlorination, Ozonation, UV treatment)-demineralization process–desalination-reverse osmosis. Corrosion-types–mechanism of dry and wet corrosion-galvanic corrosion-differential aeration corrosion-protective coatings-electroplating of gold-electroless plating of nickel.

Electrochemistry and Energy Sources: **15 Hours**

Electrochemical cells-electrolytic cell-reversible and irreversible cells - Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Nanochemistry-Basics-Comparison of molecules, nanomaterials and bulk materials; Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of nanomaterials in science and technology. Energy Sources-Fuel

cells (H_2-O_2). Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

Polymer Chemistry, Spectroscopic Techniques and Synthesis of Drug Molecules:

15 Hours

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

Field work:

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

Lab Components: (20 Hours)

1.	Estimation of hardness of water by EDTA method	[E]
2.	Estimation of alkalinity of water sample	[E]
3.	Determination of chloride content in given water sample	[E]
4.	Estimation of dissolved oxygen in water	[E]
5.	Potentiometry- determination of redox potentials and emf's	[E]
6.	Conductometric titration-mixture of acids vs NaOH	[E]
7.	Determination of strength of strong acid by pH metry	[E]
8.	Corrosion rate of mild steel in acid medium	[E]
9.	Electroplating of nickel over copper	[E]
10.	Spectrophotometry-Estimation of iron in water	[E]
11.	Separation of mixture of amino acids by thin layer chromatography	[E]
12.	Synthesis of Nylon 66	[E]
	Total Hours:	**75**

Understanding the concepts by simple Demonstrations/Experiments:

1.	To observe the hardness of given water sample by soap solution test
2.	To view the colour of the different medium of given water sample using litmus paper test
3.	To detect the chlorine content in tap water using simple chemical method
4.	To know the presence of dissolved oxygen in given water sample using glucose by redox principle
5.	To illustrate the rate of corrosion in steel nails using acid medium

Text Books:

1.	Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition, 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, C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994.

4.	Physical Chemistry, 11th Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018.
5.	Nanochemistry, 2nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013.
6.	N.Krishna Murthy, Vallinayagam D., "Engineering Chemistry" 3rd Edition, PHI Learning Pvt Ltd.,2014.
7.	Sunita Rattan, "A Text Book of Engineering Chemistry", Student Edition, SK Kataria Publishers, 2013.
8.	R.V.Gadag, A.Nithyananda Shetty "Engineering Chemistry" 3rd Edition PHI Learning Pvt Ltd., 2014.
Reference Books:	
1.	Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016.
2.	Liliya.,Bazylak.I., Gennady.E., Zaikov., Haghvi.A.K., "Polymers and Polymeric Composites" CRC Press,2014.
3.	Lefrou., Christine., Fabry., Pierre., Poignet., Jean-claude., "Electrochemistry - The Basics, with examples" 2012, Springer.
4.	Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012.
5.	Perez, Nestor, "Electrochemistry and Corrosion Science", Springer, 2016.
6.	Sengupta, Amretashis, Sarkar, Chandan Kumar, "Introduction to Nano: basics to Nanoscience and Nanotechnology", Springer Publisher, 2015.
7.	Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and Francis group, 2012.
Web References:	
1.	http://www.analyticalinstruments.in/home/index.html
2.	www.springer.com › Home › Chemistry › Electrochemistry
3.	https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry
4.	www.edx.org/
5.	https://www.ntnu.edu/studies/courses
6.	www.corrosionsource.com/
Online Resources:	
1 2 3 4 5 6	nptel.ac.in/courses/105104102/hardness.htm https://ocw.mit.edu/courses/chemistry nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf https://alison.com - Spectroscopic technique, Colorimetry https://ocw.mit.edu/courses/chemistry nptel.ac.in/courses/113108051

<table>
<tr><td colspan="8">Summative assessment based on Continuous and End Semester Examination</td></tr>
<tr><td colspan="7">Continuous Assessment (50%)</td><td>End Semester Examination (50%)</td></tr>
<tr><td colspan="3">CA 1
(10 Marks)</td><td colspan="3">CA 2
(10 Marks)</td><td>Practical Exam
(30 Marks)</td><td rowspan="3">Theory Examination (50 Marks)</td></tr>
<tr><td rowspan="2">SA 1
(6 Marks)</td><td colspan="2">FA 1</td><td rowspan="2">SA 2
(6 marks)</td><td colspan="2">FA 2</td><td rowspan="2">FA
(22 marks)</td><td rowspan="2">SA
(8 Marks)</td></tr>
<tr><td>Component -I
(2 marks)</td><td>Component -II
(2 marks)</td><td>Component -III
(2 marks)</td><td>Component -IV
(2 marks)</td></tr>
</table>

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory				
Formative assessment based on Capstone Model (8%)				
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)		Marks
C101.1	Remember	Component – I	Classroom or online Quiz	2
C101.2	Apply	Component - II	Group Assignment	2
C101.3	Understand	Component - III	Presentation	2
C101.4	Understand	Component – IV	Group Activities	2
C101.5	Apply			
C101.6	Understand			

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA1 [6 Marks]	CIA2 [6 Marks]	
Remember	30	30	20
Understand	50	40	50
Apply	20	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

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

21EN101	TECHNICAL COMMUNICATION SKILLS (MECH/MCT/IT/CIVIL/CSE)	2/0/2/3

Nature of Course	E (Theory skill based)
Pre-Requisites	Basics of English Language

Course Objectives:

1	To enhance learners' LSRW skills.
2	To develop effective communication skills.
3	To facilitate learners to acquire effective technical writing skills.
4	To prepare learners for placement and competitive exams.
5	To facilitate effective language skills for academic purposes and real-life situations

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

C101.1	Remember language skills for technical communication.	[U]
C101.2	Apply communication skills in corporate environment.	[AP]
C101.3	Understand and communicate effectively in personal and professional situation.	[AP]
C101.4	Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text.	[U]
C101.5	Apply technical writing skills to write letters, emails and prepare technical documents.	[AP]
C101.6	Apply language skills with ease in academic and real-life situations.	[AP]

Course Contents:

Listening and Speaking **17 Hours**

Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others - **Listening** to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions **Speaking**- Speaking about Giving Directions / Instruction - Talk about Preferences-Agree and Disagree - Giving Opinions - Speaking Practices by Giving Examples, Reasons and Extra Information- Short Talk on Business Topics- Non Verbal Communication- Presentation using Digital Tools- Power of Narrative- Leadership, Conflict and Persuasion.

Reading **13 Hours**

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

Writing and Grammar **15 Hours**

Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Placing an Order and Complaint Letter) - Email Writing – Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume Writing - Paragraph Writing – Proof Reading and Editing--Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart).

Parts of Speech- Tenses – Subject Verb Agreement - Sentence Structures - Connectives - Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal

Passive Voice - Vocabulary Building - Business Vocabulary -- Synonyms, Antonyms – British and American Words - One Word Substitution- Identifying Common Errors.

Lab Components

S.No	List of Experiments	RBT
1	Listening Comprehension	[E]
2	Pronunciation, Intonation, Stress and Rhythm	[E]
3	Common Everyday Situations: Conversations and Dialogues.	[E]
4	Formal Presentation	[E]
5	Group Discussion	[E]
6	Interview Skills	[E]
	Total Hours:	**60**

Text Books:

1	Practical English Usage. Michael Swan. OUP. 1995.
2	Remedial English Grammar. F.T. Wood. Macmillan.2007
3	On Writing Well. William Zinsser. Harper Resource Book. 2001
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.

Reference Books:

1	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Web References:

1	http://www.academiccourses.com/Courses/English/Business-English
2	https://steptest.in

Online Resources:

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

Summative assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)								**End Semester Examination (50%)**
CA 1 (10 Marks)			**CA 2 (10 Marks)**			**Practical Exam (30 Marks)**		**Theory Examination (50 Marks)**
SA 1 (6 Marks)	**FA 1**		**SA 2 (6 marks)**	**FA 2**		**FA (22 marks)**	**SA (8 Marks)**	
	Component -I (2 marks)	**Component -II (2 marks)**		**Component -III (2 marks)**	**Component -IV (2 marks)**			

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory				
Formative assessment based on Capstone Model (8%)				
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)**		**Marks**
C101.1	Understand	Component - I	Quiz	2
C101.2	Apply			
C101.3	Apply	Component - II	Impromptu speaking	2
C101.4	Understand			
C101.5	Apply	Component - III	Reading comprehension	2
C101.6	Apply	Component - IV	Group assignment	2

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (12%)**		**End Semester Examination (50%) [50 Marks]**
	CIA1 [6 Marks]	**CIA2 [6 Marks]**	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Summative assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	**Continuous Assessment (30%)**	
	FA (22 Marks)	**SA (8 Marks)**
Remember	20	20
Understand	40	40
Apply	40	40
Analyse	-	-
Evaluate	-	-
Create	-	-

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

COs	**Pos**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**K**	**l**	**1**	**2**	**3**
C101.1									2	3		2	1	2	1
C101.2									2	3		2	1	2	2
C101.3									2	3		2	1	2	1
C101.4										3		2	2	1	1
C101.5									2	3			2	2	1
C101.6									2	3		2	1	2	1
	3 Strongly agreed				2 Moderately agreed							1 Reasonably agreed			

21IT101	PYTHON PROGRAMMING *(COMMON TO CSE / IT / ECE / EEE / MCT)*	3/0/2/4
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

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

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Relate the general principles and good algorithmic problem Solving	[R]
C101.2	Demonstrate programs using simple python statements and expressions.	[U]
C101.3	Explain control flow and string concept in python for solving problems.	[U]
C101.4	Develop python programs using functions.	[AP]
C101.5	Construct compound data using python lists, tuples and dictionaries.	[AP]
C101.6	Develop python programs using files, exception, modules and packages.	[AP]

Course Contents:

ALGORITHMIC PROBLEM SOLVING, DATA, EXPRESSIONS, STATEMENTS: 15 Hours

Algorithms, Building Blocks of Algorithms (Statements, State, Control Flow, Functions), Notation (Pseudo Code, Flow Chart, Programming Language), Algorithmic Problem Solving, Simple strategies for developing algorithms (Iteration, Recursion). Illustrative Problems: Find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range. Python Interpreter and Interactive Mode; Values and Types: Int, Float, Boolean, String and List; Variables, Expressions, Statements, Tuple Assignment, Precedence of Operators, Comments; Modules and Functions, Function Definition and Use, Flow of Execution, Parameters and Arguments; Illustrative Programs: Exchange the values of two Variables, Circulate the values of n variables, distance between two points.

CONTROL FLOW, FUNCTIONS: 15 Hours

Conditionals: Boolean Values and Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); Iteration: State, While, For, Break, Continue, Pass; Fruitful Functions: Return Values, Parameters, Local and Global Scope, Function Composition, Recursion; Strings: String Slices, Immutability, String Functions and Methods, String Module; Lists as Arrays. Sets -Set Operations, Classes. Illustrative Programs: Sum an array of numbers.

LISTS, FILES, MODULES, PACKAGES: 15 Hours

Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters; Tuples: Tuple Assignment, Tuple as Return Value; Dictionaries:

Operations and Methods; Advanced List Processing - List Comprehension; Files and Exception: Text Files, Reading and Writing Files, Format Operator; Command Line Arguments, Errors and Exceptions, Handling Exceptions, Modules, Packages; Numpy and Numpy Operations, Pandas and pandas operations, Matplotlib: types of plots. Case study: Analyze the academic performance of students and plot a graph.	
Total Hours:	**45**

Laboratory Component:

S. No	List of Experiments
1.	Compute the GCD of two numbers.
2.	Find the square root of a number (Newton's method).
3.	Exponentiation (power of a number).
4.	Find the maximum of a list of numbers.
5.	Linear search and Binary search.
6.	Selection sort, Insertion sort.
7.	Merge sort.
8.	First n prime numbers.
9.	Multiply matrices.
10.	Programs that take command line arguments (word count).
11.	Plotting datasets.
12.	File handling and plotting.
Total Hours:	**30**

Text Books:

1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/).
2.	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3.	Tony Gaddis, "Starting out with Python'', 4th Edition, Addison Wesley, Pearson, 2017.

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 Pythonll", 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://www.programiz.com/python-programming
2.	https://www.fullstackpython.com/best-python-resources

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
Formative Assessment based on Capstone Model (8%)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**Marks**
C101.1	Remember	Assignment - 1	**2**
C101.2, C101.3	Understand	Quiz	**2**
C101.4	Apply	Assignment - 2	**2**
C101.5, C101.6	Apply	Case Study	**2**

Summative Assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Internal Assessment (12%)**		**End Semester Examination (50%) [50 Marks]**
	CIA 1 [6 Marks]	**CIA 2 [6 Marks]**	
Remember	20	15	20
Understand	30	35	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

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

Theory:

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

Practical:

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

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

21CS101	APPLICATION DEVELOPMENT PRACTICES *(COMMON TO CSE / IT)*	2/0/2/3
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

1.	To impart the knowledge of web application development platforms.
2.	To develop the front end user interface using HTML, CSS.
3.	To recognize the user experience design methodologies like Java script, JSON and JQuery for responsive web design.

Course Outcomes

Upon completion of the course, students shall have ability to

C101.1	Identify working model and learn basic web concepts to develop Static and Dynamic web pages.	[R]
C101.2	Create web pages that demonstrate proficiency in the use of HTML.	[AP]
C101.3	Present a professional document using Cascaded Style Sheets	[U]
C101.4	Use knowledge of HTML and CSS code to create personal and/or business websites following current professional and/or industry standards.	[AP]
C101.5	Apply static and dynamic web page design techniques to construct an interactive web page using Client side technologies.	[AP]
C101.6	Implement dynamic web page with validation and event handling mechanisms.	[AP]

Course Contents:

INTRODUCTION TO HTML **15 Hours**

Basic Web Concepts – Web based Client/Server model – Web Protocols – Working of web browser – Browser & Server Communication – Basics of HTML – Elements and Attributes of HTML – HTML Layouts – HTML forms – HTML Lists and Tables – HTML Media – Getting started with HTML5 – HTML Graphics

INTRODUCTION TO CSS **15 Hours**

Basics of CSS – HTML Style attributes – CSS Syntax – CSS Selectors – Three ways to insert CSS – Element based CSS – CSS Layouts – CSS Image Gallery – Gradients and Shadows – 2D and 3D transforms with CSS – CSS Pagination and Columns – Basics of Responsive UI Design – Basics of CSS frameworks

CLIENT SIDE PROGRAMMING **15 Hours**

Java Script: An introduction to JavaScript – Data Types – Conditionals and Loops – Functions – Classes and Objects – Inbuilt Methods – Arrays – Regular Expressions – Arrow Functions – Debugging in browsers – JS HTML DOM – JS Browser BOM – Introduction to AJAX and JSON – JS vs JQuery – Why JS Frameworks

Laboratory Component:		
S. No	**List of Experiments**	
1.	Design a web page using HTML basic tags	
2.	Develop web site with suitable contents and links	
3.	Design web pages using lists and tables	
4.	Build a web client-side Login, Registration form and Dashboard with dropdown menus.	
5.	Develop a HTML form and validation using HTML5 features.	
6.	Create a website using HTML □ To embed an image map in a web page. □ To fix the hot spots. □ Show all the related information when the hot spots are clicked.	
7.	Apply style specification in HTML page using CSS.	
8.	Simple programs using Java Script	
9.	Develop dynamic web application using HTML, CSS and JavaScript.	
10.	Develop responsive web application using JSON and JQuery	
	Total Hours:	**60**

Text Books:	
1.	Thomas a Powell, “HTML & CSS: The Complete Reference”, 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
2.	Russ Ferguson, “Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development”, Apress Publishers, 3rd Edition, 2019.
3.	Jon Duckett, “HTML and CSS: Design and build websites”, John Wiley & Sons, 2011.
4.	David Flanagan, “JavaScript: The Definitive Guide”, 5th Edition, O’Reilly, 2011
Reference Books:	
1.	Deitel Deitel Goldberg, “Internet and World Wide Web – How to program”, 5th Edition, Prentice Hall Publishers, 2012.
2.	Robert W Sebesta, “Programming the World Wide Web”, 7th Edition, Pearson Education Inc., 2014.
Web References:	
1.	https://developer.mozilla.org/en-US/docs/Web/HTML
2.	https://developer.mozilla.org/en-US/docs/Web/CSS
3.	https://developer.mozilla.org/en-US/docs/Web/JavaScript
Online Resources:	
1.	https://www.coursera.org/learn/html-css-javascript-for-web-developers
2.	https://online-learning.harvard.edu/subject/javascript

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

Assessment Methods & Levels (based on Blooms'Taxonomy) - Theory			
Formative assessment based on Capstone Model (8%)			
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)	Marks
C101.1	Remember	Quiz	2
C101.3	Understand	Assignment	2
C101.2 & C101.4	Apply	Case study, Seminar	2
C101.5 & C101.6	Apply	Group Assignment	2

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA1 [6 Marks]	CIA2 [6 Marks]	
Remember	20	20	20
Understand	30	30	30
Apply	40	40	40
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Summative assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	**Continuous Assessment (30%)**	
	FA (22 Marks)	**SA (8 Marks)**
Remember	10	10
Understand	30	30
Apply	40	40
Analyse	20	20
Evaluate	-	-
Create	-	-

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

21ME111	ENGINEERING GRAPHICS	1/0/3/2.5
Nature of Course	Practical application	
Pre-Requisites	Basic Drawing and Computer Knowledge	

Course Objectives:

1.	To know the method to construct the conic curves used in engineering applications.
2.	To develop an understanding of Isometric to orthographic views and vice versa.
3.	To learn the basic projection of straight lines and plane surfaces.
4.	To develop the imagination of solids inclined to one reference plane.
5.	To know the development of surfaces used in various fields.

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

C111.1	Understand the basic concepts of Engineering Graphics.	[U]
C111.2	Sketch isometric, orthographic projections and projection of lines and planes.	[AP]
C111.3	Develop lateral surfaces of solids including prisms and pyramids.	[AP]
C111.4	Construct projections of lines, planes, solids and isometric views using modelling software.	[A]

Course Contents:

Conic curves and special curves – Isometric projections, Isometric to orthographic projection-Orthographic to Isometric projection - Projection of lines and plane surfaces-Projection of solids-Development of surfaces-Introduction to perspective projection.

S.No	List of Experiments	CO Mapping	RBT
1	Introduction to drafting software.	C111.1	U
2	Construction of conic curves (Ellipse, Parabola and Hyperbola)	C111.1	U
3	Construction of special curves (Cycloid and Involutes)	C111.1	U
4	Isometric to orthographic projections – manual sketches	C111.2	Ap
5	Isometric to orthographic projections – software sketches	C111.4	A
6	Projection of lines - inclined to HP, VP and Both HP & VP	C111.4	A
7	Projection of plane surfaces (Hexagon, Pentagon and circle) – inclined to any one of the principle planes	C111.4	A
8	Projection of solids (Prism and Pyramid) – inclined to HP	C111.3	Ap
9	Projection of solids (Cone and Cylinder) – inclined to VP	C111.3	Ap
10	Development of surfaces (Prism, Pyramid, Cone and Cylinder)	C111.4	A
11	Introduction to perspective projection	C111.2	U

Total Hours: 45

Reference Books:

1	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2014.
2	K. V. Natarajan, “A Text Book of Engineering Graphics", Dhanalakshmi Publishers, 2018.
3	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2011.
4	Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2013.

Web References:	
1	http://nptel.ac.in/courses/112102101/
2	www.solidworks.com

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

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

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C111.1	3		1							3			2	1	1
C111.2	3		1							3			2	1	2
C111.3	3		1							3			2	1	2
C111.4	3		1							3			2	1	1

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21MC101	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 Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C101.1						3	3	3	3	3	3	3			1
C101.2						3	3	3	3	3	3	3			1
C101.3						3	3	3	3	3	3	3			1

21GE201	UNIVERSAL HUMAN VALUES *(COMMON TO ALL BRANCHES)*	3/0/0/3

Nature of Course	C (Theory Concept)
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 behaviour and mutually enriching interaction with Nature

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Understand about themselves and their surroundings (family, society, nature).	[U]
C201.2	Understand and to become more responsible in life, and in handling problems with sustainable solutions while keeping human relationships and human nature in mind.	[U]
C201.3	Apply sensitivity to their commitment towards what they have understood (human values, human relationship and human society).	[AP]
C201.4	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	[AP]
C201.5	Analyse between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	[AN]
C201.6	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in the nature.	[U]

Course Contents:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being - Harmony in Myself! 15 Hours

Purpose and motivation for the course. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical Facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.

