R.M.D. ENGINEERING COLLEGE

(An Autonomous Institution)

R.S.M Nagar, Kavaraipettai, Gummidipoondi Taluk,
Thiruvallur District, Tamil Nadu- 601206
Affiliated to Anna University, Chennai / Approved by AICTE, New Delhi /
Accredited by NAAC / All the Eligible UG Programs are Accredited by NBA, New Delhi

B.Tech. Degree in

INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABI

REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

(For the students admitted in the Academic Year 2022 – 2023)

DEPARTMENT OF INFORMATION TECHNOLOGY

R.M.D. ENGINEERING COLLEGE

KAVARAIPETTAI – 601 206

TAMILNADU, INDIA.

R.M.D. ENGINEERING COLLEGE
(An Autonomous Institution)
B.TECH INFORMATION TECHNOLOGY
REGULATIONS – 2022
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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To ensure graduates will be proficient in utilizing the fundamental knowledge of basic sciences, mathematics and Information Technology for the applications relevant to various streams of Engineering and Technology.

2. To enrich graduates with the core competencies necessary for applying knowledge of computers and telecommunications equipment to store, retrieve, transmit, manipulate and analyze data in the context of business enterprise.

3. To enable graduates to think logically, pursue lifelong learning and will have the capacity to understand technical issues related to computing systems and to design optimal solutions.

4. To enable graduates to develop hardware and software systems by understanding the importance of social, business and environmental needs in the human context.

5. To enable graduates to gain employment in organizations and establish themselves as professionals by applying their technical skills to solve real world problems and meet the diversified needs of industry, academia and research.

PROGRAM OUTCOMES (POs)

ENGINEERING GRADUATES WILL BE ABLE TO:

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.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

After the successful completion of the program, the graduates will be able to:

1. To create, select, and apply appropriate techniques, resources, modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
2. To manage complex IT projects with consideration of the human, financial, ethical and environmental factors and an understanding of risk management processes, and operational and policy implications.
3. Identify and utilize the strengths of current technologies in the hardware/support and mobile technology domains in implementing IT enabled services for societal needs.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	PROGRAMME OUTCOMES (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEO1	3	2										2
PEO2	3	3	1	1								2
PEO3			3			1						3
PEO4			3		1	2	3	1				
PEO5				3				1	1	2	2	1

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAM SPECIFIC OBJECTIVES (PSOs)	PROGRAMME OUTCOMES											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PSO1	3	2			3				2	2		3
PSO2	3	3	3	3	3	3	3	3	3	3	3	3
PSO3				3			3	3			3	2

Contribution 1: Reasonable 2:Significant 3:Strong

R.M.D. ENGINEERING COLLEGE
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B.TECH INFORMATION TECHNOLOGY
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I - VIII SEMESTERS CURRICULUM

SEMESTER-I

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1	22MA101	Matrices and Calculus	BSC	5	3	0	2	4
2	22CH101	Engineering Chemistry	BSC	5	3	0	2	4
3	22CS101	Problem Solving using C++	ESC	5	3	0	2	4
4	22CS102	Software Development Practices	ESC	5	3	0	2	4
5	22EC101	Digital Principles and System Design	ESC	5	3	0	2	4
LABORATORY COURSES WITH THEORY COMPONENT								
6	22GE111	Computer Aided Engineering Graphics	ESC	3	1	0	2	2
LABORATORY COURSES								
7	22GE112	Product Development Lab-I	EEC	2	0	0	2	1
MANDATORY COURSES								
8	22MC101	Induction Program (Non Credit)	MC	3 Weeks				
TOTAL				**30**	**16**	**0**	**14**	**23**

SEMESTER-II

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	22GE101	Heritage of Tamils	HSMC	1	1	0	0	1
THEORY COURSES WITH LABORATORY COMPONENT								
2	22MA201	Transforms and Numerical Methods	BSC	5	3	0	2	4
3	22CS201	Data Structures	ESC	5	3	0	2	4
4	22PH201	Physics for Computer Science and Information	BSC	5	3	0	2	4
5	22HS101	Professional Communication	HSMC	4	2	0	2	3
6	22CS202	Java Programming	ESC	5	3	0	2	4
7	22IT201	Database Management System	PCC	5	3	0	2	4
LABORATORY COURSES								
8	22GE211	Product Development Lab – II	EEC	2	0	0	2	1
MANDATORY COURSES								
9	22CH102	Environmental Sciences and Sustainability (Non Credit)	MC	2	2	0	0	0
AUDIT COURSES								
10	22AC201	Yoga for Stress Management	AC	1	1	0	0	0
TOTAL				**35**	**21**	**0**	**14**	**25**

SEMESTER-III

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY COURSES								
1.	22GE301	Universal Human Values II: Understanding Harmony	HSMC	4	2	2	0	3
2.	22GE201	Tamils and Technology	HSMC	1	1	0	0	1
3.	22MA301	Discrete Mathematics	BSC	4	3	1	0	4
4.	22IT301	Design Thinking	ESC	4	3	1	0	4
THEORY COURSES WITH LABORATORY COMPONENTS								
5.	22CS301	Advanced Java Programming	PCC	5	3	0	2	4
6.	22CS303	Design and Analysis of Algorithms	PCC	4	2	0	2	3
7.	22CS304	Operating Systems	PCC	4	2	0	2	3
LABORATORY COURSES								
8.	22GE311	Product Development Lab-III	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
9.	22CS311	Aptitude and Coding Skills I	EEC	2	0	0	2	1
10.	22IT311	Internship/Seminar	EEC	2	0	0	2	1
AUDIT COURSE								
11.	22AC301	Value Education (Non Credit)	AC	1	1	0	0	0
			TOTAL	**32**	**17**	**4**	**12**	**24**

SEMESTER-IV

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENTS								
1.	22MA401	Probability and Statistics	BSC	5	3	0	2	4
2.	22IT401	Artificial Intelligence and Machine Learning	PCC	5	3	0	2	4
3.	22IT402	Computer Architecture and Microprocessors	PCC	5	3	0	2	4
4.	22IT403	Web Development Frameworks	PCC	5	3	0	2	4
5.	22IT404	Application System Design with UML	PCC	5	3	0	2	4
6.		Professional Elective I	PEC	4	2	0	2	3
LABORATORY COURSES								
7.	22GE411	Product Development Lab - IV	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
8.	22CS411	Aptitude and Coding Skills - II	EEC	2	0	0	2	1
AUDIT COURSE								
9.	22AC401	Yoga/Personality (Non Credit)	AC	1	1	0	0	0
			TOTAL	**34**	**18**	**0**	**16**	**25**