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

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

Total Hours:	**45**

Text Books:	
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
Reference Books:	
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3	India Wins Freedom - Maulana Abdul Kalam Azad.
Web References:	
1	https://examupdates.in/professional-ethics-and-human-values/
2	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html
3	https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf
Online Resources:	
1	https://nptel.ac.in/courses/109/104/109104068/
2	https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b
3	https://www.thebalancecareers.com/life-skills-list-and-examples-4147222

Summative assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%)						End Semester Examination (60 %)
CA 1 (20 Marks)			CA 2 (20 Marks)			Theory Examination (60 Marks)
SA 1 (12 Marks)	FA 1		SA 2 (12 marks)	FA 2		
	Component -I (4 marks)	Component –II (4 marks)		Component -III (4 marks)	Component -IV (4 marks)	
Assessment Methods & Levels (based on Blooms' Taxonomy)						
Formative assessment based on Capstone Model (16%)						

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)		Marks
C201.1	Understand	Component - I	Group Discussion	4
C201.2	Apply	Component - II	Book Review	4
C201.3&4	Analyze	Component - III	Role Play	4
C201.5&6	Apply	Component - IV	Formal Presentation	4

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment		
	Continuous Assessment (24%)		End Semester Examination (60%) [60 Marks]
	CIA-I [12 marks]	CIA-II [12 marks]	
Remember	10	10	10
Understand	10	20	20
Apply	40	40	40
Analyse	40	30	30
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
C201.1	2	2	2			3	3	3	2	2		2	1	1	1
C201.2	2	2	2			3	3	3	2	2		2	1	1	1
C201.3	2	2	2			3	3	3	2	2		2	1	1	1
C201.4	2	2	2			3	3	3	2	2		2	1	1	1
C201.5	2	2	2			3	3	3	2	2		2	1	1	1
C201.6	2	2	2			3	3	3	2	2		2	1	1	1

21CS201	C AND DATA STRUCTURES *(COMMON TO CSE / IT)*	3/0/0/3

Nature of Course:	F (Theory Programming)

Course Objectives:

1	To learn the features of C
2	To handle functions, pointers, structures, unions and files using C
3	To manipulate linear and non-linear data structures
4	To explore the applications of linear and non-linear data structures
5	To familiarize the concepts of hashing.

Course Outcomes:

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

C201.1	Develop C programs for any real-world technical application using basic programming constructs, arrays and strings	[AP]
C201.2	Apply advanced features of C in solving problems	[AP]
C201.3	Design applications using sequential and random access file processing	[AP]
C201.4	Demonstrate operations like insertion, deletion, searching, traversing etc. on linear and non-linear data structures	[AP]
C201.5	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.	[AP]
C201.6	Choose appropriate data structure for any real world data set.	[A]

Course Contents:

C PROGRAMMING **15 Hours**

Basic Features: Introduction - Data Types – Variables – Operations – Expressions and Statements – Conditional and Iterative Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays- Strings.

Advanced Features: Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Storage classes - Preprocessor Directives.

LINEAR DATA STRUCTURES – LIST, STACK, QUEUE **15 Hours**

Abstract Data Types (ADTs) – List ADT – Array based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly linked lists – Application of lists – Polynomial Manipulation. Stack ADT – Operations – Applications – Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – Applications of queues.

NON-LINEAR DATA STRUCTURES **15 Hours**

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.

Total Hours:	**45**

Text Books:

1	Yashavant Kanetkar, “Let us C”, 15th Edition, BPB Publications, 2017
2	Reema Thareja, “Programming in C”, 2nd Edition, Oxford University Press, 2016.
3	Pradip Dey and Manas Ghosh, “Programming in C”, 2nd Edition, Oxford University Press, 2011.

4	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education India, 3rd Edition 2013.
Reference Books:	
1	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, University Press, 2008
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3	Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , “Data Structures and Program Design in C”, 2nd Edition, Pearson Education, 2007
5	Jean-Paul Tremblay and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2nd Edition, Tata McGraw-Hill, 1991.
6	Seymour Lipschutz, “Data Structures by Schaum series”, 2nd Edition, Tata McGraw Hill, 2013.
Web References:	
1	http://www.nptel.ac.in
2	https://visualgo.net/en
Online Resources:	
1	https://www.youtube.com/watch?v=-CpG3oATGIs
2	http://lcm.csa.iisc.ernet.in/dsa/dsa.html
3	http://utubersity.com/?page_id=878
4	http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
5	http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

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

Assessment Methods & Levels (based on Blooms’Taxonomy)			
Formative assessment based on Capstone Model (16%)			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)**	**Marks**
C201.1 & C201.2	Apply	Quiz & Assignments	4

C201.3 & C201.4	Apply	Case study	4
C201.5	Apply	Seminar	4
C201.6	Analyze	Group Assignment	4

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (24%)**		**End Semester Examination (60%) [60 Marks]**
	CIA1 [12 Marks]	**CIA2 [12 Marks]**	
Remember	20	20	20
Understand	30	20	20
Apply	50	50	50
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**
C201.1	3	3	3	2	3							2	2	2	2
C201.2	3	3	3	2	3							2	2	2	2
C201.3	3	3	3	3	3							2	2	2	2
C201.4	3	3	3	2	3							2	2	3	3
C201.5	3	3	3	3	3							3	3	2	2
C201.6	3	3	3	3	3							2	3	3	3

21MA201	ENGINEERING MATHEMATICS II (COMMON TO MECH / MCT / CIVIL / ECE / EEE / CSE / IT / AIDS)	2/1/2/4

Nature of Course	J (Problem analytical)
Pre requisites	Concepts of Differentiation and Integration.

Course Objectives:

1.	To gain knowledge in integrals, which are needed in engineering applications.
2.	To develop logical thinking and analytical skills in evaluating multiple integrals.
3.	To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines.
4.	To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Determine the area and volume by applying the techniques of double and triple integrals.	[R]
C201.2	Finding the values of integrals through different numerical methods.	[U]
C201.3	Differentiate and integrate a vector-valued functions to solve real world applications.	[AP]
C201.4	Calculate grad, div, curl and use Gauss, Stokes and Greens theorem to simplify the calculations of integrals.	[AP]
C201.5	Apply Laplace transform techniques in system modelling, digital signal processing, process control, solving boundary value problems.	[AP]
C201.6	Apply Laplace transform methods for solving linear differential equations.	[AP]

Course Contents:

INTEGRAL CALCULUS **18 Hours**

Definite integrals: Evaluation of definite integrals using Bernoulli's formula –Multiple Integrals: Double integration in Cartesian coordinates – Area as double integral –Change of order of Integration – Triple integration in Cartesian co-ordinates –Volume as triple integral – Beta and Gamma functions – Relation between Beta and Gamma Functions – Evaluation of Integrals using Beta and Gamma Functions – Numerical integration: Trapezoidal rule and Simpson's rule for single and double integrals.

VECTOR CALCULUS **14 Hours**

Vector differential operator – Gradient of a scalar point function - Directional derivatives – Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields – Simple problems – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (theorems statements only) – Simple applications involving cubes and rectangular parallelepipeds.

LAPLACE TRANSFORM **16 Hours**

Convergence of Laplace transform – Transform of some standard functions – Unit step function – Unit Impulse function – Properties – Initial and final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Application of Laplace transform for solving second order ordinary differential equation.

Lab Components:

1. Double integrals evaluation in cartesian coordinates using MATLAB.
2. Triple integral calculations using MATLAB in cartesian and cylindrical coordinates.
3. Double integral evaluation in MATLAB by Trapezoidal rule.
4. Evaluation of gradient, curl and divergence in MATLAB.
5. Line integral over a vector field using MATLAB
6. Applying Green's theorem to solve integrals in MATLAB.
7. Relation between Laplace transform of function and its derivative using MATLAB.
8. Laplace transform of Dirac delta and Heaviside functions in MATLAB.
9. Solving Differential Equations in MATLAB using Laplace Transform.
10. Inverse Laplace Transform of symbolic expressions using MATLAB.

Total Hours: (48+12)	**60**

Text Books:	
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14th Edition, Pearson, Reprint, 2018.
2	Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.
3	Grewal. B.S, "Higher Engineering Mathematics", 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 Text book of Engineering Mathematics" 9th Edition, Laxmi publications Ltd, 2014.
Web References:	
1	http://nptel.ac.in/video.php?subjectId=122107037
2	http://nptel.ac.in/courses/122107036/
3	http://nptel.ac.in/video.php?subjectId=117102060
Online Resources:	
1	https://www.coursera.org/learn/pre-calculus
2	https://www.coursera.org/learn/linearalgebra1
3	https://alison.com/courses/Advanced-Mathematics-1
4	https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x.

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

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory				
Formative assessment based on Capstone Model (8%)				
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)**		**Marks**
C201.1	Remember	Component – I	Quiz	2
C201.2	Understand	Component - II	Assignment	2
C201.3	Apply	Component - III	Seminar	2
C201.4	Apply			
C201.5	Apply	Component - IV	Tutorial	2

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (12%)**		**End Semester Examination (50%) [50 Marks]**
	CIA1 [6 Marks]	**CIA2 [6 Marks]**	
Remember	30	30	20
Understand	50	40	50
Apply	20	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

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

21PH104	PHYSICS *(COMMON TO CSE / IT / AI&DS)*	3/0/3/4.5

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

Course Objectives:

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

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

C104.1	Recall and interpret the basic concepts of lasers and various types of optical fibers for articulating in engineering applications.	[R]
C104.2	Describe and conduct experiments in photonic materials.	[U]
C104.3	Acquire basic understanding and fundamental concepts of superconductors.	[R]
C104.4	Discuss the dual nature of radiation and matter.	[U]
C104.5	Solve Schrodinger's equations on finite and infinite potential well problems.	[AP]
C104.6	Apply quantum idea for understanding the working of quantum computing.	[AP]

Course Contents:

Laser and Fiber optics **15 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 – 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 supermacy, differences in quantum and classical computation.

Lab Component		30 Hours
1	Particle size determination and measurement of d-spacing in CD using Laser.	[U]
2	Determination of wavelength, angle of divergence and coherence length of laser source.	[U]
3	Determination of numerical aperture and acceptance angle parameter of optical fiber using Laser source.	[U]
4	Characteristics curves of solar cell.	[U]
5	Characteristics curve of light dependent resistor (LDR).	[U]
6	Determination of bandgap of semiconductor.	[U]
7	Determination and verification of Stefan law.	[U]
8	Determination of Planck's constant using electroluminescence.	[U]
9	Determination of entangled photons using spectrometer.	[U]
10	Determination of wavelength of mercury spectrum – Spectrometer	[U]
	Life Skills Experiments	
1	How does a fuel (gas/liquid) pump nozzle shut off?	
2	How does a circuit breaker work?	
3	How to Check Earthing at Home?	
	Total Hours: (45+30)	**75**

Text Books:	
1	Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2016.
2	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11th Edition, Wiley, 2018.
3	Eleanor Rleffel and Wolfgang Polak, "Quantum computing a gentle introduction", 1st Edition, The MIT press, 2012.
Reference Books:	
1	William T. Silfvast "Laser Fundamentals" Cambridge University Press, 2012
2	Fedor Mitschke "Fiber Optics physics and Technology", 2nd Edition, Springer, 2017.
3	Chakrabarti P. "Optical Fiber Communication", McGraw Hill Education, 2015.
4	Kasap**,** Safa**,** Capper, "Handbook of Electronic and Photonic Materials" 2nd Edition, Springer, 2017.
5	Balkan**,** Naci, Erol**,** Ayşe, "Semiconductors for Optoelectronics", 1st Edition Springer, 2020.
6	Bhattacharya D. K. and Poonam Tandon, "Engineering Physics", Oxford University press, 2014
7	David J. Griffiths, "Introduction to Quantum Mechanics", 2nd Edition, Cambridge university press, 2017.
8	Chris Bernhardt, "Quantum Computing for Everyone" The MIT press, 2019

Web References/Online Resources

1	https://www.eatm.in/upload/srit__unit_i_laser.pdf
2	http://www.crectirupati.com/sites/default/files/lecture_notes/OFC%20NOTES.pdf
3	https://ocw.mit.edu/courses/materials-science-and-engineering/3-46-photonic-materials-and-devices-spring-2006/lecture-notes/
4	https://nptel.ac.in/courses/115/101/115101012/
5	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-763-applied-superconductivity-fall-2005/lecture-notes/
6	http://wcchew.ece.illinois.edu/chew/course/QMALL20121005.pdf
7	https://nptel.ac.in/courses/115/101/115101107/
8	https://www.technologyreview.com/2019/01/29/66141/what-is-quantum-computing/
9	https://www.quantum-inspire.com/kbase/what-is-a-qubit/
10	https://www.cl.cam.ac.uk/teaching/0910/QuantComp/notes.pdf

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

Assessment Methods & Levels (based on Blooms'Taxonomy) - Theory				
Formative assessment based on Capstone Model (8%)				
Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)		Marks
C104.1	Remember	Component – I	Quiz	2
C104.2	Understand	Component - II	Assignment	2
C104.3	Remember	Component - III	Seminar	2
C104.4	Understand			
C104.5	Apply	Component - IV	Tutorial	2
C104.6	Apply			

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment (12%)		End Semester Examination (50%) [50 Marks]
	CIA1 [6 Marks]	CIA2 [6 Marks]	
Remember	30	30	20
Understand	50	40	50
Apply	20	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C104.1	1								1			1	3	2	2
C104.2	2	1		3					1			1	3	2	1
C104.3	2	1							1			1	3	2	1
C104.4	2	1							1			1	3	2	1
C104.5	3	2	1						1			1	3	2	2
C104.6	3	3	1						1			1	3	2	1

21EE111	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING *(COMMON TO CSE / MECH / CIVIL / IT)*	3/0/2/4

Nature of Course: G (Theory analytical)

Course Objectives:

1.	To equip students with a basic understanding of Electrical circuits
2.	To learn the working principle of transformers
3.	To understand the DC and AC Machine working principles and to have a knowledge on selection of machine for specific types of applications.
4.	To give a comprehensive exposure to electrical installations.
5.	To equip students with an ability to understand basics of analog and digital electronics.

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	Understand the working principle of single phase and three phase transformers.	[U]
C111.3	Understand the working principle of DC and AC machines.	[U]
C111.4	Utilize the basic components for electrical installations.	[AP]
C111.5	Understand the basic concepts of Analog and Digital Electronics.	[U]

Course Contents:

DC Circuits and AC Circuits **20 Hours**

DC Circuits - Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage law, analysis of simple circuits with dc excitation, Mesh, Nodal Analysis Superposition, Thevenin's Theorem, Maximum power transfer theorem and Norton's Theorem.

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, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

Electrical Machines and Installations **15 Hours**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections (Qualitative only). Construction and working principle of DC motor. Construction and working principle of Synchronous motor and three phase Induction motor. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption.

Basics of Analog and Digital Electronics **10 Hours**

Semiconductor, PN junction diode, Zener diode, rectifier- Half wave, full wave and Bridge rectifier, Introduction to Number system, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates.

Total Hours:	**45**

Lab Component

1.	Familiarization of Electrical Elements, Sources, Measuring Devices and Verification of ohm's law	C111.1	[R]
2.	Estimation of voltage and current by KVL and KCL in Electric Circuits	C111.1	[U]
3.	Determination of mesh current and node voltage by Mesh and Nodal Analysis	C111.1	[U]

4.	Application of Superposition theorems, thevenin's and maximum power transfer theorem in electrical circuits	C111.1	[AP]
5.	Measurement of three phase power	C111.2	[A]
6.	Demonstration of cut-out sections of machines: dc machine (Commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine	C111.3	[U]
7.	Load test on dc shunt motor.	C111.3	[AP]
8.	Demonstration of components of LT Switch Gears	C111.4	[U]
9.	Construction of bridge rectifier with and without filters	C111.5	[U]
10.	Verification of logic gates.	C111.5	[R]
			Total Hours: 30

Text Books:	
1	Fitzgerald. A.E., Charles KingselyJr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 6th Edition 2015.
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.
5	M. Morris Mano, 'Digital Logic and Computer Design', Prentice Hall of India, 6th Edition, 2017.
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, 5th Edition 2012.
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, 'Electronic Devices and Circuits', Pearson Education, 6th Edition, 2019.
Web References:	
1	http://nptel.ac.in/course.php?disciplineId=108
2	https://ocw.mit.edu/courses/find-bytopic/#cat=engineering&subcat=electricalengineering&spec=electricpower
3	https://nptel.ac.in/video.php?subjectId=117103063
4	https://onionesquereality.wordpress.com/.../more-video- lectures-iit-open
5	https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf
Online Resources:	
1	https://www.edx.org/course/electricity-magnetism-part-1-ricex-phys102-1x-1
2	https://www.mooc-list.com/course/fundamentals-electrical-engineering-coursera
3	https://nptel.ac.in/course.php

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

	Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory			
	Formative assessment based on Capstone Model (8%)			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)**		**Marks**
C111.1	Analyze	Component - I	Assignment	**2**
C111.2	Understand	Component - II	Tutorial	**2**
C111.3	Understand	Component - III	Quiz	**2**
C111.4	Apply	Component - IV	Simulation	**2**
C111.5	Understand			

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (12%)**		**End Semester Examination (50%) [50 Marks]**
	CIA1 [6 Marks]	**CIA2 [6 Marks]**	
Remember	10	10	10
Understand	10	30	30
Apply	40	50	30
Analyse	40	10	30
Evaluate	-	-	-
Create	-	-	-

Summative assessment based on Continuous and End Semester Examination - Practical		
Bloom's Level	**Continuous Assessment (30%)**	
	FA (22 Marks)	**SA (8 Marks)**
Remember	10	10
Understand	30	30
Apply	20	20
Analyse	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
C111.1	2	1			2							2	3	1	2
C111.2	3	3	2	2	2							2	3	1	2
C111.3	3	2	1	1	2							2	3	1	2
C111.4	3	3	2	2	2							2	3	1	2
C111.5	2	1			2							2	3	1	2
1	**Reasonably Agreed**				**2**	**Moderately Agreed**					**3**	**Strongly Agreed**			

21CS202	DATA STRUCTURES LABORATORY *(COMMON TO CSE / IT)*	0/0/3/1.5

Nature of Course:	D (Practical Programming)

Course Objectives:

1.	To write C programs using functions, pointers, structures and unions.
2.	To access files using C.
3.	To implement linear and tree data structures.
4.	To introduce concepts of hashing.

Course Outcomes:

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

C202.1	Develop C programs using basic programming constructs, arrays and strings	[AP]
C202.2	Apply advanced features of C in solving problems	[AP]
C202.3	Demonstrate the file operations on binary and text files	[AP]
C202.4	Write functions to implement linear and tree data structure operations in C and present the data flow neatly	[AP]
C202.5	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval	[AP]
C202.6	Identify, implement and use appropriate linear data structures for accessing elements in the given data set and document the process	[A]

Course Contents:

1. Practice of C Programming using Branching and Iterative constructs.
2. Programs using Functions
3. Programs using arrays and strings.
4. Programs using Structures and Pointers.
5. Programs using Files.
6. Implementation of Singly, doubly and Circular Linked List.
7. Implementation of Stack using Arrays
8. Implementation of Stack using Linked List.
9. Implementation of Stack applications.
10. Implementation of Queue using Arrays
11. Implementation of Queue using Linked List.
12. Implementation of Priority Queue.
13. Implementation of Queue applications.
14. Implementation of Binary Search Tree.
15. Implementation of hashing techniques

Total Hours:	**45**

Text Books:

1	Yashavant Kanetkar, “Let us C”, 15th Edition, BPB Publications, 2017
2	Reema Thareja, “Programming in C”, 2nd Edition, Oxford University Press, 2016
3	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education India, 3rd Edition 2013.
4	Pradip Dey and Manas Ghosh, “Programming in C”, 2nd Edition, Oxford University Press, 2011.

Reference Books:

1	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, University Press, 2008
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.

3	Robert Kruse, C.L.Tondo, Bruce Leung, ShashiMogalla , “Data Structures and Program Design in C”, 2nd Edition, Pearson Education, 2007
5	Jean-Paul Tremblay and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2nd Edition, Tata McGraw-Hill, 1991.
6	Seymour Lipschutz, “Data Structures by Schaum series”, 2nd Edition, Tata McGraw Hill, 2013.
Web References:	
1	http://www.nptel.ac.in
2	https://visualgo.net/en
Online Resources:	
1	http://lcm.csa.iisc.ernet.in/dsa/dsa.html
2	http://utubersity.com/?page_id=878
3	http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
4	https://www.youtube.com/watch?v=-CpG3oATGIs

Summative assessment based on Continuous and End Semester Examination			
Bloom’s Level	**Continuous Assessment (60%)**		**End Semester Examination (40%)**
	FA (45 Marks)	**SA (15 Marks)**	**Practical Examination (40 Marks)**
Remember	-	-	-
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**
C202.1	3	3	3	2	3				2	2		3	2	2	2
C202.2	3	3	3	2	3				2	2		3	2	2	2
C202.3	3	3	3	3	3				2	2		3	2	2	2
C202.4	3	3	3	2	3				2	2		3	2	2	2
C202.5	3	3	3	3	3				2	2		3	3	2	2
C202.6	3	3	3	3	3				2	2		3	3	2	2

21ME103	ENGINEERING PRACTICES LABORATORY	0/0/3/1.5
Nature of Course	Practical Application	
Pre-Requisites	Nil	

Course Objectives:

1.	To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry.
2.	To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting.

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

C103.1	Identify and solve the basic engineering problems at home and in workplace.	[AP]
C103.2	Develop the surfaces and make simple components like tray and funnel.	[AP]
C103.3	Make simple metal joints using welding equipment and wooden joints using carpentry tools.	[AP]
C103.4	Prepare pipe connections and sand moulds.	[AP]
C103.5	Understand the fundamentals of hot forging and injection moulding.	[U]
C103.6	Examine and troubleshoot electrical and electronic circuits.	[A]

Course Contents:

GROUP A (CIVIL & MECHANICAL)

Manufacturing Methods –Sheet metal operations - Welding - arc welding, gas welding, Study of TIG & MIG welding. Study of foundry, Demonstration of Smithy and Injection moulding - Carpentry work using power tools - Plumbing components and pipelines

List of Experiments:

S.No	List of Experiments	CO Mapping	RBT
1	Preparation of butt joints and lap joints using arc welding	C103.3	[AP]
2	Sheet metal Forming and Bending, Model making – Trays and funnels.	C103.2	[AP]
3	Preparation of wooden joints by sawing, planning and cutting.	C103.3	[AP]
4	Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.	C103.4	[AP]
5	Demonstration of foundry operations like mould preparation for solid and split piece pattern.	C103.4	[U]
6	Demonstration of Smithy operations	C103.5	[AP]
7	Demonstration of assembly of pump / Demonstration of Injection moulding	C103.5	[AP]

GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING)

List of Experiments:

Basic Circuit Elements: Resistor, inductor, capacitor. Introduction to measuring equipments: Moving iron meter, moving coil meter, Wattmeter, Energy meter, CRO, Multi-meter. Digital logic circuits, PCB design, fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent lamp, iron box, mixer grinder, study of FM radio and mobile phone.

S.No	List of Experiments	CO Mapping	RBT
1	Study and identification of electronic components with specification.	C103.6	[U]
2	Testing of CRO and Electronic components using Multimeter.	C103.6	[A]
3	Generation and measurement of signals using CRO.	C103.6	[A]

4	Familiarisation of digital basic gate IC's.	C103.6	[AP]
5	Soldering practice-components devices and circuits- using general purpose PCB.	C103.6	[AP]
6	Demonstration of meters and electrical components.	C103.6	[AP]
7	Safety precautions with electrical components.	C103.6	[AP]
8	Residential house wiring.	C103.6	[A]
9	Measurement of power and energy.	C103.6	[A]
10	Trouble shooting of electrical equipments.	C103.6	[A]
		Total Hours:	**45**

Reference Books:

1	Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint).
2	Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014.
3	Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi,2012.
4	D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
5	E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Web References:

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

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (60%)		End Semester Examination (40%)
	FA (45 Marks)	SA (15 Marks)	Practical Examination (40 Marks)
Remember	10	10	10
Understand	10	10	10
Apply	40	40	40
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

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

COs	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	1	2	3
C103.1	3	3			3								1	2	1
C103.2	3	2			2								1	2	1
C103.3	3	2			2								1	2	1
C103.4	3	2			2								1	2	1
C103.5	3	2			2								1	2	1
C103.6	3	2			2								1	2	1
	3 Strongly agreed				2 Moderately agreed							1 Reasonably agreed			

21MC102	ENVIRONMENTAL SCIENCES	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Basics in Environmental Studies	

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

Module 1: Natural Resources **10 Hours**

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

Module 2: Environmental Pollutions **10 Hours**

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

Module 3: Social issues and the Environment **10 Hours**

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

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”, Third Edition, Pearson Education, 2014.
Web References:	
1	http://nptel.ac.in/courses/104103020/20
2	http://nptel.ac.in/courses/120108002
3	http://nptel.ac.in/courses/122106030
4	http://nptel.ac.in/courses/120108004/
5	http://nptel.ac.in/courses/122102006/20
Online Resources:	
1	https://www.edx.org/course/subject/environmental-studies
2	www.environmentalscience.org

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

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

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

Summative assessment based on Continuous Assessment

Revised Bloom’s Level	Term End Assessment [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
C102.1						2	2						2		
C102.2						2	2						2		
C102.3						2	2							2	
C102.4						3	3						2		
C102.5						3	3						2		

21MA302	MATHEMATICAL STRUCTURES *(COMMON TO CSE/ IT/ AI & DS)*	3/1/0/4

Nature of Course	B (100% Analytical)
Prerequisites	-

Course Objectives:

1.	To study the concepts needed to test the logic of a program.
2.	To learn the working on class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
3.	To use number theory in computer networks and security.
4.	To acquire thorough knowledge of fundamental notions from lattice theory and properties of lattices.

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

C302.1	Recall the basic concepts of logic, Sets, Relations, Functions and Number theory.	[R]
C302.2	Acquire critical thinking skills by understanding the logical structure of the language.	[U]
C302.3	Use the concepts of Discrete Mathematics in software development and hardware design.	[AP]
C302.4	Demonstrate the fundamental Concepts of sets, relations, mathematical functions and all of its properties.	[AP]
C302.5	Apply discrete mathematics in formal representation of various computing constructs and algebraic structures. Apply Euclid's algorithm and backwards substitution.	[AP]
C302.6	Apply integrated approach to number theory.	[AP]

Module 1: Propositional and Predicate Calculus **20 Hours**

Propositional Calculus: Basic concepts – Propositions - Connectives– Truth tables – Tautologies and Contradictions –Contra positive – 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- **Counting**: Permutations and Combinations.

Module 3: Lattices and Number Theory **20 Hours**

Lattices: Partially ordered sets - Hasse diagram - Lattices and their properties - **Number Theory:** Division algorithm -Base-b representations- Number patterns -Prime and composite numbers-GCD-Euclidean algorithm-Fundamental theorem of arithmetic-LCM-Wilson's Theorem-Fermat's Theorem-Tau and Sigma Function.

Total Hours:	**60**

Text Books:	
1	Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011
2	Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 7th Edition, 2017.
3	Koshy. T, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2nd Edition, 2007.
Reference Books:	
1	Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, New Delhi, 5th Edition, 2019.
2	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Pearson Education Pvt Ltd., 6th Edition, 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

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 – C302.6	Apply	Tutorial	20
C302.3 – C302.6	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	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	2	1										3	2	1
C302.2	2	2	2										3	2	1
C302.3	3	3	3										3	2	1
C302.4	2	2	2										3	2	1
C302.5	2	2	2										3	2	1
C302.6	2	2	2										3	2	1

21IT301	WEB DEVELOPMENT USING REACT	3/0/2/4
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

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

Course Outcomes

Upon completion of the course, students shall have ability to

C301.1	Demonstrate the client-side JavaScript application development and the React library.	[U]
C301.2	Illustrate the single page applications in React.	[U]
C301.3	Utilize the various React features including components and forms.	[AP]
C301.4	Show the functionality of front-end UI applications using React.	[R]
C301.5	Apply CSS for designing responsive React applications.	[AP]
C301.6	Identify the use Redux-Redux and Axios package.	[AP]

Course Contents:

Module - I: **15 Hours**

JavaScript Essentials, How JavaScript works, Event loop, Stack, Heap and Queue, Node.js Fundamentals, Introduction to Node.js, Why Node.js?, Traditional Programming Limitations, React Introduction, Overview of frameworks, libraries for client side Web applications, Understanding “what” and “why” React, React Component Demonstration using code pen, Environment Setup for React Application. Understanding NPM commands, Using VS Code, VS Code extensions for ES6, React(formatting and check styles), Hello world app in React, React Essential Features and Syntax, React App Project Directory Structure, Overview of Webpack, Babel, React Component Basic, Create React Component, Understanding JSX, Limitations of JSX, Working with Components and Reusing Components.

Module - II: **15 Hours**

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

Module – III: **15 Hours**

React Projects, Demo apps, HTTP Requests/Ajax Calls, HTTP Requests in React, Introduction of Axios package, HTTP GET Request, fetching & transforming data, HTTP POST, DELETE, UPDATE, 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:

S. No.	List of Experiments
1	Create a Stateless Functional Component
2	Create a Stateful Class Component
3	Implementation of Conditional Rendering using Class Component
4	Implementation of Communication (Parent-child) between Components
5	Create material UI Card using React
6	Design a Custom Navigation bar using React
7	Implementation of React component to handle HTTP requests
8	Implementation of a Dropdown component using React
9	Implementation of Routing in React
10	Implementation of FORM validation in React
Total Hours:	**30**

Text Books:

1.	Robin Wieruch, “The Road to React”, 2022 Kindle Edition.
2.	Alex Banks,Eve Porcello. “Learning React: Modern Patterns for Developing React Apps”, O'Reilly Media,2020.
3.	Adam Bouch, “React and React Native”, Packt Publishing, 3rd Edition, 2020.
4.	Kirupa Chinnathambi , “Learning React : A Hands-On Guide to Building Web Applications Using React and Redux”, Pearson Education, Second Edition,2018.

Reference Books:

1.	Adam Boduch, Roy Derks “React and React Native: A Complete Hands-on Guide to Modern Web and Mobile Development with React.js”, Packt Publishing, 2020.

2.	Carlos Santana Roldan, “React Cookbook”, Packt Publishing, 2018.
3.	Lionel Lopez, “React: Quickstart Step-by-step Guide to Learning React Javascript Library (React.js, Reactjs, Learning React Js, React Javascript, React Programming)”, CreateSpace Independent Publishing Platform,2017.
Web References:	
1.	https://www.coursera.org/learn/front-end-react
2.	https://www.geeksforgeeks.org/full-stack-development-with-react-node-js-live/
3.	https://www.edx.org/learn/front-end-web-development
4.	https://www.w3schools.com/REACT/DEFAULT.ASP
Online Resources:	
1.	https://reactjs.org/
2.	https://www.youtube.com/watch?v=3HMtarQAt3A
3.	https://frontendmasters.com/guides/front-end-handbook/2018/what-is-a-FD.html
4.	https://www.youtube.com/watch?v=HT82p_re-EY

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]**
C301.1	Understand	Assignment - 1	**20**
C301.2,	Understand	Quiz	**20**
C301.3 C301.4	Apply, Remember	Assignment - 2	**20**
C301.5, C301.6	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	10	10
Understand	10	10	15
Apply	70	80	75
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	20	10	10
Apply	70	80	80
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 Outcomes (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C301.1	3	3	3	2	2				2	2	2	2	3	3	2
C301.2	3	3	3	2	2				2	2	2	2	3	2	3
C301.3	3	3	3	3	2				3	2	2	2	3	2	2
C301.4	3	3	3	2	3				2	2	2	2	3	3	3
C301.5	3	3	3	2	3				2	2	2	2	3	3	3
C301.6	3	3	3	2	3				3	2	3	2	2	2	2

21CS301	OPERATING SYSTEMS *(Common to CSE, IT)*	3/0/2/4

Nature of Course:	G (Theory Analytical)
Pre requisites:	C and Data Structures

Course Objectives:

1	To describe the structure and functions of Operating System.
2	To describe the mechanisms of Operating Systems to handle processes and threads.
3	To explore the various scheduling policies and to provide solutions for critical section and deadlock problems
4	To identify the mechanisms involved in Memory management and its schemes.
5	To analyze the File systems, Device Management and security issues.

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

C301.1	Identify the basic concepts and operations of operating systems.	[U]
C301.2	Illustrate the Process management concepts including scheduling, Inter process communication, deadlocks and multithreading in real world problems.	[AP]
C301.3	Apply the concepts of memory management including Virtual Memory and Page Replacement to the issues that occur in Real time applications.	[AP]
C301.4	Analyze the concepts related to file system interface and implementation.	[A]
C301.5	Describe the disk management, system protection and security mechanisms	[U]

Course Contents

MODULE 1: Introduction **15 Hours**

Need for Operating Systems - Computer Systems - OS Operations - Abstract view of OS - Virtualization - Computing Environments - OS Services - OS Structures - System Calls - Building and Booting OS - Process - Threads - Multithreading.

MODULE 2: Process and Memory Management **15 Hours**

Process Scheduling - Process Co-ordination – Inter process communication - Synchronization - Semaphores - Monitors - Hardware Synchronization - Deadlocks - Methods for Handling Deadlocks. Memory Management Strategies - Contiguous and Non-Contiguous allocation - Virtual memory Management - Demand Paging - Page Placement and Replacement Policies.

MODULE 3: File and Device Management **15 Hours**

File-System Interface: File concept - Access methods - Directory Structure – Directory organization- File system mounting - File Sharing and Protection; File System Implementation: File System Structure- Directory implementation- Allocation Methods- Free Space Management; Mass Storage Structure - Disk Scheduling - Disk Management - I/O Systems - System Protection and Security. Case Study: - Multicore systems: Basic System and Processor Architecture- Multi-core Processors- Moving To Multi-core Intel Architecture- Scalar Optimization & Usability- Parallel Optimization Using Threads.

Total Hours:	**45**

Laboratory Component:

1	Study of Basic Linux Commands
2	Programs using Shell Programming
3	Implementation of Unix System Calls

4	Simulation and Analysis of Non Pre emptive and Pre emptive CPU Scheduling Algorithms
5	i. Simulation of Producer – Consumer Problem using Semaphores ii. Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
6	Simulation of Banker's Algorithm for Deadlock Avoidance
7	Analysis and Simulation of Memory Allocation and Management Techniques
8	Implementation of Page Replacement Techniques
9	Implementation of File organization Techniques
10	Simulation of Disk Scheduling Algorithms
	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
3	J.Archer Harris, "Schaum's Outline of Operating Systems", McGraw Hill Professional, 2001
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	http://geeksforgeeks.org/Operating Systems
2	https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
Online Resources:	
1	https://www.coursera.org/learn/os-power-user
2	https://nptel.ac.in/courses/106108101/
3	https://en.wikibooks.org/w/index.php?title=Operating_System_Design/Case_studies&oldid=4052366

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]**
C301.1, C301.2	Understand	Quiz	**20**
C301.3	Apply	Tutorial	**20**
C301.4, C301.5	Analyze	Tech Exploration Assignment	**20**
		Seminar	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	20	20	20
Understand	40	30	30
Apply	30	40	40
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	20	20	20
Apply	50	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**
C301.1	2	2	2									1	2		1
C301.2	3	3	3	2	2				2	1		3	3	1	2
C301.3	3	3	3	3	3				2	1		3	3	2	2
C301.4	3	3	3	3	3				2	1		3	3	2	2
C301.5	3	3	3						1	1		3	3		1

21CS302	JAVA PROGRAMMING	3/0/2/4
Nature of Course	F (Theory Programming)	
Pre requisites	Nil	

Course Objectives:

1	To learn the object oriented concepts using java programming
2	To analyze the types of constructor, inheritance and polymorphism
3	To apply the concepts of package, abstract class and interface
4	To apply the concepts of exception handling mechanisms in real time problems

Course Outcomes

Upon completion of the course, students shall have ability to

C302.1	Construct the Java programs using class, access modifiers, condition and looping statements	[AP]
C302.2	Implement the java programs using string class, files and serialization concepts	[AP]
C302.3	Develop the programs using object oriented concepts such as inheritance, abstraction, interface and packages	[AP]
C302.4	Classify the usage of different keywords based on its functionality and use the concepts of association, composition and aggregation for programming	[A]
C302.5	Construct the program using polymorphism and exception handling mechanisms to solve real time problems.	[AP]

Course Contents:

Module 1: **15 Hours**

Identifiers & JavaBeans, Legal Identifiers, Sun's Java Code Conventions, JavaBeans Standards, Declare Classes, Source File Declaration Rules, Class Declarations and Modifiers, Concrete Subclass, Declaring an Interface, Declaring Interface Constants, Declare Class Members, Access Modifiers, Nonaccess Member Modifiers, Constructor Declarations, Variable Declarations, Declaring Enums. An Overview of the Wrapper Classes, Creating Wrapper Objects, Using Wrapper Conversion Utilities, Autoboxing. if and switch Statements, if-else Branching, switch Statements, Loops and Iterators, using while Loops, Using do Loops, Using for Loops, using break and continue, Unlabelled Statements, Labelled Statements.

Module 2: **15 Hours**

String, StringBuilder, and StringBuffer, The String Class, Important Facts About Strings and Memory, Important Methods in the String Class, The StringBuffer and StringBuilder Classes, Important Methods in the StringBuffer and StringBuilder Classes, File Navigation and I/O, Types of Streams, The Byte-stream I/O hierarchy, Character Stream Hierarchy, Random Access File class, The java.io.Console Class, Serialization, Dates, Numbers, and Currency, Working with Dates, Numbers, and Currencies, Parsing, Tokenizing, and Formatting, Locating Data via Pattern Matching, Tokenizing. Class and Object,

Encapsulation and Abstraction, Inheritance, Polymorphism, Message Passing, Class Syntax, Access Modifiers, class, class Name, extends, implements keywords, Possible, syntaxes of Classes, Procedure to use classes in Java, Internal flow in Class Utilization, More than one class in Single Java Appl, Concrete Methods Vs Abstract Methods. Abstract Classes, Interfaces, Method Syntax.

Module 3: **15 Hours**

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

Total Hours	**45**

Laboratory Component:

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

Text Books:

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

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

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]**
C302.1	Apply	Quiz	**20**
C302.2	Apply	Assignment	**20**
C302.3	Apply	Case Study	**20**
C302.4, C302.5	Analyze	Group 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	10	10
Apply	40	60	60
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**
C302.1	3	3	2	2	2				2			2	3	2	2
C302.2	3	3	2	2	2				2			2	3	2	2
C302.3	3	3	2	2	2				2			2	3	2	2
C302.4	3	3	2	2	2				2			2	3	2	2
C302.5	3	3	2	2	2				2			3	3	2	2

21CS303	MANAGING DATA USING RDBMS	3/0/2/4
Nature of Course:	D (Theory Applications)	
Prerequisites:	Nil	

Course Objectives:

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

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

C303.1	Conceptualize data using the data models.	[U]
C303.2	Improve the database design through normalization.	[U]
C303.3	Manipulate a database using SQL.	[AP]
C303.4	Implement advanced SQL concepts on database.	[AP]
C303.5	Infer the transactions management and storage structures in a database environment.	[A]

Course Contents:

MODULE I Introduction **15 Hours**

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

MODULE II Constraints and SQL Commands **15 Hours**

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

MODULE III Queries and Transactions **15 Hours**

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

Lab Experiments:

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators

6. Implementation of virtual tables using Views 7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers) 8. Document Database creation using MongoDB 9.Study of Cloud Storage 10.Mini Project (Application Development) i) IT Training Group Database ii) Blood Donation System iii) Salary Management System iv) Traffic Light Information System

Total Hours:	**45+30 Hours**

Text Books:	
1	Abraham Silberschatz, Henry F Korth, S Sudarshan, “Data base System Concepts”, 7th Edition, McGraw hill, 2020.
2	Vijay Krishna Pallaw, “Database Management Systems”, 2nd Edition Asian Books Private Limited, 2010.
3	Mark L. Gillenson, "Fundamentals of Database Systems", 7th Edition, Wiley India Pvt. Limited, 2008.
Reference Books:	
1	Raghu Ramakrishnan, Johannes Gehrke, Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw-Hill Education, 2017
2	C. Date, "SQL and Relational Theory", O'Reilly Media, Incorporated,2011.
Web References:	
1	http://www.sqlcourse.com/
2	https://www.w3schools.com/sql/
3	https://www.geeksforgeeks.org/dbms/
Online Resources:	
1	https://www.coursera.org/learn/database-management
2	https://www.udemy.com/database-management-system/
3	https://onlinecourses.swayam2.ac.in/cec22_cs18/preview

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]**
C303.1	Understand	Quiz	**20**
C303.2	Understand	Assignment	**20**
C303.3	Apply	Group Assignment	**20**

C303.4			
C303.5	Analyze	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	30	40	40
Analyse	20	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)**	
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75M)**	**SA (25M)**	**Theory Examination (35%) Practical Examination (15%)**
	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**
C303.1	3	1			1					1		1	2		1
C303.2	3	3	3	3					2	2		3	3	2	2
C303.3	3	3	2	1					2	1	2	3	3	2	2
C303.4	3	3	2	2	2				2	1	2	2	3	2	2
C303.5	3	2	2		2				1	2	2	3	2	2	2
C303	3	3	3	3	2				2	2	2	3	3	2	2

21AD302	ANALYSIS OF ALGORITHMS	3/0/2/4
Nature of Course:	I (Problem Concepts)	
Pre requisites:	Data Structures	

Course Objectives:

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

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

C302.1	Illustrate the searching and sorting algorithms.	[U]
C302.2	Interpret the design principles of greedy and pattern searching algorithms with examples.	[AP]
C302.3	Explain the problem-solving methodology used in Backtracking.	[A]
C302.4	Analyze the time and space complexities of dynamic programming strategy in solving complex problems	[A]
C302.5	Employ range query and graph algorithms in real world problems.	[AP]

Course Contents:

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

Searching & Sorting, Divide and Conquer – Bubble sort, Insertion sort, Selection sort, Binarysearch, quick sort, merge sort - Heaps & Hashing – Binary heap, heap sort - Greedy Algorithms – Activity selection problem, Fractional knapsack - String algorithms - Naive algorithm, Rabin Karp algorithm, KMP algorithm, Z algorithm, Manachers algorithm - Tries - Making a trie node, Insert, Search and Remove operation in Tries, Huffman coding.