SEMESTER-V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1.	22IT501	Data Communications and Computer Networks	PCC	5	3	0	2	4
2.	22CS702	Data Analytics	PCC	5	3	0	2	4
3.	22IT503	Managing Cloud and Containerization	PCC	5	3	0	2	4
4.		Professional Elective II	PEC	4	2	0	2	3
5.		Professional Elective III	PEC	4	2	0	2	3
THEORY COURSES								
6.		Open Elective I	OEC	3	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES								
7.	22CS511	Advanced Aptitude and Coding Skills - I	EEC	2	0	0	2	1
8.	22IT511	Internship/Seminar	EEC	2	0	0	2	1
MANDATORY COURSE								
9.	22MC501	Indian Constitution (Non Credit)	MC	1	1	0	0	0
			TOTAL	**31**	**17**	**0**	**14**	**23**

SEMESTER-VI

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1.	22IT601	Mobile Architecture and Development	PCC	4	2	0	2	3
2.	22IT602	Embedded Systems and Internet of Things	PCC	4	2	0	2	3
3.		Professional Elective IV	PEC	4	2	0	2	3
4.		Professional Elective V	PEC	4	2	0	2	3
THEORY COURSES								
5.		Open Elective II	OEC	3	3	0	0	3
6.		Open Elective III	OEC	3	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES								
7.	22CS611	Advanced Aptitude and Coding Skills – II	EEC	2	0	0	2	1
			TOTAL	**24**	**14**	**0**	**10**	**19**

SEMESTER-VII

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1.	22IT701	Microservice Architecture	PCC	4	2	0	2	3
2.		Professional Elective VI	PEC	4	2	0	2	3
THEORY COURSES								
3.	22CS603	Professional Ethics	HSMC	3	3	0	0	3
4.		Open Elective IV	OEC	3	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES								
5.	22IT711	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	6	0	0	6	3
MANDATORY COURSE								
6.	22MC701	Essence of Indian Knowledge Tradition (Non Credit)	MC	1	1	0	0	0
			TOTAL	**21**	**11**	**0**	**10**	**15**

SEMESTER-VIII

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
LABORATORY COURSES								
1.	22IT811	Project Work	EEC	16	0	0	16	8
			TOTAL	**16**	**0**	**0**	**16**	**8**

TOTAL NO. OF CREDITS:163

CREDIT SUMMARY

S. No.	Subject Area	Credits Per Semester								Credit Total	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1	**HSMC**	-	4	4	-	-	-	3	-	11	**6.75%**
2	**BSC**	8	8	4	4	-	-	-	-	24	**14.72%**
3	**ESC**	14	8	4	-	-	-	-	-	26	**15.9%**
4	**PCC**	-	4	10	16	12	6	3	-	51	**31.3%**
5	**PEC**	-	-	-	3	6	6	3	-	18	**11.04%**
8	**OEC**	-	-	-	-	3	6	3	-	12	**7.36%**
7	**EEC**	1	1	3	2	2	1	3	8	21	**12.88%**
	Total	**23**	**25**	**25**	**25**	**23**	**19**	**15**	**8**	**163**	

HSMC - Humanities and Social Sciences including Management Course; BSC – Basic Science Course; ESC – Engineering Science Course; PCC – Professional Core Course; PEC – Professional Elective Course; EEC – Employability Enhancement Course; MC – Mandatory Course;,AC – Audit Course

PROFESSIONAL ELECTIVES & HONOURS DEGREE VERTICALS

Vertical I Data Science	Vertical II Cyber Security	Vertical III Full Stack Engineering	Vertical IV Media Processing	Vertical V Fintech and Web 3.0	Vertical VI Artificial Intelligence	Vertical VII Quantum Computing
Introduction to Generative AI	Ethical Hacking	Software Testing and Automation	Augmented and Virtual Reality	Blockchain Technologies	Soft Computing	Linear Algebra
Introduction to Data Science	Social Network Security	Server-side Programming	Computer Graphics and Multimedia	Introduction to Fintech	Applied AI and ML	Introduction to Quantum Computing
Image and Video Analytics	Cloud and Data Security	REST Application Development using Spring Boot and JPA	Digital Marketing	Bitcoin and Cryptocurrency	Social Network Analytics	Quantum Information Theory
Text and Speech Analytics	Digital and Mobile Forensics	DevOps	Human Computer Interaction	Blockchain Development	Reinforcement and Ensemble Learning	Quantum Computing Architecture
Stream Processing and Analytics	Vulnerability Analysis and Penetration Testing	Web Application Security	Visual Effects	Decentralized Finance (DeFi)	Computational Neuroscience	Quantum Algorithms
Business Intelligence on Oracle Cloud (Oracle Cloud Business Intelligence Reporting 2021 Certified specialist)	Certified Ethical Hacking	Java Development on Oracle Cloud (Oracle Java SE 11 Developer Certification)	Game Design	Blockchain Developer	Machine Learning on Oracle Cloud (Oracle Machine Learning using Autonomous Database 2021 Certified Specialist)	Quantum Statistical Data Analysis
	Artificial Intelligence in Cybersecurity					
	Information Security	Compiler Design				
Neural Networks and Deep Learning	Engineering Secure Soft ware Systems	Front End Engineering	Design Programming	Fundamentals of Blockchain	Knowledge Engineering	Quantum Computing Foundations
Recommender Systems	Network Design and Programming	Server-side Engineering	Computer Graphics for Virtual Reality	Smart Contracts and Solidity	Foundations of Deep Learning	Quantum Programming
Data Exploration and Visualization	Fault Tolerant Computing	Scalable Messaging Infrastructure - Apache Kafka	Concepts of Virtual and Augmented Reality	Blockchain Platforms and Usecases	Computer Vision	Quantum Cryptography
Cognitive Science and Analytics	Enterprise Cyber Security	Usability Design of Software Application	Mobile VR and AI in Moduley	Blockchain Security and Performance	Foundations of Natural Language Processing	Machine Learning with Quantum Computing
Capstone Design Project*	Capstone Design Project*	Capstone Design Project*	Capstone Design Project*	Capstone Design Project*	Capstone Design Project*	Capstone Design Project*

MINOR DEGREE VERTICALS

Vertical III Full Stack Engineering	**Vertical VIII Entrepreneurship and Innovation**
Front End Engineering	Foundations of Entrepreneurship
Server-side Programming	Team Building and Leadership Management For Business
Microservice Architecture	Creativity and Innovation In Entrepreneurship
DevOps	Principles of Marketing Management for Business
Capstone Design Project	Capstone Design Project

OPEN ELECTIVE COURSES – OFFERED TO OTHER DEPARTMENTS

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	22IT001	Web Development Frameworks	OEC	3	3	0	0	3
2.	22IT002	REST Application Development using Spring Boot and JPA	OEC	3	3	0	0	3
3.	22IT003	Managing Cloud and Containerization	OEC	3	3	0	0	3
4.	22IT004	Software Testing and Automation	OEC	3	3	0	0	3

MINOR DEGREE WITH SPECIALIZATION IN FULL STACK ENGINEERING

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	22IT943	Front End Engineering	PEC	3	3	0	0	3
2.	22IT944	Server-side Programming	PEC	3	3	0	0	3
3.	22IT945	Microservice Architecture	PEC	3	3	0	0	3
4.	22IT946	DevOps	PEC	3	3	0	0	3
5.	22IT947	Capstone Design Project	EEC	12	0	0	12	6
			Total	**24**	**12**	**0**	**12**	**18**

MINOR DEGREE WITH SPECIALIZATION IN ENTREPRENEURSHIP AND INNOVATION

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	22IT948	Foundations of Entrepreneurship	PEC	3	3	0	0	3
2.	22IT949	Team Building and Leadership Management for Business	PEC	3	3	0	0	3
3.	22IT950	Creativity and Innovation in Entrepreneurship	PEC	3	3	0	0	3
4.	22IT951	Principles of Marketing Management for Business	PEC	3	3	0	0	3
5.	22IT952	Capstone Design Project	EEC	12	0	0	12	6
			Total	**24**	**12**	**0**	**12**	**18**

SEMESTER –I

22MA101	MATRICES AND CALCULUS (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Explain the concepts of matrix algebra techniques needed for practicalapplications.
- Determine the curvature of the curves.
- Illustrate the simple applications of multivariable calculus and vector calculus.
- Elaborate the concept and application of multiple integrals.