Greedy and Dynamic Programming: **15 Hours**

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

Tree and Graph Algorithms: **15 Hours**

Range query Algorithms - Range Minimum Query (Brute Force Approach). Segment Tree, Range Minimum Query on the Constructed Segment Tree, Range Minimum Query Using Sparse Table. Graph Algorithms - Dijkstra's Algorithm, Floyd warshall Algorithm, Kruskal's Algorithm for Minimum Spanning Tree, Prim's Algorithm for Minimum Spanning Tree.

Total Hours:	**45**

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

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

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

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

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

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]**
C302.1	Understand	Assignment	**20**
C302.2	Apply	Quiz	**20**
C302.3, C302.4	Analyze	Tutorial	**20**
C302.5	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	10	10
Understand	10	10	15
Apply	50	60	55
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (15%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	10
Understand	20	10	10
Apply	70	80	80
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**
C302.1	3	3	3	1	3	2	2	1	2		2	1	3	2	2
C302.2	3	3	3	1	3	2	2	1	2			1	3	2	2
C302.3	3	3	3	1	3	2	2	1	2		1	1	3	2	2
C302.4	3	3	3	1	3	2	2	1	2			2	3	2	2
C302.5	3	3	3	1	3	2	2	1	2			2	3	2	2

21EC411	DIGITAL PRINCIPLES AND SYSTEM 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		
C411.1	Identify and encode information in binary and to manipulate Boolean functions using Boolean algebra.	[U]
C411.2	Interpret and minimize Boolean functions and implement them using digital logic gates.	[U]
C411.3	Illustrate and design different combinational logic circuits.	[A]
C411.4	Analyze and design various sequential circuits.	[A]
C411.5	Construct Verilog models for digital logic circuits.	[AP]
C411.6	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**	**FA (16%) [80 Marks]**
C411.3, C411.4	Analyse	Quiz	20
,C411.1, C411.2, C411.3	Understand, Apply	Assignment	20
C411.4, C411.5	Apply, Analyse	Quiz	20
C411.5, C411.6	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
C411.1	2	3		1									2		
C411.2	2	3	3	1									2		
C411.3	2	3	2										2		
C411.4	2	3	2	1									2		
C411.5	2		2		2							1	2	2	2
C411.6	2	2	2	1								1	2	1	

21MA404	RANDOM VARIABLE & STATISTICS *CSE / IT / AI & DS*	3/1/0/4

Nature of Course	B (100% Analytical)
Pre requisites	Concepts of basic differentiation and Integration

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

C404.1	Recall the concepts of basic probability	[R]
C404.2	Understand how to handle situations involving random variable	[U]
C404.3	Applying different pattern of standard distributions in real life problems.	[AP]
C404.4	Use distribution in cluster analysis of similar binary variables	[AP]
C404.5	Derive the logic and attain the knowledge of hypothesis testing.	[AP]
C404.6	Apply the analytical comparisons using ANOVA.	[AP]

Course Contents:

Module 1: Probability and Random Variables **20 Hours**

Probability: Probability concepts - Addition and Multiplication law of probability – Conditional probability - Total probability theorem - Bayes theorem– **Random Variables:** One dimensional random variable - Discrete random variables -Probability mass function - Continuous random variables - Probability density function- Moments and Moment generating Function.

Module 2: Standard distributions **20 Hours**

Standard distributions: Discrete distributions - Binomial – Poisson – Geometric – Continuous distributions - Uniform – Exponential - Normal distributions –Weibull distribution. **Two dimensional random variables:** Joint distributions - Marginal and conditional distributions – Covariance – Correlation and rank correlation - Regression and their properties.

Module 3: 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. Latin square method.

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 Publishers, 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, Ninth 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.
4	R for Everyone: Advanced Analytics and Graphics, Jared P. Lander.
5	Hands-on Programming with R, Garrett Grolemund.
Web References:	
1	http://nptel.ac.in/courses/111104079/
2	http://nptel.ac.in/video.php/subjectId=117105085
3	http://nptel.ac.in/syllabus/111105041/
4	http://freevideolectures.com/Course/3028/Econometric-Modelling/22#
5	http://nptel.ac.in/courses/111104079/
Online Resources:	
1	www.edx.org/Probability
2	https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/
3	https://onlinecourses.nptel.ac.in/noc15_ec07/

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]**
C404.1	Remember	Quiz	20
C404.2	Understand	Seminar	20
C404.3 – C404.4	Apply	Tutorial	20
C404.5 – C404.6	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	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**
C404.1	1	1											2	1	1
C404.2	2	2											2	1	1
C404.3	3	3											2	2	2
C404.4	3	3											2	2	1
C404.5	3	3											3	1	1
C404.6	3	3											3	1	1

21IT401	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		
C401.1	Recall the design of the various units of digital computers that store and process information via instructions.	[R]
C401.2	Illustrate the functionality of all components and connectivity to the Central Processing Unit.	[U]
C401.3	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]
C401.4	Classify the hazards of pipelining technique and use in high performance processors.	[U]
C401.5	Make use of various memory components and memory mapping techniques including Cache and virtual memory for increasing the memory bandwidth and high performance.	[AP]
C401.6	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: DDR4 and Dual Inline Memory Module (DIMM)

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 and Embedded Systems”, 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					
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	Assignment	20
C401.2, C401.3	Understand	Group Assignment	20
C401.4, C401.5	Apply	Online Quiz	20
C401.6	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 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	1		1								1	2	2
C401.2	1	2	2		2								2	1	1
C401.3	3	3	3	3	3								3	3	1
C401.4	1	1	2		1								1	1	1
C401.5	2	1	2	2	1								2	1	2
C401.6		2	2		2								1	1	1

21IT402	SOFTWARE TESTING USING SELENIUM	3/0/0/3
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

Introduction to Automation Testing, Advantages and Disadvantages History of selenium, why selenium, Difference between selenium and other tools, Components, Variables and Datatypes, Control Statements, Arrays, Strings and Functions, Classes and Objects, Inheritance, and Polymorphism, Exception Handling, Collections, and File Handling.

Working with Selenium: 15 Hours

Introduction, generating scripts, wait commands, Validation commands, Store commands, Limitations, Sample Program, Navigation, radio Buttons and Checkbox, drop down list, File upload, drag and drop. Error and alert messages, multiple windows, Iframes, web table and calendar, Types and use of framework, Execution of programs, checking reports, Implementing Listeners, run group test cases.

Maven: 15 Hours

Maven configuration, Executing TestNG from maven, managing Test suites, Read and write excel, Creating and Building test cases, build validation and generic functions, Reports Run project with ANT/MAVEN/Eclipse, JDBC Drivers, Connection Interface, Prepared Statement, Resulset and basic commands, Reading nodes and hubs, Types of browsers, Limitations and Configurations. Running tests on browsers, prioritizing the test cases, node timeout, Grid coding, Scenario building and execution.

Total Hours	**45**

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”, 1st Edition, Packt Publishing Limited, 2014
2.	Sujay Raghavendra, "Python Testing with Selenium: Learn to Implement Different Testing Techniques Using the Selenium WebDriver", Apress, 2020.
3.	Pinakin Ashok Chaubal, “Selenium Framework Design in Keyword-Driven Testing: Automate Your Test Using Selenium”, BPB Publications, 2020.
Web References:	
1.	https://www.coursera.org/projects/building-test-automation-framework-using-selenium-and-testng
2.	https://www.edx.org/professional-certificate/delftx-automated-software-testing
3.	https://onlinecourses.nptel.ac.in/noc22_cs12/preview
4.	https://www.nextgenerationautomation.com/post/selenium-coding-exercises
5.	https://www.studytonight.com/maven/build-and-test-maven-project
Online Resources:	
1.	https://www.tutorialspoint.com/selenium-for-software-testing-getting-started/index.asp
2.	https://www.softwaretestingmaterial.com/selenium-tutorial/
3.	https://www.leapwork.com/discover/selenium-automation

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

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C402.3	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 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**
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

21CS402	WEB FRAMEWORKS	3/0/0/3
Nature of Course	F (Theory Programming)	
Pre requisites	Java Programming	

Course Objectives:

1	To impart the knowledge of REST API and HTTP methods used in Spring Boot Framework.
2	To 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 LIKE queries using JPA.	[AP]
C402.3	Build application using Spring Boot and handle CRUD operations with JPQL	[AP]
C402.4	Demonstrate various relational mapping with JPA.	[U]
C402.5	Develop Spring AOP - Annotation Based Application	[AP]

Course Contents:

Module - I **15 Hours**

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

Module - II **15 Hours**

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

Module - III **15 Hours**

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

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 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]**
C402.1	Apply	Assignment - 1	20
C402.2, C402.3	Apply	Assignment – 2	20
C402.4	Understand	Quiz	20
C402.5	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	10	10
Understand	10	10	15
Apply	70	80	75
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
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**

21AD403	CLOUD COMPUTING	3/0/0/3

Nature of Course	F (Theory Programming)

Course Objectives:

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

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

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

Course Contents:

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

Introduction, Services provided by AWS, Future of AWS, AWS EC2, AWS S3 - Cloud storage, Types, Benefits, AWS IAM - AWS Security, IAM, Working of IAM, Components AWS Cloud Front Working, Benefits. Introduction, Benefits, Snapshots vs AMI, Working, Different scaling plans. Introduction, Benefits, Algorithms used for load balancing.

MODULE II: CONTAINERIZATION USING DOCKERS **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.

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

Total Hours:	**45**

Text Books:

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

Reference Books:

1	Ardian, “Using Docker: Developing and Deploying Software with Containers”, O’Reilly Media Inc, 2015.

Web References:

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

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]**
C403.1	Apply	Quiz	20
C403.2	Understand	Tutorial	20
C403.3	Apply	Group Assignment	20
C403.4	Analyze		
C403.5	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)**	

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

21CS403	WEB FRAMEWORKS LABORATORY	0/0/3/1.5
Nature of Course:	L (Programming)	
Pre requisites:	Java Programming	

Course Objectives:

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

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

C403.1	Create simple applications with REST API and handle HTTP methods.	[AP]
C403.2	Create a simple Spring Application and inject the literal values by setter injection methods.	[AP]
C403.3	Apply LIKE queries using JPA to Various applications.	[AP]
C403.4	Build application using Spring Boot with JPA repository.	[A]
C403.5	Create applications with Spring Rest Controller API to perform CRUD operations.	[C]

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: 30

Text Books:

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

Reference Books:

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

Web References:
1. https://www.freecodecamp.org/news/how-to-build-a-rest-api-with-spring-boot-using-mysql-and-jpa-f931e348734b/
2. https://github.com/scbushan05/book-api-spring-boot
3. https://www.geeksforgeeks.org/spring-value-annotation-with-example/
4. https://www.baeldung.com/spring-jpa-like-queries
5. https://medium.com/thecodefountain/design-a-rest-api-with-spring-boot-and-mysql-a5572d94ccc7
Online Resources:
1. https://www.udemy.com/course/rest-api-with-java-spring-boot-spring-data-jpa-jparepository-swagger/
2. https://spring.io/guides/tutorials/rest/
3. https://www.javaguides.net/2018/10/spring-boot-2-restful-api-documentation-with-swagger2-tutorial.html

Continuous Assessment				**End Semester 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	50	60	60
Analyse	30	40	40
Evaluate	10	-	-
Create	10	-	-

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

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21AD404	CLOUD COMPUTING LABORATORY	0/0/3/1.5

Nature of Course	M (Practical Application)
Pre requisites	Data Base Design

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

C404.1	Demonstrate the basic global infrastructure of the AWS Cloud.	[AP]
C404.2	Identify an appropriate solution using AWS Cloud services for various use cases.	[U]
C404.3	Interpret how the components of Docker containers support compute container implementation.	[AP]
C404.4	Examine common Infrastructure Servers, Availability and Scalability.	[A]
C404.5	Learn why automation, culture, and metrics are essential to a successful DevOps project.	[U]

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

Total Hours:	**30**

Text Books:

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

Reference Books:

1.	Ardian, “Using Docker: Developing and Deploying Software with Containers”, O’Reilly Media

	Inc, 2015.
Web References:	
1	https://cloudacademy.com/course/introduction-to-devops/intro-3/

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

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

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

21IT501	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

C501.1	Construct Finite Automata based on regular expressions and will be able to build Regular Expressions to suit pattern of language	[AP]
C501.2	Model languages with a recursive structure using Context free grammar.	[AP]
C501.3	Construct Pushdown automata and Turing machine mathematical models.	[AP]
C501.4	Analyze the languages are regular and context free using pumping lemma	[A]
C501.5	Inspect the properties of Regular languages and context free languages	[A]
C501.6	Illustrate their knowledge of Recursive and Recursive Enumerable Languages and will be able to compare the classes of languages	[U]

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]**
C501.1, C501.2	Apply	Online Quiz	20
C501.3, C501.4	Apply, Analyze	Assignment	20
C501.5	Analyze	Online Quiz	20
C501.6	Understand	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	20
Apply	40	50	40
Analyse	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**
C501.1	2	3	2	3	2							1	2	2	2
C501.2	2	3	2	2	2								2	2	2
C501.3	2	2	2	3	2							1	1	2	2
C501.4	2	1	2	1	1								1	1	1
C501.5	2	1	2	2	2								2	1	2
C501.6	2	3	2	2	2								3	3	2

21IT502	DATA COMMUNICATIONS 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 and types of LAN.	
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		
C502.1	Understand the fundamentals of data communications and functions of layered architecture.	[U]
C502.2	Illustrate error detection, correction methods and interpret different network technologies.	[U]
C502.3	Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and routing technologies.	[A]
C502.4	Construct Routers and Switches for efficient Data Transfer.	[AP]
C502.5	Understand the application layer protocols and gain familiarity with common networking & Application Protocols.	[U]
C502.6	Analyze the fundamental process and working of transport layer protocols.	[A]

Course Contents:

Data Communications and Physical layer: 15 Hours

Introduction, networks topologies, ISO/OSI model, TCP / IP model and protocols, Performance Metrics. Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B), Networking Devices: Hubs, Bridges, Switches, Routers and Gateways. Switching-Circuit Switched Networks-Packet Switched Networks.

Data Link and Network Layers 15 Hours

Data Link Layer: Addressing, Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, LAN: Design, specifications of popular technologies, switching, Ethernet, Gigabit Ethernet, Token Ring, Token Bus, Bluetooth, Wi-Fi, Wi-Max, FDDI, PPP.**MAC Layer:** Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA. **Network layer:** Internet Protocol, IPv4, IPv6, ARP, DHCP, ICMP, Distance vector routing, Link state routing, Classless Inter-domain routing, RIP, OSPF, BGP, Subnetting, Network Address Translation.

Transport layer and Application Layer: 15 Hours

UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, Socket Programming. **Application Layer:** DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW, Design issues in protocols at different layers, CASE STUDY-Configuration of Router and Switches using Packet Tracer.

Total Hours	**45**

Text Books:	
1.	A S Tanenbaum, DJ Wetherall, “Computer Networks”, 6th Edition, Prentice-Hall, 2021.
2.	Behrouz A. Forouzan, “Data communication and Networking”, 5th Edition, Tata McGraw- Hill, 2013.
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://learnerstv.in/courses/computer-sc-computer-networks-free-video-tutorials-and- notes-lectures/
3.	http://freevideolectures.com/Course/3162/Computer-Networking-Tutorial
Online Resources:	
1.	https://nptel.ac.in/courses/106/105/106105081/
2.	https://www.free-online-training-courses.com/networking/
3.	http://www.omnisecu.com/basic-networking/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**	**FA (16%) [80 Marks]**
C502.1	Understand	Quiz	20
C502.2	Understand		
C502.3	Analyze	Assignment	20
C502.4	Apply		
C502.5	Understand	Seminar	20
C502.6	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	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**
C502.1	1	1	2	-	-	-	-	-	-	-	-	2	2	2	-
C502.2	3	3	3	3	2	-	-	-	-	-	-	3	3	3	3
C502.3	3	3	3	3	2	-	-	-	-	-	-	3	3	3	2
C502.4	1	2	2	1	3	-	-	-	-	-	-	2	2	1	-
C502.5	3	2	3	2	2	-	-	-	-	-	-	2	3	2	-
C502.6	1	1	-	2	2	-	-	-	-	-	-	2	3	3	-

21EC511	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

21IT503	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:

C503.1	Understand the foundational concepts in networking and system administration.	[U]
C503.2	Apply various networking protocols using sockets.	[A]
C503.3	Construct TCP sockets for client server communication.	[AP]
C503.4	Analyze the performance of the protocols and algorithms in different layers.	[A]
C503.5	Make use of simulation tools to implement various algorithms.	[AP]
C503.6	Analyze the network file transfer tool used for communication.	[A]

Course Contents:

1. Study of system administration and network administration.
2. Simulation of networking and intermediate devices.
3. Implementation of bit stuffing and character stuffing.
4. Implementation of Sliding window protocol and stop and wait protocol.
5. Write a code simulating PING and TRACEROUTE commands.
6. Implementation of client server model using UDP and TCP.
7. Applications using TCP Sockets like
   a. File transfer
   b. Chat
   c. Concurrent server
8. Implementation of Subnetting Applications.
9. Implementation of DNS.
10. Configuration of a simple network using Cisco Packet Tracer and simulate the transfer of packets.

Total Hours:	**45**

Text Books:

1	Elliotte Rusty Harold, “Java Network Programming”, Developing NetworkedApplications”, 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-down Approach”, 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.certexams.com/labs/CCNA-Demo-PracticalManual
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**
C503.1	3	3	2	2	3	-	-	-	-	-	-	1	3	2	3
C503.2	2	3	3	2	3	-	-	-	-	-	-	1	3	3	2
C503.3	3	3	2	2	3	-	-	-	-	-	-	1	2	2	3
C503.4	2	3	3	2	3	-	-	-	-	-	-	1	3	2	3
C503.5	2	3	3	2	3	-	-	-	-	-	-	1	3	2	3
C503.6	3	3	3	2	3	-	-	-	-	-	-	1	3	2	2

21IT504	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**		
C504.1	Identify a problem and carry out a thorough study on the chosen problem	[AP]
C504.2	Analyze ongoing developments in the chosen domain and demonstrate technical knowledge pertaining to the same.	[A]
C504.3	Apply suitable tools, techniques, Algorithms, frameworks to solve the practical problems.	[AP]
C504.4	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	100
Project Evaluation	September	30	
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
C504.1	3	3	2	2	1			3	3	3		3	2	3	3
C504.2	3	3	3	3	3			3	2	3	2	3	2	3	3
C504.3	3	3	3	3		3	3	3	3	3	3	3	2	3	3
C504.4	3	3	3	3				3	3	3	3	3	2	3	3

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21IT601	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
Architecture of Embedded Systems - Embedded Systems Development process - Architecture of Internet of Things - ARM Architecture – Instruction set – Programming ports – Timer / Counter – Serial Communication. **Fundamentals and Design Methodology of IoT:** Functional Blocks of IoT –IoT Standards and Protocols – IoT Communication Models and Communication APIs – IoT Levels – IoT Design Methodology – IoE vs IoT vs M2M – Domain specific IoT.

System Hardware for IoT: 15 Hours
Sensors & Actuators – Hardware Kits: Arduino, Node MCU, Raspberry Pi. **Arduino UNO:** 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.
Case studies: AWS / ThingSpeak / AZURE IoT Hub / Adafruit IO

Total Hours	**45**

Text Books:	
1.	Raj Kamal “Embedded Systems - SoC, IoT, AI and Real-Time Systems”, 4th Edition, McGraw Hill Education, 2020.
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.zettajs.org/
4.	http://www.buyya.com/papers/IoT-Book2016-C1.pdf
5.	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	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	10	-	10
Understand	20	20	30
Apply	60	50	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	1	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	1	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	1	2	1	1	2		1		1		1	2	1	1	1

3	Strongly agreed	2	Moderately agreed	1	Weakly agreed

21CS601	PRINCIPLES OF COMPILER DESIGN	3/0/0/3
Nature of Course:	D (Theory Design)	
Pre requisites	Formal Languages and Automata Theory, 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

C601.1	Construct a lexical analyzer to identify the tokens in a program	[AP]
C601.2	Construct a parser through the application of grammar.	[AP]
C601.3	Discuss the intermediate code generation and symbol table organization techniques	[U]
C601.4	Explain target machine's run time environment	[U]
C601.5	Construct a compiler for a small language with code generation and optimization strategies	[AP]

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**

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.	HenkAlblas 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**
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	Apply	Quiz	20
C601.2	Apply	Tutorial	20
C601.3	Understand	Assignment	20
C601.4	Understand		
C601.5	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	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
C601.1	3	3	3	3	1							2	3	2	
C601.2	3	3	3	3	1							2	3	2	
C601.3	3	3	3	3	1								3	2	1
C601.4	3	3	3										2	2	1
C601.5	3	3	3	3	1							3	3	2	1
C601	**3**	**3**	**3**	**3**	**1**							**3**	**3**	**2**	**1**

21CS602	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 - Symmetric Cipher Model – Classical Encryption techniques - Symmetric ciphers - Substitution Techniques - Transposition Techniques - Block Cipher Design Principles - Data Encryption Standard – DES example - The Strength of DES - 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's Theorem - 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 - 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

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]**
C602.1 & C602.2	Understand	Quiz	20
C602.3 & C602.4	Apply	Assignment	20
C602.5	Apply	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	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**

21IT602	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

C602.1	Demonstrate the concept of Internet of Things	[U]
C602.2	Develop IoT and Embedded Systems based application	[AP]
C602.3	Construct interfacing of various sensors with Arduino/Raspberry Pi.	[AP]
C602.4	Inspect the ability to transmit data wirelessly between different devices.	[A]
C602.5	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 a System using LM35 temperature sensor.
5. Design and development a System using MQ5 sensor.
6. Design and development a System using Soil Moisture sensor.
7. Design and development a System using PIR sensor.
8. Design and development 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:

2.	Adrian McEwen and Hakim Cassimally “Designing the Internet of Things”, Wiley Publishers, 2013,
3.	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**
C602.1	1	1	2		1	2	1					1	3	3	1
C602.2	3	3	3	3	3	1	2			2		2	3	3	3
C602.3	3	2	3	3	2	2	2			1		1	2	3	2
C602.4	1	1	3	3	3		2		2	2		2	2	3	2
C602.5	3	3	3	3	3	2	1		2	1		1	2	3	2

21CS604	COMPILER DESIGN LABORATORY	0/0/3/1.5
Nature of Course:	L (Programming)	

Course Objectives:

1.	To learn the concept of token separation.
2.	To study the working of LEX and YACC tools.
3.	To understand the construction of various types of parsers.
4.	To understand the various phases of compilers.

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

C604.1	Implement a lexical analyzer which generates tokens for C statements using C and LEX tool.	[AP]
C604.2	Implement Syntax Analyzers using C and YACC tool.	[AP]
C604.3	Construct Symbol table using C Language.	[AP]
C604.4	Implement Frontend and Backend of a compiler for simple C statements.	[AP]
C604.5	Analyze the code optimization strategies of a compiler.	[A]

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.

Total Hours:	**45**

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.	AllenI. Holub, “Compiler Design in C”, Prentice Hall of India, 2016

2.	C.N.Fischer and R.J. Le Blanc, “Crafting a compiler with C”, Benjamin Cummings,2010
3.	Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”,PHI, 2001.
4.	Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003.
5.	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

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	20	20	20
Apply	60	60	60
Analyse	20	20	20
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**
C604.1	3	3	3	3	3				2	1		2	3	3	2
C604.2	3	3	3	3	3				2	1		2	3	3	2
C604.3	3	3	3	3	3				2	1		2	3	3	2
C604.4	3	3	3	2	2				2	1		2	3	3	2
C604.5	3	3	3	3	3				2	1		2	3	3	2
C604	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**2**	**3**	**3**	**2**

21IT701	COMPUTATIONAL BIOLOGY	3/0/0/3
Nature of Course	D (Theory Application)	
Pre requisites	Nil	

Course Objectives:

1.	To familiarize the students with the basic organization of organisms and subsequent building to a living being
2.	To gain insights from varied backgrounds of engineering, computer science, and the life sciences.
3.	To provide basic knowledge on nature inspired computing techniques

Course Outcomes

Upon completion of the course, students shall have ability to

C701.1	Define biological cell structure and its functions .	[R]
C701.2	Demonstrate protein structure and its synthesis.	[U]
C701.3	Summarize different biological databases.	[U]
C701.4	Apply different prediction strategies on biological data.	[AP]
C701.5	Select evolutionary computing and artificial neuro and immune systems.	[AP]
C701.6	Examine swarm intelligence and ant colony optimization techniques.	[A]

Course Contents:

Introduction Databases, Tools and Uses **15 Hours**

Introduction: Methods of Science-Living Organisms: Cells and Cell theory, Cell Structure and Function, Genetic information, protein synthesis, and protein structure, Cell metabolism - Homoeostasis- Cell growth, reproduction, and differentiation. Applications of Bioinformatics, importance of biological databases, Types of biological databases, analysis packages.

Biochemistry, Immune System, Predictive methods **15 Hours**

Biological Diversity-Chemistry of life: chemical bonds-Biochemistry and Human biology-Protein synthesis-Stem cells and Tissue engineering, Nervous system-Immune system-General principles of cell signaling. predictions Gene strategies, protein prediction strategies, molecular visualization tools.

Nature Inspired Computing Techniques **15 Hours**

Artificial neural networks :Biological motivation -Design principles ,Scope of artificial neural networks, Current trends and open problems, Evolutionary computing : Biological motivation, Design principles, Scope of evolutionary computing , Current trends and open problems Swarm intelligence: biological motivation, basic ant colony optimization algorithm, basic particle swarm optimization algorithm, Scope of swarm intelligence, Current trends and open problems Artificial immune systems: Biological motivation, Design principles, Scope of artificial immune systems, Current trends and open problems.

Total Hours	**45**

Text Books:

1.	S.C.Rastogi, Namita Mendiratta, Parag Rastogi, “Bioinformatics: Methods and Applications (Genomics, Proteomics and Drug Discovery)”, PHI Learning Pvt. Ltd 2013.
2.	S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, “Biology for Engineers”, Tata McGraw-Hill, New Delhi, 2012.

3.	Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.
Reference Books:	
1.	Andreas D Baxevanis & B F Francis, "Bioinformatics- A practical guide to analysis of Genes & Proteins", John Wiley, 3rd Edition 2009.
2.	C S V Murthy, “Bioinformatics”, Himalaya Publishing House, 1st Edition, 2016
3.	David W.Mount “Bioinformatics sequence and genome analysis”, Cold spring harbor laboratory press, 2004.
4.	S. Ignacimuthu, S.J., “Basic Bioinformatics”, Narosa Publishing House, 2013
5.	Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, “Biochemistry”, W.H. Freeman and Co. Ltd., 6th Edition, 2006.
6.	Robert Weaver, “Molecular Biology”, MCGraw-Hill, 5th Edition, 2012.
7.	Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
Web References:	
1.	https://www.coursera.org/specializations/bioinformatics
2.	https://nptel.ac.in/courses/102/106/102106068/
Online Resources:	
1.	https://ocw.mit.edu/courses/health-sciences-and-technology/hst-508-genomics-and-computational-biology-fall-2002
2.	https://dspace.mit.edu/bitstream/handle/1721.1/103560/6-047-fall-2008/contents/lecture-notes/index.htm
3.	https://www.cs.helsinki.fi/bioinformatiikka/mbi/courses/08-09/itb/lectures/itb0809-slides-p1-431.pdf
4.	https://nptel.ac.in/courses/121/106/121106008/
5.	https://courses.cs.washington.edu/courses/cse466/05sp/pdfs/lectures/10-EvolutionaryComputation.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]**
C701.1	Understand	Assignment	20
C701.2	Apply	Quiz	20

C701.3 C701.4	Apply	Case Study	20
C701.5, C701.6	Analyse	Poster Presentation on Tools	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	40
Analyse	10	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**
C701.1	3	3	3	3	1	1	1	1			1	1	2	2	2
C701.2	3	3	3	3	1	1	1	1			1	1	2	2	2
C701.3	3	3	3	3	1	1	1	1			1	1	2	2	2
C701.4	3	3	3	3	1	1	1	1			1	1	2	2	2
C701.5	3	3	3	3	1	1	1	1			1	1	3	2	2
C701.6	3	3	3	3	1	1	1	1			1	1	3	2	2

21IT702	BIG DATA ANALYTICS	3/0/2/4
Nature of Course:	H (Theory Technology)	
Prerequisites:	Nil	

Course Objectives:

1.	To introduce different kinds and sources of Big data.
2.	To provide an insight into different data analytics techniques.
3.	To explore mining hidden structures in big data.
4.	To study and evaluate dimensionality reduction for big data.

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

C702.1	Recall the key concepts and terminologies that define the veryessence of Big Data	[R]
C702.2	Understand big data management's key issues and associated applications in intelligent business and scientific computing.	[U]
C702.3	Infer the fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.	[U]
C702.4	Apply business models, scientific computing paradigms and software tools for big data analytics.	[AP]
C702.5	Analyze adequate perspectives of big data analytics in various applications like recommender systems, social media applications.	[A]
C702.6	Determine an extensive, detailed and critical knowledge of big data management principles and technology practices.	[E]

Course Contents:

Introduction to Big Data and Analytics: **15 Hours**

Introduction to Big data: characteristics of data and types of digital data. Evolution of big data-Challenges with big data- Traditional Business Intelligence vs Big data. **Big data analytics:** Classification of analytics-challenges-Terminologies used in big data environments. Plotting and visualization using NumPy and pandas data structure.

Introduction to Technology Landscape: **15 Hours**

NoSQL , Comparison of SQL and NoSQL, **Introduction to Hadoop:** RDBMS vs Hadoop, Distributed computing challenges, Hadoop overview- Hadoop Distributed File System (HDFS)- processing data with Hadoop, managing resources and applications with Hadoop YARN- interacting with Hadoop ecosystem(Storm, Flume, Amazon Kinesis). **Map Reduce Framework:** Exploring the features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions, Techniques to optimize Map Reduce jobs, Uses of Map Reduce. Controlling MapReduce Execution with InputFormat, Reading Data with custom RecordReader,-Reader, Writer, Combiner, Partitioners, Map Reduce Phases Developing simple MapReduce Application.

Real-Time Analytics: **15 Hours**

Spark: Introduction to Data Analysis with Spark, In-Memory Computing with Spark, Spark Basics, Interactive Spark with PySpark, Writing Spark Applications. **HBase:** Features, architecture of HBase, operations of HBase. **Sqoop:** Getting started with sqoop, Import and Export data using sqoop.
Case Study: Creating information dashboard for given scenarios using Tableau, ExploringTwitter Sentiment Analysis and the Weather

Total Hours (Theory):	**45**

Lab Component

S. No.	Lab Exercises
1	Plotting and visualization using Numpy and Pandas data structure.

2	Deploy the Hadoop tool and use its function for analyzing data.	
3	File Management in Hadoop.	
4	Run a basic word count Map Reduce program to understand Map Reduce Paradigm.	
5	Write a Map Reduce program that mines weather data.	
6	Implement matrix multiplication with Hadoop Map Reduce.	
7	Install, Deploy & configure Apache Spark cluster and run apache spark application.	
8	Implementation of Matrix algorithms in Spark Sql programming.	
9	Data analytics using Apache Spark on Amazon food dataset.	
10	Use HBase to read and write data.	
	Total Hours(Lab):	**30**
	Total Hours: (45+30)	**75**
Text Books:		
1	Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2016.	
2	William McKinney, “Python for Data Analysis”, O'Reilly Media, 2nd Edition, 2017.	
3	Benjamin Bengfort, Jenny Kim, “Data Analytics with Hadoop - An Introduction for Data Scientists”, O'Reilly Media, June 2016.	
Reference Books:		
1	Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, John Wiley & Sons, Inc., 2013.	
2	Tom White, “Hadoop: The Definitive Guide”, O’Reilly Publications, 2011.	
3	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.	
4	Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.	
Web References:		
1	https://www.edx.org/learn/big-data	
2	https://www.coursera.org/browse/data-science/data-analysis?languages=en	
3	https://www.udemy.com/topic/big-data/	
Online Resources:		
1	NoSQL vs. SQL - How NoSQL is Better for Big Data Applications? - Whizlabs Blog	
2	https://hadoop.apache.org/	
3	https://spark.apache.org/docs/latest/api/python/	
4	https://hive.apache.org/	

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]**
C702.1	Remember	Assignment	**20**
C702.2	Understand	Quiz	**20**
C702.3	Understand		
C702.4	Apply	Assignment	**20**
C702.5	Analyse	Case Study	**20**
C702.6	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	30	10	10
Understand	40	40	40
Apply	20	20	20
Analyse	10	30	30
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	30	30	30
Analyse	20	20	20
Evaluate	10	10	10
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**
C702.1	3	3	3	2	2				1	2		2	3	3	2
C702.2	3	3	3	3	2					1	1	3	3	2	3
C702.3	3	3	2	3	3				1	2	2	3	2	3	3
C702.4	3	2	3	2	3	1	1		2	2	2	3	3	3	3
C702.5	3	3	3	3	3				2	2	2	3	3	3	3
C702.6	3	3	3	2	3				1	2	2	3	3	3	3
C702	**3**	**2.8**	**2.8**	**2.5**	**2.5**	**0.1**	**0.1**		**2**	**1.16**	**1.5**	**2.8**	**2.8**	**2.8**	**2.8**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21IT801	PROJECT	0/0/24/12
Nature of Course	M (Practical Application)	
Pre-Requisites	Programming Languages	
Course Objectives:		
1	To demonstrate technical, interdisciplinary and interpersonal abilities.	
2	To enhance problem-solving and critical thinking abilities through the identification and resolution of technical challenges.	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C801.1	Identify the real-life problem from societal need point of view.	[AP]
C801.2	Choose and compare alternative approaches to select most feasible one.	[C]
C801.3	Analyze and synthesize the identified problem from technological perspective.	[A]
C801.4	Design the reliable and scalable solution to meet challenges.	[C]
C801.5	Examine and validate the solution based on the criteria specified.	[A]

Course Guidelines:

1. The entire semester shall be utilized by the students to do their 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	February	30	100
Project Evaluation	March	30	
Project Evaluation	April	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
C801.1	3	3	2	2	1	2		3	3	3		3	2	3	3
C801.2	3	3	3	3	3	3		3	2	3	2	3	2	3	3
C801.3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
C801.4	3	3	3	3	2			3	3	3	3	3	2	3	3
C801.5	3	3	3	3	2	3	3	3	2	3	3	3	2	3	3

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21CS901	API DEVELOPMENT USING MVC ARCHITECTURE	3/0/0/3
Nature of Course	C (Theory Concepts)	
Prerequisite	Web Development using React	

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:

C901.1	Identify the entities and attributes in ER design.	[AP]
C901.2	Draw a schema diagram using MySQL workbench.	[AP]
C901.3	Customize application configuration with Spring Boot Framework.	[AP]
C901.4	Develop Spring Boot applications by adding REST Controller and REST API methods.	[E]
C901.5	Create Data Repository and apply CRUD operations in it.	[C]

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.	Sourabh Sharma, “Modern API Development with Spring and Spring Boot: Design Highly Scalable and Maintainable APIs with REST, GRPC, GraphQL, and the Reactive Paradigm”, Packt Publishing, 2021
2.	Sikha Bagui, Richard Earp, “Database Design Using Entity-Relationship Diagrams (Foundations of Database Design)”, 2nd Edition, Auerbach Publications, 2022

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 (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C901.1	Apply	Quiz	20
C901.2			
C901.3	Apply	Assignment	20
C901.4	Create	Case Study	20
C901.5			20

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

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

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

21IT901	UI/UX APPLICATION DEVELOPMENT	3/0/0/3
Nature of Course	C (Theory Concept)	
Prerequisites	Java Programming	

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

C901.1	Demonstrate the client-side HTML application development using REACT	[U]
C901.2	Illustrate the use of JavaScript in REACT applications.	[U]
C901.3	Apply CSS for designing REACT applications.	[AP]
C901.4	Develop simple applications using JSON packages.	[AP]
C901.5	Create simple applications using REST API	[AP]
C901.6	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]**
C901.1	Understand	Assignment	20
C901.2, C901.3	Understand, Apply	Case Study	20
C901.4, C901.5	Apply	Online Quiz	20
C901.6	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
C901.1	3	3	3	3	2							2	3	2	2
C901.2	3	3	3	2	3							2	2	3	2
C901.3	3	3	2	3	3							3	3	3	2
C901.4	3	3	2	2	3							2	3	3	3
C901.5	3	2	3	2	3							2	2	2	2
C901.6	3	2	2	2	2							2	3	2	2

21CS902	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:

C902.1	Illustrate cloud benefits using Amazon Web Services.	[U]
C902.2	Deploy applications using PuttyGen Environment set up.	[AP]
C902.3	Identify an appropriate solution using AWS Cloud services for various use cases.	[AP]
C902.4	Explain the concept of Virtual Network Configuration , IAM , load balancing and scaling.	[AP]
C902.5	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 KindleEdition,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]**
C902.1	Apply	Quiz	20
C902.2	Understand	Tutorial	20
C902.3	Apply	Assignment/ Presentation	20
C902.4	Analyze		
C902.5	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
C902.1	2	1	3	3	3	2						3	2	3	3
C902.2	1	2	3	3	3	2		2			2	3	2	3	3
C902.3	2	2	3	3	2	2		2			2	3	2	3	3
C902.4	2	1	3	3		2						3	2	3	3
C902.5	2	1	2	3	2	2		2				3	2	3	3
C902	**2**	**2**	**3**	**3**	**3**	**2**		**2**			**2**	**3**	**2**	**3**	**3**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21IT902	ADVANCED APPLICATION DEVELOPMENT	0/0/6/3
Nature of Course	M (Practical Application)	
Pre-Requisite	Web Frameworks, Web Development using REACT, Cloud Computing, 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		
C902.1	Apply the basic concepts and design Front End for real world applications	[AP]
C902.2	Apply the basic concepts and implement Backend business logic for real world applications	[AP]
C902.3	Illustrate the security related features and apply security concepts in real worldbusiness applications	[U]
C902.4	Illustrate the process of Integrating front end and back-end application and deploy them in Cloud	[U]
C902.5	Apply EC2 instances, configuring networking, and deploying Dockerized applications and also apply insights into DevOps practices related to continuous integration and deployment	[AP]
C902.6	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 as 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 working at 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 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/
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**
C902.1	3	3	3	3	3	2		2	2	2	2	2	3	3	3
C902.2	3	3	3	3	3	2		2	2	2	2	2	2	2	3
C902.3	3	3	3	3	3	2		2	2	2	2	2	3	3	3
C902.4	3	3	3	3	3	2		2	2	2	2	2	2	3	3
C902.5	3	3	3	3	3	2		2	2	2	2	2	3	2	3
C902.6	3	3	3	3	3	2		2	2	2	2	2	3	2	3

21IT903	R PROGRAMMING	3/0/0/3
Nature of Course	F (Theory Programming)	
Pre requisites	Database Management Systems	

Course Objectives:

1.	To understand the basics in R programming.
2.	To understand different data types and data structures in R programming.
3.	To identify and deal with missing data
4.	To understand and learn different packages in R programming
5.	To interface R with other languages like C/C++/Python

Course Outcomes

Upon completion of the course, students shall have ability to

C903.1	Relate the different data structures in R to define the input and output.	[R]
C903.2	Recall the different operations on list and vectors.	[U]
C903.3	Interpret the R programming constructs, control statements and functions.	[U]
C903.4	Demonstrate Linear, nonlinear and Time series models.	[U]
C903.5	Apply graphs to visualize the data.	[AP]
C903.6	Analyze and Interface R with Other programming languages like C/C++/Python.	[A]

Course Contents:

Introduction to R and Data Structures **15 Hours**

R Introduction - R Data Structures: Vectors, Scalar, Declarations, recycling, Common Vector operations, Using all and any, Vectorized operations, NA and NULL values, Filtering, Vectorized if-then else, Vector Equality, Vector Element names. Matrix and Arrays: Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns - Adding and deleting rows and columns. Lists: Creating lists, General list operations, Accessing List components and values, applying functions to lists, recursive lists. Case Study: Missing values and handling missing values in real dataset using R with imputation techniques.