UNIT I	MATRICES	15

Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

Theory: 9

Experiments using SCILAB:

1. Introduction to SCILAB through matrices and general syntax.
2. Finding the Eigen values and Eigenvectors.
3. Plotting the graph of a quadratic form.

Laboratory: 6

UNIT II	SINGLE VARIABLE CALCULUS	15

Curvature in Cartesian and Polar Co-ordinates – Centre and radius of curvature –Circle of curvature–Evolutes.

Theory: 9

Experiments using SCILAB:

1. Evaluating the radius of curvature.
2. Finding the coordinates of the center of curvature.
3. Tracing of Curves.

Laboratory: 6

UNIT III	MULTIVARIABLE CALCULUS	15

Partial derivatives (excluding Euler's theorem) – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables.

Theory: 9

Experiments using SCILAB:

1. Evaluating the maxima of functions of several variables.
2. Evaluating the minima of functions of several variables.

3. Evaluation of Jacobians.

Laboratory: 6

UNIT IV	MULTIPLE INTEGRALS	15

Double integrals – Change of order of integration – Area enclosed by plane curves –Triple integrals – Volume of solids.

Theory: 9

Experiments using SCILAB:

1. Evaluating area under a curve.
2. Evaluating area using double integral.
3. Evaluation of volume by integrals.

Laboratory: 6

UNIT V	VECTOR CALCULUS	15

Gradient, divergence and curl (excluding vector identities) – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane and Gauss divergence theorem (Statement only) – Simple applications involving cubes and rectangular parallelopipeds.

Theory: 9

Experiments using SCILAB:

1. Evaluating gradient.
2. Evaluating directional derivative.
3. Evaluating divergent and curl.

Laboratory: 6

TOTAL: 75 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:CO1:
Use the matrix algebra methods to diagonalize the matrix.
CO2: Determine the evolute of the curve.
CO3: Apply differential calculus ideas on the function of several variables.
CO4: Evaluate the area and volume by applying the concept of multiple integration.
CO5: Utilize the concept of vector calculus in evaluating integrals.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:

1. M. K. Venkataraman, "Engineering Mathematics", Volume I, 4th Edition, TheNational Publication Company, Chennai, 2003.
2. Sivaramakrishna Dass, C. Vijayakumari, "Engineering Mathematics", Pearson Education India, 4th Edition 2019.

3. H. K. Dass, and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. ChandPrivate Limited, 3rd Edition 2014.
4. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill PublishingCompany, 6th Edition, New Delhi, 2008.
5. S.S. Sastry, “Engineering Mathematics”, Vol. I & II, PHI Learning Private Limited, 4th Edition, New Delhi, 2014.

LIST OF EQUIPMENTS:

1. SCILAB- Open source

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22CH101	ENGINEERING CHEMISTRY (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand the water quality criteria and interpret its applications in water purification.
- To gain insights into the basic concepts of electrochemistry and implement its applications in chemical sensors.
- To acquire knowledge on the fundamental principle of energy storage devicesand relate it to electric vehicles.
- To identify the different types of smart materials and explore their applications in Engineering and Technology.
- To assimilate the preparation, properties and applications of nano materials invarious fields.

UNIT I	WATER TECHNOLOGY	15

Sources of water –Impurities - Drinking water quality parameters –Hardness and its types, problems - Municipal water treatment and disinfection (chlorination- break-point chlorination, UV, Ozonation). Boiler troubles- Scales and sludges, Boiler feed water: Requirements - Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning). External treatment –Ion exchange demineralization - Principle, process and fouling.

Desalination of brackish water: Reverse osmosis –principle-types of membranes, process and fouling.

(Theory-9)

Determination of total, temporary and permanent hardness of water by EDTA method.

Determination of chloride content of water sample by argentometric method.

Determination of alkalinity in water sample

(Laboratory-6)

UNIT II	ELECTROCHEMISTRY AND SENSORS	15

Introduction- Conductance- factors affecting conductance – Electrodes– origin of electrode potential – single electrode potential, standard electrode potential – measurement of single electrode potential –over voltage - reference electrodes

(standard hydrogen electrode, calomel electrode)-ion selective electrode- glass

electrode - Nernst equation (derivation),numerical problems, Electrochemical seriesand its applications.

Chemical sensors – Principle of chemical sensors – Breath analyzer– Gas sensors –CO2 sensors-Sensor for health care – Glucose sensor.

(Theory-9)

Determination of the amount of NaOH using a conductivity meter. Determination of the amount of acids in a mixture using a conductivity meter.Determination of the amount of given hydrochloric acid using a pH meter.

(Laboratory-6)

UNIT III	ENERGY STORAGEDEVICES AND ENERGYSOURCES	15

Batteries –Primary alkaline battery - Secondary battery - Pb-acid battery, Fuel cell - H2 – O2 fuel cell.

Batteries used in E- vehicle: Ni-metal hydride battery, Li-ion Battery, Li-air Battery Nuclear Energy – Nuclear fission, fusion, differences, characteristics – nuclear chain reactions – light water nuclear reactor – breeder reactor.

(Theory-9)

Determination of single electrode potential of the given electrode. Estimation of the iron content of the given solution using a potentiometer.

Determination of electrochemical cell potential (using different electrodes/ different concentrations of electrolytes)

(Laboratory-6)

UNIT IV	SMART MATERIALS FOR ENGINEERING APPLICATIONS	15

Polymers – Definition – Classification – smart polymeric materials - Preparation, properties and applications of Piezoelectric polymer - Polyvinylidene fluoride (PVDF), Electroactive polymer- Polyaniline (PANI) and Biodegradable polymer - Polylactic acid(PLA).

Polymer composites: Definition, Classification – FRP's – Kevlar.

Shape Memory Alloys: Introduction, Shape memory effect – Functional properties ofSMAs – Types of SMA - Nitinol (Ni-Ti) alloys - applications.

Chromogenic materials: Introduction – Types - applications.

(Theory-9)

Determination of the molecular weight of polymer using Ostwald viscometer.

Application of polymeric fibers in 3D printing.