Data Frames, Factors and Tables **15 Hours**

Data Frames: Creating Data Frames, Matrix-like operations in frames, Merging Data Frames - Applying functions to Data frames. Factors: factors and levels, Common functions used with factors, Working with tables, Other factors and table related functions. R programming Structures: Control statements, Arithmetic and Boolean operators and values, Default values for arguments, Returning values, functions are objects, Environment and Scope Issues, Recursion, Replacement functions — Tools for composing function code. Case study: Exploratory data analysis in R - Voting system using dplyr package.

Simulations in R **15 Hours**

Graphs: Creating Graphs, Customizing Graphs, Saving graphs to files, Creating 3D plots. Interfacing: Interfacing R to other languages - Parallel R - Basic Statistics: Text - Image - Linear Model -Non- linear models - Time Series and Auto-correlation - Clustering - PCA - RDA. Case study to visualize the data using ggplot2.

Total Hours	**45**

Text Books:

1.	Norman Madoff, “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press, 2011.

2.	Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data Analytics Series, 2nd Edition,2017.
Reference Books:	
1.	Mark Gardener, " Beginning R - The Statistical Programming Language", Wiley, 2013.
2.	Robert J Knell, “Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R”, Amazon Digital South Asia Services Inc, 2014.
Web References:	
1.	https://www.stats.ox.ac.uk/~evans/Rprog/LectureNotes.pdf
2.	https://learn.datacamp.com/courses/free-introduction-to-r
3.	https://www.listendata.com/2016/08/dplyr-tutorial.html
Online Resources:	
1.	https://www.vskills.in/practice/r-programming-practice-questions
2.	https://www.dezyre.com/projects/data-science-projects/data-science-projects-in-r
3.	https://nptel.ac.in/courses/111/104/111104120/

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	Understand	Programming Assignment	20
C903.2	Remember	Quiz	20
C903.3 C903.4 C903.5	Apply	Case Study	20
C903.6	Analyse	Mini Projects	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	30	20	20
Apply	50	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
C903.1	3	3	3	2	2						3	2	3	3	2
C903.2	3	2	2	1	2							3	2	2	1
C903.3	2	3	3	2	3						2	2	3	3	2
C903.4	2	1	3	2	1						2	2	2	2	1
C903.5	2	1	3	2	1						2	2	2	3	2
C903.6	3	3	3	2	2							3	3	2	2

21IT904 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP **0/0/6/3**

OBJECTIVES:

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skillsof the students.

This course is a four months immersive program to keep up with the industry demand and to havecritical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from Industry and faculties. **This is an EEC category course offered as an elective, under the type,"Experiential Project Based Learning".**

Highlights of this course:

- Students undergo training on emerging technologies
- Students develop solutions for real-world use cases
- Students work with mentors to learn and use industry best practices
- Students access and use Self-Learning courses on various technologies, approachesand methodologies.
- Collaborate in teams with other students working on the same topic
- Have a dedicated mentor to guide

OUTCOMES:

On completion of the course, the students will be able to:

- Upskill in emerging technologies and apply to real industry-level use cases
- Understand agile development process
- Develop career readiness competencies, Team Skills / Leadership qualities
- Develop Time management, Project management skills and Communication Skills
- Use Critical Thinking for Innovative Problem Solving
- Develop entrepreneurship skills to independently work on products

The course will involve 40-50 hours of technical training, and 40-50 hours of project development.The activities involved in the project along with duration are given in Table 1.

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

TABLE 2: EVALUATION SCHEMA

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP			
Technical Skills		Soft Skills	
Criteria	Weightage	Criteria	Weightage
Project Design using Design Thinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
Total	70	Total	30
Total Weightage			100
Passing Requirement			50
Continuous Assessment Only			

AMENDMENT IN RESPECTIVE REGULATIONS:

1. Course is offered in the
    - 6th/7th semesters of UG programmes
2. This is an EEC category course offered as an elective under the type, “Experiential ProjectBased Learning”.
3. **Evaluation of Experiential Project Based Learning:**
    - **Project Review & Scoring**: Evaluator accesses the project deliverables, reviews the work done by the team and assigns the score for defined metrics.
    - **Project Status Review**: Mentor reviews the deliverables submitted by studentteams and shares his/her comments. Mentor ensures the timely completion ofproject.
    - The evaluation shall be carried out as per the metrics given in Table 2.
4. If a student takes a break and rejoins the programme at a later point in time in a semesterother than the prescribed semesters identified for the course, he/she is permitted to opt for a professional elective in lieu of this course.

Course Assessment scheme: Assessed through **Continuous assessment mode**

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Passing Criteria:

The passing requirement for the courses of the type ‘Experiential Project Based Learning’ fallingunder the category of EEC is 50% of the continuous assessment marks only.

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21IT905	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		
C905.1	Summarize the theoretical foundation and practices associated with modern Free and open source software (FOSS) projects.	[U]
C905.2	Demonstrate the knowledge of the fundamental concepts of open source linux operating system.	[U]
C905.3	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]
C905.4	Build efficient and simplified code by incorporating the object orientedtools in PHP, Perl, Ruby.	[AP]
C905.5	Code solutions using various concepts of Perl including data and variable types, Subroutines, File operations, String manipulation, Lists,etc.	[AP]
C905.6	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]**
C905.1	Remember	Quiz	20
C905.2	Understand	Assignment	20
C905.3, C905.4	Understand	Assignment	20
C905.5, C905.6	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**
C905.1	2	3	2	-	-	3	-	3	2	1	-	2	1	1	2
C905.2	1	2	1	-	1	-	-	-	-	-	-	2	1	1	2
C905.3	2	3	2	-	3	-	-	-	-	-	-	-	2	3	3
C905.4	1	3	3	2	3	-	-	-	2	-	2	-	3	3	3
C905.5	2	3	3	2	3	-	-	-	2	-	2	2	3	3	3
C905.6	2	3	3	2	3	-	-	-	2	-	2	2	3	3	3

21IT906	SOFTWARE ENGINEERING AND DESIGN	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	-	

Course Objectives:	
1.	To discuss the essence of software engineering process and traditional models
2.	To provide practical knowledge of how to create SRS for software applications
3.	To learn various O-O concepts along with their applicability contexts.
4.	To learn various modeling techniques to model different perspectives of object-oriented software design
5.	Develop design solutions for problems on various O-O concepts

Course Outcomes		
Upon completion of the course, students shall have ability to		
C906.1	Recite the software engineering process, including the specification, design, implementation, and testing of software systems	[R]
C906.2	Develop software requirements for real time applications that meet specification, performance, maintenance and quality requirements	[AP]
C906.3	Understand the basic concepts of Object orientation	[U]
C906.4	Illustrate the importance of object oriented modeling for appropriate analysis and design of given scenarios	[U]
C906.5	Summarize building blocks in structural and behavioral modeling of a software system for visualizing the relationships	[R]
C906.6	Develop unified modeling techniques for case studies	[A]

Course Contents:

SOFTWARE DEVELOPMENT AND PROCESS MODELS **15 Hours**

Introduction to Software Engineering: Software Process, Software Requirement Specification, Design process, Testing and Maintenance - **Traditional SDLC Models**: Waterfall model, Incremental model, Iterative model, RAD - **Software Requirement Specification**: Requirement analysis and specification, Requirements gathering and analysis – Case studies on Software Requirement Specification **- Software Design**: Design process, Coupling, Cohesion.

MODELING WITH UNIFIED MODELING LANGUAGE (UML) **15 Hours**

Basic Behavioral Modeling : Unified Process , UML diagrams, Use Case Diagram, Class diagram, State transition diagram, Object diagram, Interaction diagram, Activity diagram, Package diagram, Component diagram, Deployment diagram – Case studies on UML diagrams for real-time applications – **Modeling concepts:** Classes, Abstract Classes and Objects, Events - Object-Oriented Modeling - Falsification and Prototyping - Object oriented analysis.

OBJECT ORIENTED DESIGN AND TESTING **15 Hours**

Object Oriented Design: Generic components of OO Design model, Decomposing the System - Addressing the design goals**:** System design activities, Managing system design - **Object Oriented Testing:** Overview of Testing and object oriented Testing, Types of Testing, Object oriented Testing strategies.

Total Hours	**45**

Text Books:

1. Roger S. Pressman, Bruce R. Maxim “Software Engineering: A Practitioner’s approach”, McGraw Hill, 8th Edition, 2014.

2.	Bernd Bruegge, Allen Dutoit "Object-Oriented Software Engineering: Using UML, Patterns, and Java", Pearson, 2013.
Reference Books:	
1.	Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education, 2nd Edition, 2004.
2.	Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", McGraw-Hill Education, 4th Edition, 2010.
Web References:	
1.	https://davcollegetitilagarh.org/wp-content/uploads/2020/09/fundamentals-of-software-engineering-fourth-edition-rajib-mall.pdf
2.	https://personal.utdallas.edu/~chung/SP/applying-uml-and-patterns.pdf
3.	https://www.utdallas.edu/~chung/OOAD/M03_1_StructuralDiagrams.ppt
Online Resources:	
1.	https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2.	https://www.tutorialspoint.com/uml/uml_overview.html 2.
3.	https://onlinecourses.nptel.ac.in/noc19_cs48/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]**
C906.1, C906.5	Remember	Assignment	20
C906.3, C906.4	Understand	Seminar	20
C906.2	Apply	Case Study	20
C906.6	Analyze	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	20
Understand	30	30	50
Apply	30	-	30
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 Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C906.1	1	2	3	2	2	1	1	2	3	1	3	1	2	2	2
C906.2	3	2	3	3	2	1	1	1	2	1	3	1	2	3	1
C906.3	2	1	3	3	2	1	2	1	2	1	3	1	2	1	1
C906.4	3	2	3	3	3	2	1	1	2	3	3	1	2	2	2
C906.5	2	2	1	1	1	1	1	1	1	2	2	1	2	2	1
C906.6	2	2	1	1	1	1	1	1	1	2	2	1	2	2	1

21AD906	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:

C906.1	Identify the basic concepts and design issues of React.	[R]
C906.2	Understand the principles of process and Spring boot.	[U]
C906.3	Illustrate the approaches in scheduling and Spring Cloud to apply in real world problems.	[AP]
C906.4	Apply concepts of Micro services Communication to the issues that occur in Real time applications.	[AP]
C906.5	Identify issues related to Docker, API Gateway.	[AP]
C906.6	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**		
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**
C906.1	3	3	3	2	3	2						2	2	2	2
C906.2	3	3	3	2	3	2						2	2	2	2
C906.3	3	3	3	3	3	2						2	2	2	2
C906.4	3	3	3	2	3	2						2	2	3	3
C906.5	3	3	3	3	3	3						3	3	2	2
C906.6	3	3	3	2	3	2						2	2	3	3

21CS914	FUNDAMENTALS OF DATA SCIENCE	3/0/0/3
Nature of Course	D (Theory Application)	
Prerequisites	Python Programming	

Course Objectives:

1.	To understand the basics of python programming and OOPS functions
2.	To have a basic understanding of the Numpy and Pandas tools for data manipulation process.
3.	To develop a solution for real-time datasets using tools.
4.	To gain knowledge on data analytics and data visualization.

Course Outcomes

Upon completion of the course, students shall have ability to

C914.1	Describe the basic principles in Python and python programming	[U]
C914.2	Build the Python projects with Database connectivity	[AP]
C914.3	Explain the concept of Data Manipulation using Numpy and Pandas by examples .	[U]
C914.4	Apply Data Manipulation and description for real-time data with tools.	[AP]
C914.5	Infer the data analytics and visualization using pandas	[A]

Course Contents:

Module I Introduction to Python **15 hours**

Introduction to Python, Data Types, Looping and conditional statements, Data structures of List-Tuple-Dictionary-String, OOPS-functions-class and objects-modules-inheritance-encapsulation-exception handling -python and Database connectivity

Module II Data Manipulation Using Numpy and Pandas **15 hours**

Basics of NumPy Arrays: Introduction to numpy, creating numpy array, numpy manipulation, matrix in numpy, operations in numpy array, reshaping numpy array, indexing numpy array, arithmetic operations on numpy array, numpy and random data, sorting and searching in array, universal functions, working with images Introducing Pandas Objects: pandas series, data frame, panel, basic functionalities, reading data from different files

Module III Exploratory Data Analytics **15 hours**

Advance pandas: pandas reindexing, iterations, sorting, indexing and selecting, window functions, date functionality, time delta, categorical data, and visualizations. Simple Line Plots – Boxplots- Simple Scatter Plots - Visualizing Errors- Density and Contour Plots - Histograms, Binnings, and Density Customizing Plot Legends- Customizing Colorbars - Multiple Subplots Text and Annotation -Customizing Ticks

Total Hours	**45**

Text Books:

1.	Nichola Lacey, “Python by Example: Learning to python in 150 challenges” Cambridge University Press. 1st Edition, 2019.
2.	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler, “Python Basics: A practical introduction to Python3”, Real Python Publication, 4th Edition, 2021.
3.	Cole Nussbaumer Knaflic, “Story Telling with Data: A data visualization guide for business professionals”, Wiley Publications, 2015.

Reference Books:

1.	Eric Matthes, “Python Crash Course: A Hands-On, Project-Based Introduction to Programming”, No Starch Press, 2nd Edition, 2019.

2.	Al Sweigart “Automate the Boring Stuff With Python: Practical Programming for Total Beginners ”, No Starch Press, 2015.
Web References:	
1.	https://realpython.com/python-web-applications/
2.	https://www.python.org/about/gettingstarted/
3.	https://www.programiz.com/python-programming
Online Resources:	
1.	https://www.udemy.com/course/python-complete-course-for-beginners/
2.	https://www.simplilearn.com/learn-python-basics-free-course-skillup
3.	https://www.learnpython.org/

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]**
C914.1	Understand	Quiz - 1	20
C914.3			
C914.2, C914.4	Apply	Assignment - 1	20
C914.5	Analyse	Quiz – 2	20
		Assignment - 2	20

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

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

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C914.1	3	3	3	3	2								3		2
C914.2	3	3	3	2	2								3		2
C914.3	3	3	3	3	2								2		2
C914.4	3	3	3	2	2	2	2	2	2	2		2	2	2	2
C914.5										3	1	2	2	2	2
C914	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**2**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21CS911	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3/0/0/3

Nature of Course	H (Theory Technology)
Prerequisites	Random Variables and Statistics

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:

C911.1	Demonstrate supervised learning techniques	[AP]
C911.2	Illustrate unsupervised, semi-supervised and reinforcement learning algorithms	[AP]
C911.3	Build Artificial Neural network for the given classification problem	[AP]
C911.4	Apply CNN for solving image classification or recognition problems	[AP]
C911.5	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		
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]**
C911.1	Apply	Quiz	20
C911.2			
C911.3	Apply	Assignment	20
C911.4	Analyze	Mini Project Presentation	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	-	-	-
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
C911.1	3	3	3	3	2								3		2
C911.2	3	3	3	2	2								3		2
C911.3	3	3	3	3	2								2		2
C911.4	3	3	3	2	2	2	2	2	2	2		2	2	2	2
C911.5										3	1	2	2	2	2
C911	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**2**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21AD911	STATISTICS AND MACHINE LEARNING	3/0/0/3

Nature of Course	D (Theory Application)
Pre requisites	Introduction to Artificial Intelligence, Machine Learning

Course Objectives:

1	To understand the basics of machine learning.
2	To understand the deep insights on statistical concepts of machine learning.
3	To understand the different probabilistic techniques.
4	To learn about applications of machine learning in variety of real-world problems.
5	To analyze, critique, and revise statistical visualizations.

Course Outcomes:

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

C911.1	In-depth understanding of statistical knowledge for analytical use cases	[U]
C911.2	Interpret the different approaches in predictive and segmenting analysis of data	[U]
C911.3	Analysing, implementing and building POCs on learnt algorithms.	[AN]
C911.4	Able to apply concepts in the field of machine learning.	[AP]
C911.5	Able to integrate the statistical models of machine learning.	[AP]

Course Contents:

MODULE I INTRODUCTION TO STATISTICS **15 Hours**

Introduction - Different types of Statistics: Descriptive and inferential, Introduction to data/variables and their types. Descriptive Statistics: Measure of central tendency: Mean, Median, and Mode - Measure of spread: Range, Percentile, Quartiles, IQR, 5-point summary, Introduction to outliers - Measure of Dispersion: Variance, Population variance, Sample variance, Frequency Distribution: Normal Distribution, Standard Normal Distribution, Log-normal distribution, and polynomial distribution. Variance, Standard Deviation, Sample Variance, Mean Absolute deviation - Measure of data symmetry, Z-score, Standardization, Normalization Central limit theorem, Case study: Statistical model in machine learning.

MODULE II PROBABILITY **15 Hours**

Addition Rule in Probability-Multiplication rule in probability Permutation-Combination Corelation: Pearson, Spearman and Phik - Inferential Statistics: Population and sample, Sampling techniques, sampling bias, Hypothesis testing: Introduction, null and alternate hypothesis, alpha value, All test statistics (Z-test, T-test, F-test, chi-square test), P-value, Errors in testing.

MODULE III ADVANCED MACHINE LEARNING **15 Hours**

Unsupervised Learning: K-means clustering, Hierarchal clustering, anomaly detection, PCA (Principal component analysis), ICA (Independent component analysis) AI vs ML vs DL vs DS, Need of DL, History of AI, Applications of deep learning, NLP in ML: tokenization, lemmatization, stemming, encoding, Word2Vec, doc2vec, tfidif, word embeddings, Perceptron and ANN-Applications of machine learning.

Total Hours:	**45**

Text Books:

1	Masashi Sugiyama, “Introduction to Statistical Machine Learning”, 9th edition, Morgan-Kaufmann, 2016.
2	Saikat Dutt, “Machine Learning”, First edition, Pearson education, 2018.

Reference Books:

1	Sarab Boslaugh and Paul Andrew Watters, “Statistics in a Nutshell: A desktop guide reference”, O’REILLY, 2018.
2	Ddrik P. Kroese, Zdarvko I. Botev, Thomas Taimre, Radislav Vaisman, “Data Science and Machine Learning: Mathematical and Statistical methods”, Pearson education, 2016.