(Laboratory-6)

UNIT V	NANO CHEMISTRY	15

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) – properties of nanomaterials – types – nanotubes -carbon nanotubes, applications of CNT - nanocomposites – General applications of nanomaterials in electronics, information

technology, medical and healthcare, energy, environmental remediation, constructionand transportation industries.

(Theory-9)

Determination of concentration of $BaSO_4$ nanoparticles by conductometric titrations.
Preparation of ZnO nanocrystal by precipitation method.

(Laboratory-6)

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Interpret the water quality parameters and explain the various water treatment methods.

CO2: Construct the electro chemical cells and sensors.

CO3: Compare different energy storage devices and predict their relevance in electricvehicles.

CO4: Classify different types of smart materials, their properties and applications in Engineering and Technology.

CO5: Integrate the concepts of nano chemistry and enumerate its applications in variousfields.

TEXT BOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 2022.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2012.

REFERENCES:

1. S.S. Daraand S.S. Umare, "A Textbook of Engineering Chemistry",12th Edition, S.Chand &Company, NewDelhi, 2013.
2. V.R. Gowarikar, Polymer Science, 2nd edition, New Age International Publishers, 2021.
3. J. C. Kuriacose and J. Rajaram, "Chemistry in Engineering and Technology", Volume - 1&Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.
4. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, "Nanochemistry: A Chemical Approach to Nanomaterials",2nd Edition, RSC publishers , 2015.
5. Prasanna Chandrasekhar, "Conducting polymers, fundamentals and applications–Including Carbon Nanotubes and Graphene", Second Edition, SpringerScience& Business Media, New York, 2019.
6. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, "Vogel's Quantitative Chemical Analysis", 6th edition, Pearson Education Pvt. Ltd., 2019.

LIST OF EQUIPMENTS:

1. Conductivity meter – 20 Nos.
2. pH meter - 19 Nos.
3. Potentiometer - 20 Nos.

22CS101	PROBLEM SOLVING USING C++ (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs using exceptions.

UNIT I	PROBLEM SOLVING AND PROGRAMMING FUNDAMENTALS	15

Computational thinking for Problem solving – Algorithmic thinking for Problem solving - Building Blocks - Problem Solving and Decomposition - Dealing with Error – Evaluation. Overview of C – Data types – Identifiers – Variables – Storage Class Specifiers – Constants – Operators - Expressions – Statements – Arrays and Strings – Single-Dimensional – Two-Dimensional Arrays – Arrays of Strings – Multidimensional Arrays.

List of Exercise/Experiments:

1. Write C/C++ programs for the following:
    a. Find the sum of individual digits of a positive integer.
    b. Compute the GCD of two numbers.
    c. Find the roots of a number (Newton‘s method)
2. Write C/C++ programs using arrays:
    a. Find the maximum of an array of numbers.
    b. Remove duplicates from an array of numbers.
    c. Print the numbers in an array after removing even numbers.
3. Write C/C++ programs using strings:
    a. Checking for palindrome.
    b. Count the occurrences of each character in a given word.

UNIT II	POINTERS AND FUNCTIONS	15

Pointers -Variables – Operators – Expressions – Pointers and Arrays – Functions - Scope Rules – Function Arguments – return Statement – Recursion – Structures – Unions – Enumerations.

List of Exercise/Experiments:

1. Generate salary slip of employees using structures and pointers. Create a structure Employee with the following members:
    EID, Ename, Designation, DOB, DOJ, Basic pay
    Note that DOB and DOJ should be implemented using structure within structure.
2. Compute internal marks of students for five different subjects using structures and functions.

UNIT III	CLASSES AND OBJECTS	15

Concepts of Object-Oriented Programming – Benefits of OOP – Simple C++ program - Classes and Objects - Member functions - Nesting of member functions - Private

member functions - Memory Allocation for Objects - Static Data Members - Static Member functions - Array of Objects - Objects as function arguments - Returning objects
- friend functions – Const Member functions - Constructors – Destructors.

List of Exercise/Experiments:

1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

UNIT IV	OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM	15

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes.
Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – Pure Virtual Functions – Polymorphism.

List of Exercise/Experiments:

1. Write a Program to Demonstrate the i) Operator Overloading. ii) FunctionOverloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance are supported:
   a) Single inheritance b)Multiple inheritance c)Multi level inheritance d)Hierarchical inheritance.

UNIT V	I/O, FILES AND EXCEPTIONS	15

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

List of Exercise/Experiments:

1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimumbalance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.
4. Mini project.

TOTAL: 45+30 = 75 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:CO1:

Solve problems using basic constructs in C.

CO2: Implement C programs using pointers and functions.

CO3: Apply object-oriented concepts and solve real world problems.

CO4: Develop C++ programs using operator overloading and polymorphism.

CO5: Implement C++ programs using Files and exceptions.

TEXT BOOKS:

1. Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2015. (Unit 1 &2)
2. E Balagurusamy, "Object Oriented Programming with C++", 4th Edition, TataMcGraw-Hill Education, 2008. (Unit 3, 4 & 5)

REFERENCES:

1. Karl Beecher, "Computational Thinking: A beginner's guide to problem-solving and programming", BCS Learning & Development Ltd, 2017. (Unit 1)
2. Nell Dale, Chip Weems, "Programming and Problem Solving with C++", 5thEdition, Jones and Barklett Publishers, 2010.
3. John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.
4. Yashavant P. Kanetkar, "Let us C++", BPB Publications, 2020
5. ISRD Group, "Introduction to Object-oriented Programming and C++", TataMcGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design",Third Edition, Thomson Course Technology, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01297200240671948837_shared/overview

LIST OF EQUIPMENTS:

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

22CS102	SOFTWARE DEVELOPMENT PRACTICES (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

UNIT I	AGILE SOFTWARE DEVELOPMENT AND Git and GitHub	15

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

- Introduction to Git –Setting up a Git Repository - Recording Changes to the Repository- Viewing the Commit History - Undoing Things - Working with Remotes -Tagging - Git Aliases - Git Branching - Branches in a Nutshell - Basic Branching and Merging - Branch Management - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

List of Exercise/Experiments:

1. Form a Team, Decide on a project:
   a) Create a repository in GitHub for the team.
   b) Choose and follow a Git workflow
      - Each team member can create a StudentName.txt file with contents about themselves and the team project
      - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
      - Team members can now create a Pull request to merge the branch to master branch or main development branch.
      - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
      - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull requestand peer reviews.
3. Form a Team, Decide on a project:
   c) Create a repository in GitHub for the team.
   d) Choose and follow a Git workflow
      - Each team member can create a StudentName.txt file with contents about themselves and the team project
      - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
      - Team members can now create a Pull request to merge the branch to master branch or main development branch.
      - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updation.
      - Once pull request is reviewed and merged, the master or main

development branch will have files created by all team members.

4. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

UNIT II	HTML	15

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and datalist Elements – Page-Structure Elements.

List of Exercise/Experiments:

1. Create web pages using the following:
   - Tables and Lists
   - Image map
   - Forms and Form elements Frames

UNIT III	CSS	15

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients – Multiple Background Images – Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module – Multicolumn Layout.

List of Exercise/Experiments:

1. Apply Cascading style sheets for the web pages created.

UNIT IV	JAVASCRIPT BASICS	15

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

List of Exercise/Experiments:

1. Form Validation (Date, Email, User name, Password and Number validation)using JavaScript.

UNIT V	JAVASCRIPT OBJECTS	15

Objects – Math, String, and Date, Boolean and Number, document Object – UsingJSON to Represent objects – DOM: Objects and Collections – Event Handling.

List of Exercise/Experiments:

1. Implement Event Handling in the web pages.

Mini Projects-Develop any one of the following web applications (not limited to one)using above technologies.

a. Online assessment system
b. Ticket reservation system
c. Online shopping
d. Student management system
e. Student result management system
f. Library management

g. Hospital management
h. Attendance management system
i. Examination automation system
j. Web based chat application

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Apply agile development methods in software development practices.
CO2: Set up and create a GitHub repository.
CO3: Develop static and dynamic webpages using HTML.
CO4: Design interactive personal or professional webpages using CSS.
CO5: Develop web pages using Java script with event-handling mechanism.

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGrawHill International Edition, Nineth Edition, 2020.
2. Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
3. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.

REFERENCES:

1. Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1 st Edition, 2010.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective",Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
4. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition,Wiley Publications, 2009.
5. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, PrenticeHall of India, 2014.
6. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094421427470336209 9_shared/overview

LIST OF EQUIPMENTS:

Systems with either Netbeans or Eclipse
Java/JSP/ISP Webserver/Apache Tomcat /
MySQL / Dreamweaver or
Equivalent/ Eclipse, WAMP/XAMP

22EC101	DIGITAL PRINCIPLESAND SYSTEMS DESIGN (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To acquire the knowledge in Digital fundamentals and its simplification methods.
- To familiarize the design of various combinational digital circuits using logicgates.
- To realize various sequential circuits using flip flops.
- To interpret various clocked sequential circuits.
- To elucidate various semiconductor memories and related technology.
- To build various logic functions using Programmable Logic Devices.

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES	9

Review of number systems-representation-conversions, Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms, min term and max term, Simplification of Boolean expressions-Karnaugh map, Implementation of Boolean expressions using logic gates and universal gates.

List of Exercise/Experiments:

1. Implementation of Boolean expression using logic gates.

UNIT II	COMBINATIONAL LOGIC CIRCUITS	9

Design of combinational circuits - Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/De-mux, Parity Generator/Checker

List of Exercise/Experiments:

1. Design of adders
2. Design of subtractors.
3. Design of binary adder using IC7483
4. Design of Multiplexers &Demultiplexers.
5. Design of Encoders and Decoders.
6. Implementation of a boolean function using a multiplexer.

UNIT III	SEQUENTIAL CIRCUITS	9

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Asynchronous and Synchronous Counters Design - Shift registers, Universal Shift Register

List of Exercise/Experiments:

1. Design and implementation of 3 bit ripple counters.
2. Design and implementation of 3 bit synchronous counter
3. Design and implementation of shift registers

UNIT IV	SYNCHRONOUSSEQUENTIAL CIRCUITS DESIGN	9

Design of clocked sequential circuits - Moore/Mealy models, state minimization, state assignment, circuit implementation

UNIT V	MEMORY AND PROGRAMMABLE LOGIC DEVICES	9

Basic memory structure ROM: PROM – EPROM – EEPROM –RAM – Static and dynamic RAM – Programmable Logic Devices: Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.

TOTAL: 75 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to: CO1:

Implement digital circuits using simplified Boolean functions.

CO2: Realize Combinational circuits for a given function using logic gates.

CO3: Demonstrate the operation of various counters and shift registers using FlipFlops.

CO4: Analyze Synchronous Sequential circuits.

CO5: Summarize the various types of memory devices.

CO6: Design the Combinational circuits using Programmable Logic Devices.

CO7: Perform practical exercises as an individual and / or team member to manage thetask in time.

CO8: Express the experimental results with effective presentation and report.

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson, 2018.

2. S.Salivahanan and S.Arivazhagan, Digital Circuits and Design, 5th Edition, Oxford University Press, 2018.

REFERENCES:

1. A.Anandkumar, Fundamental of digital circuits, 4th Edition, PHI Publication,2016.

2.WilliamKleitz, Digital Electronics-A Practical approach to VHDL, Prentice Hall International Inc, 2012.

3. Charles H.Roth, Jr. andLarry L. Kinney, Fundamentals of Logic Design, 7th Edition, Thomson Learning, 2014.

4. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education Inc, 2017. 5.John.M Yarbrough, Digital Logic: Applications and Design, 1st Edition, Cengage India, 2006.

NPTEL LINK: https://nptel.ac.in/courses/108/105/108105132/

22GE111	COMPUTER AIDED ENGINEERING GRAPHICS (Common to All Branches)	L	T	P	C
		1	0	2	2

OBJECTIVES:

The Course will enable learners to:

- To help students understand universal technical drawing standards.
- To provide training on drafting software to draw part models.
- To demonstrate the concepts of orthographic and isometric projections.
- To use drawing skills for communicating concepts, ideas for engineeringproduct design.
- Use pictorial views to visualize and draw the isometric view of the objects.

UNIT I	INTRODUCTION TO CONVENTIONS IN ENGINEERING DRAWINGAND CONIC SECTIONS	9

Introduction to Engineering Drawing - Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size,layout and folding of drawing sheets – Lettering and dimensioning. Conic curves - Ellipse, Parabola and Hyperbola by Eccentricity method.

(Theory - 3)

Drawing of a title block with necessary text, projection symbol and lettering usingdrafting software.

Drafting of Conic curves - Ellipse, Parabola and Hyperbola

(Laboratory - 6)

UNIT II	ORTHOGRAPHIC PROJECTION	9

Visualization concepts and Orthographic Projection - Layout of views – Orthographic Projection- Conversion of pictorial diagram into orthographic views.

(Theory - 3)

Drawing orthographic view of simple solids like Prism, Pyramids, Cylinder, Cone, etc,and dimensioning.
Drawing of orthographic views from the given pictorial diagram.

(Laboratory -6)

UNIT III	PROJECTION OF PLANES	9

Projection of planes (polygonal and circular surfaces) inclined to both the planes byrotating object method.

(Theory - 3)

Drawing of plane Surface inclined to HP.
Drawing of plane Surface inclined to VP.

(Laboratory -6)

UNIT IV	PROJECTION OF SOLIDS	9

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis isinclined to HP by rotating object method.

(Theory - 3)

Drawing of simple solids like prism and pyramids when the axis is inclined to HP. Drawing of simple solids like cylinder and cone when the axis is inclined to HP.

(Laboratory -6)

UNIT V	ISOMETRIC DRAWING	9

Principles of isometric view – Isometric view of simple solids – Prism, Pyramid, Cylinderand Cone.