Web References:

1	https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2	https://onlinecourses.nptel.ac.in/noc24_ma30/preview

Online Resources:	
1	https://www.javatpoint.com/probability-and-statistics-books-for-machine-learning
2	https://www.javatpoint.com/statistics-definition

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, C911.2	Apply	Tutorial	20
C911.3	Understand	Assignment	20
C911.4, C911.5	Apply	Case Study	20
C911.6	Understand	Quiz	20

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

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

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

21IT911	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

C911.1	Infer the different architectures of AI Computer Vision.	[U]
C911.2	Examine different methodologies to create application using LeNet-5, AlexNet, VGG, ResNet.	[A]
C911.3	Interpret state-of-the-art works of literature on Object detection and localization algorithms.	[U]
C911.4	Identify the appropriate deep learning models for analyzing the data for a variety of real world problems.	[AP]
C911.5	Develop computer vision applications.	[AP]
C911.6	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]**
C911.1, C911.3	Understand	Assignment	20
C911.4	Apply	Quiz	20
C911.5	Apply	Assignment	20
C911.2 C911.6	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
C911.1	2	2	2	2	2						2	2	2	2	2
C911.2	2	2		1	2						2	2	2	2	2
C911.3	2		1	1	3						2	2	2	2	2
C911.4	2	2	1	2	1						3	3	2	3	2
C911.5	1	2	2	1	2						2	3	3	2	2
C911.6	1	3	2	1	2						2	2	2	3	2

21IT912	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

C912.1	Understand basics of data warehousing and mining.	[U]
C912.2	Perform data pre-processing.	[AP]
C912.3	Apply association, classification and clustering methods.	[AP]
C912.4	Compare between classification and clustering solutions.	[AP]
C912.5	Analyze data mining techniques for real world problems.	[A]
C912.6	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]**
C912.1	Understand	Online Quiz	20
C912.2, C912.3	Apply	Presentation	20
C912.4, C912.6	Apply	Assignment	20
C912.5	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**
C912.1	2	3	1		1								1	2	2
C912.2	1	2	2		2	2							2	1	1
C912.3	3	3	3	3	3	1							3	3	1
C912.4	1	1	2		1								1	1	1
C912.5	2	1	2	2	1	3							2	1	2
C912.6	1	2	2	3	3	3							2	2	3

21IT913	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

C913.1	Identify the attributes of data streams that render them valuable for addressing practical challenges in the real world.	[AP]
C913.2	Recognize and implement suitable algorithms to analyze data streams across a range of problems.	[A]
C913.3	Apply diverse algorithms to analyze the data streams.	[AP]
C913.4	Identify the relevant metrics and procedures that contribute to a comprehensive evaluation of the model.	[AP]
C913.5	Discover the storage platform for stream data and utilize various visualization tools for stream data.	[AP]
C913.6	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]**
C913.1	Understand	Assignment	20
C913.2 C913.3	Analyse	Assignment	20
C913.4 C913.5	Apply	Quiz	20
C913.6	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**
C913.1	3	3	3	2	2						2	2	3	3	2
C913.2	3	3	3	3	2		1				1	2	3	3	2
C913.3	3	3	3	3	3		1	1	1	1	2	2	3	3	2
C913.4	3	3	3	2	2						1	1	3	3	2
C913.5	3	3	3	3	3		1		2	2	2	1	3	3	2
C913.6	3	3	3	3	3	2	2	1	2	2	2	2	3	3	2

21IT914	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

C914.1	Recall the basic concepts of cognitive science and its algorithms	[R]
C914.2	Understand the complexities of cognition using neural, social and technological approaches	[U]
C914.3	Practice the Learning, reasoning and designing methodologies in cognitive systems	[AP]
C914.4	Use various Analytics techniques in cognitive systems	[AP]
C914.5	Apply cognitive science theories, concepts to individual, social and cultural issues	[AP]
C914.6	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		
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]**
C914.1	Understand	Online Quiz	20
C914.2	Understand	Assignment	20
C914.3, C914.4 & C914.5	Apply	Assignment	20
C914.6	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
C914.1	3		3		3		2					2	3		
C914.2	2			2			3				2	2		2	
C914.3		3			2				2			2	3		
C914.4	3		2			2	3			2		3			3
C914.5	3		2			2	3			2		3			3
C914.6	3		2			2	3			2		3			3

21IT921	CYBER SECURITY	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Nil	

Course Objectives:

1.	To understand the fundamental concepts of cyber security.
2.	To learn various security techniques and attacks.
3.	To learn about processor design.
4.	To handle files and directory permissions.
5.	To design various security policies.

Course Outcomes

Upon completion of the course, students shall have ability to

C921.1	Understand cyber security and applications.	[U]
C921.2	Apply various techniques to protect system from security attacks.	[AP]
C921.3	Examine the Linux commands	[R]
C921.4	Apply various file handling techniques in real time applications.	[AP]
C921.5	Understand the basics of HTTP, SSL, TLS, DES	[U]
C921.6	Infer suitable security policies for the given requirements.	[A]

Course Contents:

Introduction to Cyber Security: 15 Hours

Introduction to cyber-Security –History of cyber security- Benefits of cyber security- Applications of Cyber security -backup and Data Recovery-Physical access control-Logical access controls - Securely Configured and Encrypted Devices- Securely Configured Network Components- Network segmentation- Email and Online Protection- Wireless Security-Wireless Security-Maintenance monitoring and patching- Vulnerability Assessments and Security Training

Processor Design and Advanced Linux 15 Hours

Changing Directory & Navigation, listing files, Copy, Move, Remove files, Vim, Nano, User Commands, Group Commands, Network Display Commands, Network Configuration Commands, Network Address Spoofing, Handling Files and Directory permissions

Security Protocols: 15 Hours

HTTP, HTTPS, SSL, TLS, Symmetric Key Ciphers: Simplified DES – Block cipher Principles of DES – Strength of DES –Block cipher design principles – Block cipher mode of operation - prime and relatively prime numbers – Testing for primality – Factorization – Euler ‘s totient function, Fermat ‘s and Euler ‘s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - Asymmetric Key Ciphers: RSA cryptosystem – Key management – Diffie Hellman key exchange.

Total Hours	**45**

Text Books:

1.	Charles J. Brooks, Christopher Grow, Philip Craig, “Cybersecurity Essentials Paperback – Illustrated”, Sybex Publisher, 2018.
2.	William Stallings, “Cryptography and Network Security - Principles and Practice” 7th Edition, Pearson Publishers, 2017.
3.	James Graham, Richard Howard and Ryan Olson, "Cyber Security Essentials", Auerbach Publications, USA, 2017.

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]**
C921.1	Understand	Quiz	20
C921.2	Apply		
C921.3	Remember	Assignment	20
C921.4	Apply		
C921.5	Understand	Assignment	20
C921.6	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	20
Understand	35	35	35
Apply	25	25	25

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
C921.1	2	3	3	3	-	-	-	-	-	-	-	3	2	2	2
C921.2	2	3	3	3	-	-	-	-	-	-	-	3	2	1	2
C921.3	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
C921.4	3	2	2	3	-	-	-	-	-	-	-	2	2	2	2
C921.5	3	3	3	3	-	-	-	-	-	-	-	2	2	2	1
C921.6	3	3	3	3	-	-	-	-	-	-	-	2	2	2	1

21AD921	ETHICAL HACKING	3/0/0/3
Nature of Course	C (Theory Concept)	
Prerequisites	Nil	

Course Objectives:

1.	To understand the basic concepts of ethical hacking.
2.	To know about legal consideration while using ethical hacking.
3.	To understand the surveying the attack surface.
4.	To outline the design of active host.
5.	To discuss about network mapping technology.

Course Outcomes

Upon completion of the course, students shall have ability to

C921.1	Understand the requirements of ethical hacking.	[U]
C921.2	Know the usage of threat agent and risk.	[R]
C921.3	Discover the various manipulations on surveying attack.	[AP]
C921.4	Interpret the real-world active reconnaissance.	[AP]
C921.5	Analyze the working of active host.	[A]

Course Contents:

Module I: Introduction to Ethical Hacking **15 hours**

Introduction to Ethical Hacking - Confidentiality, Integrity and availability in Ethical Hacking - Legal Considerations – Threat – Threat Agent – Vulnerability – Flaw – Issue – exploit – Attack – Risk -Incident

Module II: Reconnaissance - Surveying the Attack Surface **15 hours**

Introduction to Reconnaissance - Surveying the attack surface - passive reconnaissance - active reconnaissance – Information collection using Reconnaissance. **Case study** on Reconnaissance

Module III: Scanning and Enumeration **15 hours**

Introduction to Scanning and enumeration - Introduction to Active host – Identifying active host -Network Mapping-Introduction to Nmap and its utilities. **Case study** on Nmap

Total Hours	**45**

Text Books:

1.	Hein Smith, Hilary Morrison, “Ethical Hacking: A Comprehensive Beginner’s Guide to Learn and Master Ethical Hacking”, 2018 Kindle Edition.
2.	Paulino Calderon Pale, “Nmap Network Exploration and Security Auditing Cookbook: Network discovery and security scanning at your fingertips”, Third Edition, Packt Publishing, 2017.

Reference Books:

1.	Michael T. Simpson, Kent Backman, James E. “Corley, Hands-On Ethical Hacking and Network Defense”, Second Edition, CENGAGE Learning, 2010.
2.	Steven DeFino, Barry Kaufman, Nick Valenteen, “Official Certified Ethical Hacker Review Guide”, CENGAGE Learning, 2009-11-01.
3.	Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, Syngress Basics Series – Elsevier, August 4, 2011.
4.	Whitaker & Newman, “Penetration Testing and Network Defense”, Cisco Press, Indianapolis, IN, 2006.

Web References:	
1.	https://www.coursera.org/learn/ethical-hacking-essentials-ehe
2.	https://www.javatpoint.com/ethical-hacking
3.	https://www.udemy.com/topic/ethical-hacking/
4.	https://www.geeksforgeeks.org/introduction-to-ethical-hacking/

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	Quiz	20
C921.2	Remember	Tutorial	20
C921.3	Apply	Assignment	20
C921.4	Apply		
C921.5	Analyze	Presentation	20

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

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

Course 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	2			1						1			3	2	2
C921.2	2	1	1	1						1	1		2	2	3
C921.3	2	1	1	1						1	1		2	2	2
C921.4	2	1	1	1						2	2		3	3	3
C921.5	2	1	1	1						1	1		3	2	2

21CS921	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

C921.1	Explain the fundamentals of Cyber security and understand the importance of Cyber Intelligence.	[U]
C921.2	Identify the malware, ransomware attacks and the key elements of the cyber threats.	[U]
C921.3	Categorize the tools of cyber security.	[AN]
C921.4	Illustrate role of encryption tools and web vulnerability scanning tools.	[AP]
C921.5	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]**
CS921.1	Understand	Quiz	20
CS921.2	Understand	Assignment	20
CS921.3	Analyze	Presentation	20
CS921.4 & CS921.5	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
C921.1	3	3	3									3	3		3
C921.2	3	3	3	2								3	3		3
C921.3	3	3	3	2	2				1	1		3	3	2	3
C921.4	3	3	3	2	2				1	1		3	3	2	3
C921.5	3	3	3	3	3				1	1	3	3	3	3	3
C921	**3**	**3**	**3**	**3**	**3**				**1**	**1**	**3**	**3**	**3**	**3**	**3**

3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed

21AD922	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:

C922.1	Understanding the basics of networking with the introduction on the system attacks	[U]
C922.2	Explain the foundations of attacks in terms of industry, society and information systems	[U]
C922.3	Apply appropriate methods, securities and vulnerabilities.	[AP]
C922.4	Explore the methods of services of a remote host.	[A]
C922.5	Design and implement innovative features in NSE scripts.	[AP]
C922.6	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		
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	Quiz	20
C922.2	Apply	Tutorial	20
C922.3	Apply	Assignment	20
C922.4	Understand		
C922.5 & C922.6	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	-	-	-

<table>
<tr><th colspan="6">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="5">Continuous Assessment (40%)

[200 Marks]</th><th rowspan="3">End Semester Examination (60%)

[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="2">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1

(60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2

(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I

(20 Marks)</th><th>Component - II

(20 Marks)</th><th>Component - I

(20 Marks)</th><th>Component - II

(20 Marks)</th></tr>
</table>

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
C922.1	3	3	3	2	2							2	3	3	2
C922.2	3	3	2	2	2							2	2	2	2
C922.3	3	3	3	3	2							2	2	2	3
C922.4	3	3	3	2	3							2	2	2	3
C922.5	3	3	3	3	2							2	2	2	2
C922.6	3	3	3	3	3							2	2	2	2

21IT922	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

C922.1	Learn the basics of wireless sensor networks and Embedded Operating system.	[R]
C922.2	Understand the architecture and elements of wireless sensor networks	[U]
C922.3	Understand the various routing protocols of wireless sensor networks	[U]
C922.4	Apply the concept of Synchronization and Localization for sensor networks	[AP]
C922.5	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]**
C922.2, C922.3	Understand	Assignment	20
C922.5	Analyse	Quiz	20
C922.1 C922.4	Apply	Case Study	20
C922.5	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**
C922.1	2	2	2	2	1	2	2	-	-	-	-	1	2	2	2
C922.2	3	3	2	3	1	1	3	-	-	-	-	1	2	2	2
C922.3	3	3	2	2	1	1	2	-	-	-	-	1	2	2	2
C922.4	3	3	2	3	1	2	2	-	-	-	-	1	2	3	2
C922.5	3	2	2	2	1	2	3	-	-	-	-	1	3	2	2

21IT923	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

C923.1	Outline the challenges in ad-hoc networks.	[U]
C923.2	Analyze the protocols and scheduling mechanisms used at the MAC layer.	[A]
C923.3	Summarize the different routing protocols used in network and transport layers.	[U]
C923.4	Apply the energy management and QoS techniques in various real time environments.	[AP]
C923.5	Identify the issues related to security and cross layer integration.	[AP]
C923.6	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]**
C923.1	Understand	Quiz	20
C923.2, C923.6	Analyze	Assignment – 1	20
C923.5, C923.4, C923.3	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**
C923.1	3	3	2	2	2						3	2	3	3	2
C923.2	3	3	3	3	2						2	2	2	3	1
C923.3	3	3	3	3	2						2	2	2	3	2
C923.4	3	3	3	2	2						2	1	1	2	2
C923.5	3	3	3	2	2						2	2	2	2	2
C923.6	3	3	3	3	2						2	2	2	3	1

21IT924	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

C924.1	Extend the emerging abstract models for Blockchain Technology	[U]
C924.2	Build new applications with different tiers of blockchain technology	[AP]
C924.3	Understand the concept of bitcoin and the technological background behind it	[U]
C924.4	Utilize the Bitcoin Security features and its implementation	[AP]
C924.5	Categorize Ethereum and Hyperledger technology	[A]
C924.6	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]**
C924.1, C924.2	Understand, Apply	Online Quiz	20
C924.3, C924.4	Understand, Apply	Assignment	20
C924.5	Analyse	Assignment	20
C924.6	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**
C924.1	3	3	1									1	2	2	2
C924.2	3	2	2									2	-	2	2
C924.3	3	3	2									2	2	1	2
C924.4	3	2	2									-	-	1	1
C924.5	3	2	3									2	-	2	2
C924.6	3	2	3									2	2	1	1

21IT001	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

21IT002	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

21IT003	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

21IT004	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: laaS- 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 ǁ”, 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

21IT005	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

21IT006	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

21IT007	OPEN-SOURCE DEEP LEARNING FRAMEWORKS	3/0/0/3
Nature of Course	D (Theory Application)	
Pre requisites	Python Programming, Artificial Intelligence and Machine Learning	

Course Objectives:

1.	To become familiar with the language and fundamental concepts of artificial neural networks.
2.	To understand and implement Deep Learning Architectures.
3.	To familiarize the student with the Image Processing facilities like TensorFlow and Keras.
4.	To get familiar with the use of TensorFlow/Keras in Deep Learning Applications.
5.	To make the students build deep learning models, interpret results, and build own deep learning projects.

Course Outcomes

Upon completion of the course, students shall have ability to

C007.1	Understand and review tools available to build Deep Learning including Tensor Flow, Keras.	[U]
C007.2	Build Deep Learning Machine Learning models using Tensor Flow and various interfaces.	[AP]
C007.3	Apply deep neural network models to generate realistic images in Tensorflow.	[AP]
C007.4	Develop probabilistic models with TensorFlow, making particular use of the TensorFlow Probability library.	[AP]
C007.5	Classify regression and classification models using the Keras library together with convolutional networks and to build them using the Keras library.	[A]
C007.6	Develop deep learning algorithms for computer vision problems using Keras.	[AP]

Course Contents:

Introduction to Artificial Neural Networks with Keras: 15 Hours
From Biological to Artificial Neurons, **Implementing MLPs with Keras:** Building an Image Classifier Using the Sequential API, Building an Image Classifier and regression MLP using the Sequential API, Building Complex Models using the Functional API, Building Dynamic Models Using the Subclassing AP, Fine-Tuning Neural Network Hyper parameters. **Training Deep Neural Networks:** Vanishing/Exploding Gradients Problems, Reusing Pretrained Layers, Faster Optimizers, Avoiding Over fitting through Regularization.

Models and Training with TensorFlow: 15 Hours
Tour of TensorFlow, Using TensorFlow like NumPy, Customizing Models and Training Algorithms, TensorFlow Functions and Graphs. **Loading and Preprocessing Data with TensorFlow**: The Data API, The TFRecord Format, The Features API, TF Transform. **Case Study**: The TensorFlow Datasets (TFDS) Project.

Deep Computer Vision using Convolutional Neural Networks: 15 Hours
The Architecture of the Visual Cortex, Convolutional Layer, Pooling Layer. **CNN Architectures:** LeNet-5, AlexNet, GoogLeNet, VGGNet, ResNet, Xception, SENet. Implementing a ResNet-34 CNN using Keras, Using Pretrained Models from Keras, Pretrained Models for Transfer Learning, Classification and Localization, Object Detection, Semantic Segmentation.

Total Hours	**45**

Text Books:	
1.	Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”, 3rd Edition, O'Reilly Media, 2022.
2.	Antonio Gulli, Amita Kapoor, Sujit Pal “Deep Learning with TensorFlow 2 and Keras”, 2nd Edition, Packt Publishing, 2019
3.	Ian Goodfellow, Yoshua Bengio, Aaron Cour, “Deep Learning (Adaptive Computation and Machine Learning series)”, The MIT Press, 2016.
Reference Books:	
1.	Liangqu Long, Xiangming Zeng, “Beginning Deep Learning with TensorFlow: Work with Keras, MNIST Data Sets, and Advanced Neural Networks”, APress; 1st Edition, 2022.
2.	Joseph, Ferdin Joe John, Sarayut Nonsiri, and Annop Monsakul. "Correction to Keras and TensorFlow: A Hands-On Experience." Advanced Deep Learning for Engineers and Scientists. Springer, 2021.
3.	Davies, E. R., and Matthew Turk. “Advanced methods and deep learning in computer vision”, Elsevier Science & Technology, 2021.
Web References:	
1.	https://www.kaggle.com/code/jameskhoo/deep-learning-with-keras-and-tensorflow/notebook
2.	https://codebasics.io/courses/deep-learning-with-tensorflow-keras-and-python
3.	https://github.com/codebasics/deep-learning-keras-tf-tutorial
4.	https://www.analyticsvidhya.com/blog/2021/11/training-neural-network-with-keras-and-basics-of-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]
C007.1	Understand	Assignment	20
C007.2 C007.3	Apply	Quiz	20
C007.4 C007.6	Apply	Case Study	20
C007.5	Analyse	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	20	20
Apply	70	50	60
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 Outcomes (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C007.1	2	3	3	3	3	2	2	1	1			2	3	2	2
C007.2	1	2	2	2	2	2	2	1	1			2	3	2	1
C007.3	3	3	2	2	3	2	2	1	1			2	3	3	3
C007.4	1	2	3	3	1	2	2	1	1			2	2	2	2
C007.5	2	3	2	2	2	2	3	1	1			2	2	3	2
C007.6	2	2	3	2	2	2	2	1	1			2	3	2	3

21IT008	KOTLIN FOR CROSS - PLATFORM APPLICATION DEVELOPMENT	3/0/0/3
Nature of Course	H (Theory Technology)	
Pre requisites	Web Development using React and Java Programming	

Course Objectives:

1.	To study the key characteristics of Kotlin
2.	To understand the types of tasks where Kotlin can be used
3.	To understand the basic syntaxes of variables, conditions, loops and array
4.	To learn the working of different types of functions, OOP in Kotlin
5.	To understand the creation and running of an Android Activity

Course Outcomes

Upon completion of the course, students shall have ability to

C008.1	Outline the Kotlin programming concepts.	[U]
C008.2	Classify the standard functions included with Kotlin's standard library	[U]
C008.3	Experiment with the basics of Android for creating text, images, and interactive buttons	[AP]
C008.4	Illustrate the interoperability with Java classes and ensure Java compatibility	[A]
C008.5	Make use of object-oriented concepts in implementing simple Android Application.	[AP]
C008.6	Deduce the real world applications using kotlin language	[A]

Course Contents:

Introduction: **15 Hours**

Overview of Kotlin – Advantages and Disadvantages- Kotlin for Android - Getting started with Hello World app - Data Types – Operators - Kotlin mutable and immutable variables Type Conversion - Expression & Statement – Comments - Input/Output- Java Interoperability – Calling Kotlin from Java – Calling Java from Kotlin – if expression - when Expression - while Loop - for Loop – break and continue- Null safety-Case study: Design a simple arithmetic calculator App