(Theory - 3)

Drawing isometric projection of simple solids. Modeling of 2D to 3D objects using drafting software.

(Laboratory -6)

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain the various engineering standards required for drafting and exploreknowledge in conic sections.

CO2: Draw the orthographic views of 3Dprimitive objects.

CO3: Describe the projection of plane surfaces by the rotating plane method. **CO4:** Apply the projection concepts and drafting tools to draw projections of solids.**CO5:** Sketch the pictorial views of the objects using CAD tools.

TEXT BOOKS:

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 33rd Edition, 2020.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 15th Edition, 2019.

REFERENCES:

1. Bhatt N.D. "Engineering Drawing", Charotar Publishing House, 53rd edition ,2019.
2. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw HillPublishing Company Limited, New Delhi, 3rd Edition, 2019.
3. Engineering Drawing Practice for Schools and Colleges BIS SP46:2003 (R2008), Published by Bureau of Indian Standards (BIS), 2008.
4. Parthasarathy. N.S and Vela Murali, "Engineering Graphics", Oxford University,Press, New Delhi, 2019.
5. Gopalakrishna. K.R., Engineering Drawing Vol. 1 & 2, Subhas Publications, 27th Edition, 2017.

22GE112	PRODUCT DEVELOPMENT LAB - I (Common to All Branches)	L	T	P	C
		0	0	2	1

The students may be grouped into 3 to 4 and work under a project supervisor. The device/system/component/prototype Idea to be developed by the students and a final presentation to be done by the students about the idea generated at the end of the semester.

OBJECTIVES:

The Course will enable learners to:

- Understand the functionalities and limitation of various machine/equipment
- Demonstrate various operations that can be performed to machines
- Summarize the basic principles of machines to convert their ideas into products

I

1. Study of Manufacturing Processes (Carpentry, Plumbing, Machines andWelding).
2. Study of fundamental operations of 3D Printer and Scanner with Software.
3. Study of Smart Machining (CNC and Laser cutting) and Engraving Techniques.II
    1. Study of Fundamental of Circuit Design.
4. Study of PCB Milling Machine.
5. Study of Soldering and Desoldering.
6. 1. Study of Computer Peripheral Devices (Processing Information Devices)
    1. Present the Product Idea Presentation - Phase – I.

TOTAL: 30 PERIODS

Note:

The students can select the prototype to be made of their choice after learning theabove exercises.

OUTCOMES:

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

CO1: Understand the concept of manufacturing processes.

CO2: Describe the working of the machine element.

CO3: Discuss the various applications of engineering materials

CO4: Summarize the basics of core engineering concepts.

CO5: Describe the process for converting ideas into products

LIST OF EQUIPMENTS:

1. CNC Router – 1 No.
2. 3D Printer – 1 No.
3. 3D Scanner – 1 No.
4. Laser cutting Machine – 1 No.
5. Centre lathe – 2 Nos.
6. Arc welding transformer with cables and holders – 2 Nos.
7. Plumbing tools – 2 Nos.
8. Carpentry tools – 2 Nos.
9. Multimeter – 10 Nos.
10. Drilling Machine – 1 No.
11. Solder Stations 5 Sets
12. Desoldering Machine – 1 No.
13. PCB Milling Machine – 1 No.
14. Variable Power Supply – 1 No.
15. Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor,etc. – 10 Sets
16. Personal Desktop Computers – 30 Nos.

SEMESTER – II

22GE101	HERITAGE OF TAMILS (Common to All Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES:

The Course will enable learners to:

- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thinai in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

UNIT I	LANGUAGE AND LITERATURE	3

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

UNIT II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -- Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III	FOLK AND MARTIAL ARTS	3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV	THINAI CONCEPT OF TAMILS	15

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONALMOVEMENT AND INDIAN CULTURE	3

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL:15PERIODS

OUTCOMES:

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

CO1: State the role of Tamil literature in shaping Tamil Cultural roots.

CO2: Express the cultural and religious significance of Tamil art and sculptures.

CO3: Identify and describe the techniques of folk and martial arts.

CO4: Classify the role of Thinai concept in Tamil culture and literature.

CO5: Compare the idea of cultural and intellectual contributions of Tamils.

TEXT BOOKS & REFERENCES:

1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL –(in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) –Reference Book

22MA201	TRANSFORMS AND NUMERICAL METHODS (Common to CSE / IT / ADS / CSD)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Introduce the concepts of Laplace transforms and Z-transforms.
- Illustrate the application of transforms in solving differential and difference equations.
- Explain the Numerical methods for handling algebraic and transcendental equations.
- Introduce the numerical techniques for interpolation, differentiation and integration.

UNIT I	LAPLACE TRANSFORMS	15

Laplace transforms – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions – Derivatives and integrals of transforms –Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (Statement only).

Theory: 9

Experiments using SCILAB:

1. Finding Laplace transform of a function.
2. Finding inverse Laplace Transforms.
3. Determine the input for given output function of Laplace Transform.

Laboratory: 6

UNIT II	Z – TRANSFORMS	15

Z-transforms – Elementary properties – Inverse Z-transforms – partial fractions method –residues method – Convolution theorem.

Theory: 9

Experiments using SCILAB:

1. Finding Z –transform of a sequence.
2. Finding convolution of two sequences.
3. Plotting the input and output function of Z transform.

Laboratory: 6

UNIT III	SOLUTION OF DIFFERENTIAL AND DIFFERENCE EQUATIONS	15

Solution of linear ordinary differential equation of second order with constant coefficients and first order simultaneous equations with constant coefficients using Laplace transform. Formation of difference equations – Solution of first and second order difference equations with constant coefficients using Z-transform.

Theory: 9

Experiments using SCILAB:

1. Solving second order Ordinary Differential Equation.
2. Finding the Laplace transform and its inverse of a function numerically.
3. Finding the Z-transform numerically

Laboratory: 6

UNIT IV	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	15

Solution of algebraic and transcendental equations by Newton Raphson method - Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Gauss Seidel Iterative method– Eigenvalues of a matrix by Power method.

Theory: 9

Experiments using SCILAB:

1. Finding the real roots of algebraic and transcendental equations using Newton Raphson method.
2. Finding the largest Eigenvalue by power method.
3. Solving system of linear equations using Gauss Seidel Method.

Laboratory: 6

UNIT V	NUMERICAL DIFFERENTIATION AND INTEGRATION	15

Finite differences – Forward and Backward differences – Interpolation – Newton's forward and backward interpolation formulae - Lagrange's interpolation for unequal intervals - Numerical Differentiation - Newton's and Lagrange's formulae - Numerical integration using Trapezoidal and Simpson's 1/3 rules – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

Theory: 9

Experiments using SCILAB:

1. Finding approximately the missing value using Lagrange interpolation.
2. Evaluating line integrals by trapezoidal rule.
3. Evaluating line integrals by Simpson's rule.

Laboratory: 6

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Determine Laplace transform and inverse transform of simple functions.

CO2: Determine Z- transform and inverse transform of simple functions.

CO3: Solve ordinary differential equations using Laplace transform and difference equations using Z-Transform.