Object Oriented Concepts: **15 Hours**

Kotlin function- Infix Function Call - Default and Named Arguments - Recursion - Tail Recursion - Kotlin Class and Objects – Constructors- Kotlin Getters and Setters - Inheritance - Visibility Modifiers - Abstract Class - Interfaces - Nested and Inner Classes - Data Class - Sealed Class - Kotlin Object- Companion Objects - Extension Function - Operator Overloading. Case study: Design a banking management application using object oriented programming using kotlin

Collections: **15 Hours**

Kotlin Collections- Kotlin list : Arraylist - Set -Map - Installation of android studio - Hello World App- Android event handling, multi-touch event handling- Establishing JDBC Connection- Accessing database from Kotlin- Exception Handling - try, catch, throw and finally - Nested try block and multiple catch block. Case study: Build a simple database application that can sort and store the user's data

Total Hours	**45**

Text Books:

1.	Pierre-Yves Saumont, "The Joy of Kotlin", Manning Publications, 2019.

2.	Ken Kousen, “Kotlin Cookbook, A Problem Focused Approach”, O'Reilly Media, Inc. 2019.
3.	Antonio Leiva, “Kotlin for Android Developers: Learn Kotlin while developing an Android App”, CreateSpace Independent Publishing, 2016
Reference Books:	
1.	John Horton, “Android Programming with Kotlin for Beginners”, Packt Publishing Limited, 2019.
2.	Dmitry Jemerov, Svetlana Isakova, “Kotlin in Action”, Manning Publications, 2017,
3.	Stephen Samuel, Stephen Bocutiu, “Programming Kotlin”, Packt Publishing Limited 2017.
4.	Aleksei Sedunov “Kotlin In-Depth”,BPB Publications,2022.
Web References:	
1.	https://developer.android.com/kotlin
2.	https://kotlinlang.org/
3.	https://www.w3schools.com/kotlin/index.php
Online Resources:	
1.	https://onlinecourses.swayam2.ac.in/aic20_sp02/preview
2.	https://www.coursera.org/projects/learn-object-oriented-programming-with-kotlin
3.	https://www.udemy.com/course/complete-kotlin-android-developer-course-tutorial/

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]**
C008.1 C008.2	Understand	Assignment	20
C008.3	Apply	Quiz	20
C008.5	Apply	Case Study	20
C008.4, C008.6	Analyse	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	20	20	20
Apply	60	50	50
Analyse	20	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**
C008.1	3	3	3		2	2			1		2	2	2	3	2
C008.2	3	3	3		2	2			1		2	2	3	3	3
C008.3	3	3	3	3	3	2		2	1		2	2	3	3	3
C008.4	3	3	3	2	2	2			1		2	2	2	3	3
C008.5	3	3	3	2	2	2		2	1		2	2	2	3	3
C008.6	3	3	3		2	2			1		2	2	2	3	3

21IT009	EXTENDED REALITY	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Nil	

Course Objectives:

1.	Interpret the concepts of augmented reality
2.	Describe the various kinds of display techniques in augmented reality
3.	To Understand the basic concept and framework of virtual reality
4.	Describe the technology for multimodal user interaction and perception in VR
5.	Apply the virtual, augmented and extended reality concepts in various fields

Course Outcomes

Upon completion of the course, students shall have ability to

C009.1	Understand the basic technology used in augmented reality	[U]
C009.2	Develop visual, audio and other contents in augmented reality	[AP]
C009.3	Understand the fundamental concepts and features of virtual reality	[U]
C009.4	Utilize various input-output interfaces and interactive techniques in virtual reality	[AP]
C009.5	Apply AR and VR concepts in various modern fields	[AP]
C009.6	Analyze and use XR technology in engineering and other fields	[A]

Course Contents:

Augmented Reality Concepts **15 Hours**

Introduction of Augmented Reality (AR): History of Augmented Reality, System Structure of Augmented Reality, Key Technology in AR, Augmented Reality Vs Virtual Reality. **Display Techniques:** Monitor Based, Head Mounted Displays – Video See-through and optical See- through methods, Issues and Challenges in AR, **Augmented Reality Content:** Creating Visual Content, Creating Audio Content, Creating Content for Other Senses (Touch, Taste, Smell), Mobile Augmented Reality.

Virtual Reality Concepts **15 Hours**

Introduction of Virtual Reality (VR): Fundamental Concept and Components of Virtual Reality, Primary Features and Architecture of VR systems. **Multiple Modals of Input and Output Interface in Virtual Reality:** Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video based Input, 3D Menus & 3D Scanner, Output -- Visual / Auditory / Haptic Devices. **Interactive Techniques in Virtual Reality**: Body Track, Hand Gesture, 3D Manus, Object Grasp.

Extended Reality and Applications **15 Hours**

Extended Reality (XR): Definitions of extended reality; Historical context of extended reality (analogue & digital). **Application of AR:** Medicine, Broadcast Augmentation **Application of VR:** VR Technology in Engineering, Education and Medicine. **Tools:** Cospaces – Hands-on Training & Case study on Real Time Human Body Analysis.

Total Hours	**45**

Text Books:

1.	Alan Craig, Morgan Kaufmann, “Understanding Augmented Reality”, 1st Edition, 2013.

2.	Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles and Practice (Usability)”, Pearson Education (US), 2016.
3.	Burdea, G. C., P. Coffet., “Virtual Reality Technology”, 2nd Edition. Wiley IEEE Press, 2017.
4.	Bernard Marr, “Extended Reality in Practice”, Wiley, 2021.
Reference Books:	
1.	Jason Jerald, “The VR Book: Human-Centred Design for Virtual Reality”, Association for Computing Machinery and Morgan & Claypool, New York, NY, USA. 2015.
2.	Steve Aukstakalnis, “Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)”, Addison-Wesley Professional, 1st Edition, 2016.
3.	Jolanda G. Tromp, Marco Sacco, Mariano Alcaniz “Roadmapping Extended Reality”, Wiley, 2022.
Web References:	
1.	https://nptel.ac.in/courses/106106138/
2.	https://www.coursera.org/learn/ar
3.	https://www.coursera.org/specializations/extended-reality-for-everybody
4.	https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality-technologies-applications-issues
5.	https://www.edx.org/learn/augmented-reality
6.	https://www.mooc-list.com/tags/extended-reality-everybody-specialization
7.	https://stanford.edu/class/ee267/
Online Resources:	
1.	https://docs.unity3d.com/Manual/XR.html
2.	https://www.javatpoint.com/augmented-reality-vs-virtual-reality
3.	https://www.techtarget.com/whatis/definition/augmented-reality-AR
4.	https://www.guru99.com/difference-between-ar-vr.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]**
C009.1, C009.3	Understand	Assignment	20
C009.2, C009.5	Apply	Assignment	20

C009.4	Apply	Quiz	20
C009.6	Analyze	Technical 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	-	-	-
Understand	40	30	30
Apply	50	50	50
Analyse	10	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**
C009.1	3	2	2	2	1						2	2	1	2	1
C009.2	2	2	1	1	2	1					2	2	3	3	2
C009.3	3	2	3	3	3	2					2	3	3	3	2
C009.4	2	2	3	3	3	2					3	3	3	3	2
C009.5	1	2	3	3	2	2					2	2	3	3	2
C009.6	1	2	3	3	2	2					3	2	1	2	1

21IT010	EXPLAINABLE AI	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Artificial Intelligence and Machine Learning	
Course Objectives:		
1.	To facilitate understanding of the purpose of explainability in the context of the machine learning applications.	
2.	To provide guidelines for scrutinizing and choosing the appropriate explainability technique with respect to the scenario.	
3.	To instruct on evaluation of XAI methods by different properties including precision & fidelity, robustness, uncertainty, and representativeness	
4.	To brief on the procedure to build XAI models for various prominent ML and AI algorithms.	
Course Outcomes		
Upon completion of the course, students shall have ability to		
C010.1	Understand the concepts of Explainable AI and interpretable machine learning.	[U]
C010.2	Choose and assess appropriate Explainable AI methods.	[A]
C010.3	Apply comprehension of current techniques for generating explanations from black-box machine learning methods for real life applications.	[AP]
C010.4	Make use of analytics tools and performance metrics to address model fairness, explainability issues, and mitigate bottlenecks	[AP]
C010.5	Utilize proper tools to explain a model's inner workings to laypeople and expert audiences and to promote a model's fairness	[AP]
C010.6	To build explainable models for Linear Regression, Logistic Regression, Decision Tree and CNN.	[AP]

Course Contents:

Explaining Artificial Intelligence **15 Hours**

Defining explainable AI, Designing and extracting, XAI Medical diagnosis timeline, White box XAI for AI bias and ethics: Moral AI bias in self driving cars, Autopilot decision trees.

Explaining Machine Learning **15 Hours**

Explaining Machine learning with Facets, Overview of Facets, Sorting the Facets statistics, Facets dive, Linear and Logistic models with SHAP, Local Interpretable Model-Agnostic Explanations(LIME) .

Contrastive XAI & Cognitive XAI: **15 Hours**

Contrastive Explanations method, Defining and training the CNN model, Defining and training the autoencoder, Cognitive rule based explanations, A cognitive approach to vectorizers, Human cognitive input for the CEM.

Total Hours	**45**

Text Books:	
1.	Denis Rothman, “Hands-On Explainable AI (XAI) with Python”, Packt 2020.
2.	Molnar, C., “Interpretable Machine Learning: A Guide For Making Black Box Models Explainable”, 2020.
Reference Books:	
1.	Michael Munn, David Pitman, “Explainable AI for Practitioners: Designing and Implementing Explainable ML Solutions”, O’Reilly, 2022.
2.	Ajay Thampi, “Explainable AI: Interpreting, Explaining and Visualizing Deep Learning”, Manning Publications, 2022.
Web References:	
1.	https://www.coursera.org/lecture/machine-learning-modeling-pipelines-in-production/explainable-ai-qQYBK
2.	https://human-centered.ai/methods-of-explainable-ai/
Online Resources:	
1.	https://cloud.google.com/explainable-ai
2.	https://www.ibm.com/watson/explainable-ai
3.	https://shap.readthedocs.io/en/latest/example_notebooks/overviews/An%20introduction%20to%20explainable%20AI%20with%20Shapley%20values.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]**
C010.1	Understand	Assignment	20
C010.5	Apply	Quiz	20
C010.3 C010.4	Apply	Case Study	20
C010.2, C010.6	Analyze, 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	20	20	20
Apply	60	70	60
Analyse	20	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**
C010.1	2	1	2	1								1	2	2	2
C010.2	2	2	2	1	1	1					1	1	2	2	2
C010.3	2	2	3	2	2	3	2			1	2	1	2	2	2
C010.4	2	2	2	1	3	1	1			1	1	1	2	2	2
C010.5	2	2	3	2	3	3	2	1		3	2	1	2	2	2
C010.6	3	2	3	1	3						2	1	2	2	2

21IT011	PRINCIPLES OF INDUSTRY 4.0	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Nil	

Course Objectives:

1.	To describe the advancements in Industry 4.0
2.	To understand industry 4.0 applications in the business world.
3.	To distinguish and overcome the challenges in the business world.

Course Outcomes

Upon completion of the course, students shall have ability to

C011.1	Relate the drivers and enablers of Industry 4.0	[R]
C011.2	Define the smartness in Smart Factories, Smart cities, smart products and smart services.	[R]
C011.3	Understand the various systems used in a manufacturing plant and their role in an Industry 4.0 world.	[U]
C011.4	Choose the key IIoT technologies	[AP]
C011.5	Identify the opportunities and challenges brought about by Industry 4.0	[AP]
C011.6	Classify the security challenges involved in industry 4.0	[A]

Course Contents:

Introduction to the Industrial Internet and IIoT Reference Architecture: 15 Hours
Introduction to IIoT, Key IIoT Technologies Catalysts and Precursors of the IIoT, Innovation and the IIoT, Key Opportunities and Benefits, The Digital and Human Workforce. The IIC Industrial Internet Reference Architecture, Industrial Internet Architecture Framework (IIAF), Architectural Topology, The Three-Tier Topology, Connectivity, Key System Characteristics, Data Management.

Middleware IIoT, WAN and Securing the Industrial Internet: 15 Hours
Examining the Middleware Transport Protocols - Middleware Software Patterns: Publish/Subscribe Pattern - Delay Tolerant Networks (DTN) - Software Design: API - Web Services. Middleware Industrial Internet of Things Platforms - IIoT WAN Technologies and Protocols - Securing the Industrial Internet.

Industry 4.0 and Smart Factories: 15 Hours
Introducing Industry 4.0 - The Value Chain - Industry 4.0 Design Principles - Building Blocks of Industry 4.0 - Smart Manufacturing - Smart Factories - Real-World Smart Factories - Digital Transformation - Customer Experience - Transforming Operational Processes - Transforming Business Models - Increase Operational Efficiency - Adopt Smart Architectures and Technologies.

Total Hours	**45**

Text Books:

1.	Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, Apress, 2016.

Reference Books:

1.	Elena G. Popkova, Yulia V. Ragulina, Aleksei V. Bogoviz, “Industry 4.0: Industrial Revolution of the 21st Century”, Springer, 2019.
2.	Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits, “Industry 4.0 for SMEs: Challenges, Opportunities and Requirements”, Palgrave MacMillan, 2020.

3.	Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova, “Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work”, Emerald Group Publishing, 2019.
4.	Alp Ustundag, Emre Cevikcan, “Industry 4.0: Managing The Digital Transformation”, Springer, 2017.
Web References:	
1.	https://www.ibm.com/in-en/topics/industry-4-0
2.	https://www.sap.com/india/insights/what-is-industry-4-0.html
3.	https://www.classcentral.com/course/linkedin-learning-foundations-of-the-fourth-industrial-revolution-industry-4-0-76632
4.	https://www.ibm.com/in-en/topics/industry-4-0
Online Resources:	
1.	https://onlinecourses.nptel.ac.in/noc21_cs66/preview
2.	https://www.udemy.com/course/fundamental-of-industry-40/
3.	https://www.tuvsud.com/en-in/landing/asmea/introduction-to-smart-industry-readiness-index-training

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]**
C011.1, C011.2	Remember	Online Quiz	20
C011.3	Understand	Online Quiz	20
C011.4, C011.5	Apply	Assignment – 1	20
C011.6	Analyse	Assignment - 2	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	30	30
Understand	40	30	30
Apply	20	20	20
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
C011.1	2	3	1		1								1	2	2
C011.2	1	2	2		2								2	1	1
C011.3	3	3	3	3	3								3	3	1
C011.4	1	1	2		1								1	1	1
C011.5	2	1	2	2	1								2	1	2
C011.6		2	2		2								1	1	1

21IT012	FOG AND EDGE COMPUTING	3/0/0/3
Nature of Course	C (Theory Concept)	
Pre requisites	Embedded Systems and Internet of Things and Cloud Computing	

Course Objectives:

1.	To explore major components of fog and edge computing architectures.
2.	To identify potential technical challenges of the transition process and suggest solutions.
3.	To analyze data and application requirements and pertaining issues.
4.	To discover the need for new computing paradigms.

Course Outcomes

Upon completion of the course, students shall have ability to

C012.1	Demonstrate the software using standard open-source fog and edge computing software for data analytics.	[U]
C012.2	Understand the key architectures and applications in fog and edge computing.	[U]
C012.3	Identify the basic principles and concepts of fog and edge computing systems and their relation to other models such as Cloud Computing.	[AP]
C012.4	Analyze the challenges of developing fog and edge-based applications and middleware, and the possible solutions to deal with them.	[A]
C012.5	Select the best approach for a particular problem regarding the design and development of a fog and edge computing system.	[AP]
C012.6	Classify and implement an application using containers while taking into account some of the issues like security, offloading, SDN, load balancing, communication, containers and orchestration, application areas.	[A]

Course Contents:

Fog Computing: **15 Hours**

Introduction to Fog Computing, Limitation of Cloud Computing, Differences between Cloud and Fog Computing, Advantages, Business Models, Architecture, Opportunities and Challenges, Challenges in Fog Resources: Taxonomy and Characteristics, Resource Management Challenge, Optimization Challenges, Miscellaneous Challenges.

Edge Computing: **15 Hours**

Introduction to Edge Computing, Origins of Edge, Edge Helping Low-End IoT Nodes, Architecture, Edge Helping Higher-Capability Mobile Devices: Mobile Offloading, Edge Helping the Cloud, Programming Paradigms, Research Challenges and Research Directions, Fog Protocols, Management and Orchestration of Network Slices in 5G, Fog, Edge and Clouds, Data Management and Analysis in Fog Computing.

Application of Edge/Fog Computing: **15 Hours**

Edge/Fog for Augmented Reality, Data Processing on the Edge/Fog, Dispersed Learning with Edge/Fog Computing, Video Analytics on the Edge/Fog, Smart e-Health, Smart surveillance, Smart transportation, Predictive analysis for Edge/Fog applications deployment, Testing of Edge/Fog IoT apps, ML techniques for defending IoT systems.

Total Hours	**45**

Text Books:

1.	Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge Computing”, Wiley Publications, 2019.

2.	Wei Change and Jie Wu, “Fog/Edge Computing for Security, Privacy and Applications”, Springer, 2021.
3.	Perry Lea, “IoT and Edge Computing for Architects” Packt Publishing, 2nd Edition, 2020.
Reference Books:	
1.	Seong-eun Yoo, Taehong Kim, Youngsoo Kim, “Edge/Fog Computing Technologies for IoT Infrastructure”, Multidisciplinary Digital Publishing, 2021
2.	Taheri J. & Deng S. (eds.): “Edge Computing: Models, Technologies and Applications”, IET, 2020
3.	Al-Turjman F. (ed.): “Edge Computing: from hype to reality”, Springer, 2019.
Web References:	
1.	https://www.automationworld.com/fog-computing-vs-edge-computing-whats-difference
2.	https://a16z.com/2016/12/16/the-end-of-cloud-computing/
3.	http://www.faredge.eu/#/
4.	https://opcfoundation.org/markets-collaboration/openfog/
5.	https://www.docker.com/
Online Resources:	
1.	https://www.comsoc.org/publications/magazines/ieee-communications-magazine/cfp/future-trends-fogedge-computing-and
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9781119525080
3.	https://www.oreilly.com/library/view/fog-and-edge/9781119524984/

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]**
C012.3	Apply	Assignment	20
C012.4	Analyze	Case Study	20
C012.1 C012.2	Understand	Quiz	20
C012.2, C012.6	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	20	10	20
Apply	50	40	40
Analyse	30	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**
C012.1	3	3	2	3	2						2	2	3	3	3
C012.2	3	2	3	2	2				1	1	2	2	3	2	3
C012.3	2	3	2	3	3						2	2	3	3	2
C012.4	3	2	2	3	3						2	2	2	3	2
C012.5	3	3	2	3	2				1	1	2	2	3	3	3
C012.6	3	3	2	2	2				1	1	2	2	2	3	3

21MC103	SOFT SKILLS	2/0/0/0
Nature of Course:	Theory Concept	
Pre requisites:	Technical Communication Skills	

Course Objectives:

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

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

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

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

21MC105	GENERAL APTITUDE	2/0/0/0
Nature of Course	Problem analytical	
Pre requisites	Basic Mathematical calculations	

Course Objectives:

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

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

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

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		

21MC106	LIFE SKILLS AND ETHICS	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

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

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

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

Total Hours:	**30**

Reference Books:

1	Barun K. Mitra, “Personality Development & Soft Skills”, First Edition, Oxford Publishers, 2011.
2	Kalyana, “Soft Skill for Managers”, 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

21MC107	STRESS MANAGEMENT	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

C107.1	Understand the basic principles of stress management	[U]
C107.2	Apply the concept of recognizing your stress triggers and find 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		

21MC108	CONSTITUTION OF INDIA	2/0/0/0

Nature of Course : Theory

Pre Requisites : Nil

Course Objectives:

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

Course Outcomes:

Upon completion of the course, students shall have ability to

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

Course Contents:

Module 1 **10 Hours**

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

Module 2 **10 Hours**

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

Module 3 **10 Hours**

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

Total Hours:	**30**

Text Books:

1	Dr. D. D. Basu, “Introduction to the Constitution of India”, LexisNexis, New Delhi, 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	

21MC109	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2/0/0/0
Nature of Course : Theory		
Pre Requisites : Nil		

Course Objectives:

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

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

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

21VA900	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/

21VA901	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/