CO4: Compute the solutions of algebraic, transcendental and the system of equations.

CO5: Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

TEXTBOOKS:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES:

1. Erwin. Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Jain R.K. and Iyengar S. R. K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
4. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
5. Sastry S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

LIST OF EQUIPMENTS:

1. SCILAB - Open source

22CS201	DATA STRUCTURES (Common to CSE, ECE, IT and AIML)		L	T	P	C
			3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand the concepts of List ADT.
- To learn linear data structures – stacks and queues ADTs.
- To understand and apply Tree data structures.
- To understand and apply Graph structures.
- To analyze sorting, searching and hashing algorithms.

UNIT I	LINEAR DATA STRUCTURES – LIST	15

Algorithm analysis - running time calculations - Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists - circularly linked lists - doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

List of Exercise/Experiments:

- Array implementation of List ADTs.
- Linked list implementation of List ADTs.

UNIT II	LINEAR DATA STRUCTURES – STACKS, QUEUES	15

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT – Queue Model - Implementations: Array and Linked list - applications of queues - Priority Queues – Binary Heap – Applications of Priority Queues.

List of Exercise/Experiments:

- Array implementation of Stack and Queue ADTs.
- Linked list implementation of Stack and Queue ADTs.
- Applications of List – Polynomial manipulations
- Applications of Stack – Infix to postfix conversion and expression evaluation.

UNIT III	NON-LINEAR DATA STRUCTURES – TREES	15

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT– AVL Tree.

List of Exercise/Experiments:

- Implementation of Binary Trees and operations of Binary Trees.
- Implementation of Binary Search Trees.
- Implementation of Heaps using Priority Queues.

UNIT IV	NON LINEAR DATA STRUCTURES - GRAPHS	15

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Applications of graphs – BiConnectivity – Euler circuits.

List of Exercise/Experiments:

- Graph representation and Traversal algorithms.

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	15

Searching- Linear Search - Binary Search - Sorting - Bubble sort - Selection sort - Insertionsort – Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

List of Exercise/Experiments:

- Implement searching and sorting algorithms.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Implement abstract data types for list.

CO2: Solve real world problems using appropriate linear data structures.

CO3: Apply appropriate tree data structures in problem solving.

CO4: Implement appropriate Graph representations and solve real-world applications.

CO5: Implement various searching and sorting algorithms.

TEXTBOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Pearson Education, 2014.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.

REFERENCES:

1. Rajesh K. Shukla, "Data Structures using C and C++", Wiley India Publications, 2009.
2. Narasimha Karumanchi, "Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles", Career Monk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, "An Introduction to Data Structures with Application", McGraw-Hill, 2017.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", Third Edition, Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, "Fundamentals of Data Structures inC++", Second Edition, Silicon Press, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501578165051392105 84/overview

LIST OF EQUIPMENTS:

Systems with Linux/Ubuntu Operating System with gnu C++ compiler

22PH201	PHYSICS FOR COMPUTER SCIENCE AND INFORMATION TECHNOLOGY (CSE, IT, AIML)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Learn the fundamental concepts of Physics and apply this knowledge toscientific, engineering and technological problems.
- Make the students enrich basic knowledge in electronics and quantumconcepts and apply the same in computing fields.

UNIT I	LASER AND FIBRE OPTICS	15

Population of energy levels – Einstein's A and B coefficients derivation - Resonant cavity - Optical amplification (qualitative) - Semiconductor lasers: homo junction and hetero junction- Engineering applications of lasers in data storage (qualitative). Fibre optics: Principle and propagation of light through optical fibre - V-number - Types of optical fibres (Material, refractive index and mode) - Losses in optical fibre - Fibre optic communication - Fibre optic sensors (pressure and displacement).

(Theory -9)

List of Experiments:

1. Determination of divergence of laser beam
2. Determination of acceptance angle and numerical aperture of an optical fibre

(Laboratory -6)

UNIT II	ELECTRON THEORIES OF MATERIALS	15

Classical free electron theory - Expressions for electrical conductivity and thermal conductivity - Wiedemann-Franz law - Success and failures of CFT- Effect of temperature on Fermi function- Density of energy states and average energy of electron at 0 K - Energy bands in solids.

(Theory -9)

List of Experiments

1. Determination of thermal conductivity of a bad conductor by Lee's disc method
2. Measurement of the internal resistance using potentiometer

(Laboratory -6)

UNIT III	SEMICONDUCTOR PHYSICS	15

Intrinsic Semiconductors – E-kdiagram-Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors- Band gap determination-Extrinsic semiconductors - Carrier concentration in n-type and p-type semiconductors -Electrical conductivity of intrinsic and extrinsic semiconductors -Variation of Fermi level with temperature and impurity concentration - Hall effect and its applications.

(Theory-9)

List of Experiments

1. Bandgap determination of intrinsic semiconductor.
2. Determination of wavelength of semiconductor laser

(Laboratory -6)

UNIT IV	INTRODUCTION TO NANO DEVICES AND QUANTUM COMPUTING	15

Introduction to nanomaterial -Electron density in a bulk material - Size dependence of Fermi energy - Quantum confinement - Quantum structures - Density of states in quantum well, quantum wire and quantum dot structures - Band gap of nanomaterial.
Quantum computing: Quantum states - classical bits - quantum bits or qubits - CNOT gate - multiple qubits - Bloch sphere - quantum gates - advantages of quantum computing over classical computing.

(Theory - 9)

List of Experiments

1. Synthesis of nanoparticles by sol-gel method
2. Determination of particle size using laser source

(Laboratory - 6)

UNIT V	MAGNETIC AND SUPERCONDUCTING MATERIALS	15

Introduction- Bohr magneton -magnetic dipole moment - origin of magnetic moments - types of magnetic materials-Ferromagnetism: Domain Theory - antiferromagnetism - ferrimagnetism - magnetic principle in computer data storage
- Magnetic hard disc (GMR sensor) - Introduction to spintronics. Superconducting materials – properties, types of superconductors, applications –SQUID and MAGLEV trains - *superconducting qubits in quantum computing.*

(Theory -9)

List of Experiments

1. Determination of hysteresis loss using B-H loop
2. Determination of magnetic susceptibility of a paramagnetic liquid usingQuincke's apparatus

(Laboratory -6)

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Discuss the basic principles of working of laser and their applications infibre optic communication

CO2: Summarize the classical and quantum electron theories and energy bandstructures

CO3: Describe the conductivity in intrinsic and extrinsic semiconductors andimportance of Hall effect measurements

CO4: Associate the properties of nanoscale materials and their applications inquantum computing

CO5: Interpret the properties of magnetic and superconducting materials andtheir applications in computer data storage

TEXTBOOKS:

1. **S.O. Kasap**,Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition) 2020.
2. **Jasprit Singh**, Semiconductor Devices: Basic Principles, Wiley (IndianEdition) 2007.
3. **Parag K Lala**, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition) 2020.

REFERENCES:

1. **R.P. Feynman**, The Feynman Lectures on Physics - Vol. II, The NewMillennium Edition, 2012.
2. **M.A.Wahab**, Solid State Physics, 3rd Edition, Narosa Publishing House Pvt.Ltd., 2015.
3. **B.Rogers, J. Adams and S.Pennathur**,Nanotechnology: UnderstandingSmall System, CRC Press, 2014.
4. **C.P. Williams,** Explorations in Quantum Computing, Springer-Verlag London, 2011.
5. **Wilson J.D. and Hernandez C.A.,** Physics Laboratory Experiments,Houghton Mifflin Company, New York 2005.
6. **Department of Physics,** Physics laboratory manual, R.M.K. Group of Institutions, 2021.

LIST OF EQUIPMENTS:

1.	Semiconductor Laser	6 Nos.
2.	Determination of optical fibre parameters	6 Nos.
3.	Lee's disc apparatus	6 Nos.
4.	Potentiometer	6 Nos.
5.	Bandgap determination set up	6 Nos.
6.	Sol-gel synthesis	2 Nos.
7.	B-H loop set-up	5 Nos.
8.	Quincke's apparatus	2 Nos.

22HS101	PROFESSIONAL COMMUNICATION (Common to All Branches)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Strengthen basic reading and writing skills.
- Comprehend listening contexts competently.
- Inculcate reading habit and develop effective reading skills.
- Improve active and passive vocabulary.
- Acquire speech clarity with right pronunciation.
- Develop vocabulary of a general kind and enhance grammatical accuracy.
- Imbibe Content and Language Integrated Learning (CLIL).

UNIT I	FORMAL AND INFORMAL COMMUNICATION	12

Listening: Short Texts, Short Formal and Informal Conversations **Speaking:** Self Introduction, Exchanging Personal Information **Reading:** Practice in Skimming, Scanning and Predicting, Reading Comprehension
Writing: Free Writing, Hints Development **Grammar:** Parts of Speech, Prepositions. **Vocabulary:** Compound Nouns, Technical Words.

(Theory 6)

1. Familiarization of Vowel Sounds-Monophthongs, Diphthongs and Consonant Sounds
2. Listening to Formal Conversations in British and American Accents
3. Guided Writing

(Laboratory 6)

UNIT II	GRAMMAR AND LANGUAGE DEVELOPMENT	12

Listening: Telephonic Conversations.
Speaking: Sharing information of a personal kind - Greetings – Taking leave. **Reading:** Short comprehension passages - Pre-reading and Post-reading (multiple choice questions shortquestions / open and close ended questions)
Writing: Instructions, Recommendations, Checklists **Grammar:** Tenses, Framing 'Wh' & 'Yes' or 'No' questions **Vocabulary:** Numerical Adjectives, Collocations

. (Theory 6)

1. Communication Etiquettes
2. Self -Introduction using SWOT Analysis

(Laboratory 6)

UNIT III	BASIC TECHNICAL WRITING AND STUDY SKILLS	12

Listening: Listening to longer texts and filling up the tables **Speaking:**
Asking about routine actions and expressing opinions
Reading: Short texts (Cloze Test)
Writing: Formal letters, E-mail writing, Interpretation of Charts and Graphs **Grammar:**
Cause and Effect expressions**,** Conditional Clauses **Vocabulary:** Often misspelled and confusing words

(Theory 6)

Mechanics of Reading Skills News
Reading–Cloze Tests

(Laboratory 6)

UNIT IV	GROUP DISCUSSION AND JOB APPLICATIONS	12

Listening: Listening to recorded dialogues of conversations and completing exercises based on them
Speaking: Discussion on Social issues.
Reading: Reading text from magazines
Writing: Purpose Expressions, Letter of Application, Minutes of Meeting.
Grammar: Modal Verbs, Subject-Verb agreement
Vocabulary : Sequence Words

(Theory 6)

1. Group Presentation, Group Discussion: Do's and Don'ts of GroupDiscussion
2. Discussions on failure and success in interviews of famous personalities Spotting Errors

(Laboratory 6)

UNIT V	ART OF REPORTING	12

Listening: Listening to TED talks **Speaking:** Debate & Presentations **Reading:** Biographies
Writing: Definitions (Single line & Extended), Report Writing (Industrial visit, Accident and Feasibilityreports)
Grammar: Reported speech
Vocabulary : Verbal Analogies (Theory 6)

1. Writing based on listening to academic lectures and discussions
2. Leadership skills, Negotiation skills
3. Mechanics of Report Writing

(Laboratory 6)

LIST OF PROJECTS

1. Create a podcast on a topic that will be interesting to college students
2. Read and Review (Movie/Book/Technical Article)
3. Presentation on Social Issues
4. Submit a report on "Global English: A study"

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Comprehend conversations and short talks delivered in English
CO2: Participate efficiently in informal conversations and develop an awareness of the self and apply well-defined techniques
CO3: Read articles of a general kind in magazines and newspapers efficiently
CO4: Write short general essays, personal letters and E-mails in English CO5: Develop vocabulary of a general kind by enriching reading skills

TEXT BOOKS:

1. **Kumar, Suresh E, & Sreehari, P.** *Communicative English*. Orient Black Swan, 2007.
2. **Richards, Jack C.** Interchange Students' Book-2 New Delhi: CUP,2015.

REFERENCES:

1. **Bailey, Stephen.** Academic Writing: *A practical guide for students*. New York: Rutledge,2011.
2. **Dhanavel, S P.** English and Soft Skills, Volume Two, Orient Black Swan.
3. **Elbow, Peter.** *Writing Without Teachers*. London: Oxford University Press, 1973.
4. **Larsen, Kristine.** *Stephen Hawking*: *A Biography*, Greenwood: Publishing Group, 2005.
5. **Redston, Chris & Gillies Cunningham.** Face2Face (Pre- intermediate Students' Book &Workbook) Cambridge University Press, New Delhi: 2005.
6. Lewis, Norman. Word Power Made Easy, Latest Edition: Penguin Random House India: 2015

WEB REFERENCES:

1. Basics of Business Communication
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0126
   88768083632128308_shared/overview
2. communicating to Succeed
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0126
   86653619175424640_shared/overview
3. Business English
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012683227498151936
   279_shared/overview
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013267708367904
   768573/overview (lab support)
4. Business Writing
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012689
   47760100966433_shared/overview
5. Email Etiquettes
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01329462
   386556108817682_shared/overview
6. Email Writing Skills
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012689543
   63013529666_shared/overview
7. Time Management
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0129859
   21210736640721_shared/overview
8. Understanding Body Language
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012979737
   65144576024689_shared/overview
9. ONLINE RESOURCES:
   https://infyspringboard.onwingspan.com/web/en/page/home

22CS202	JAVA PROGRAMMING (Common to All Branches	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To explain object-oriented programming concepts and fundamentals of Java
- To apply the principles of packages, interfaces and exceptions
- To develop a Java application with I/O streams, threads and generic programming
- To build applications using strings and collections.
- To apply the JDBC concepts

UNIT I	JAVA FUNDAMENTALS	15

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – this keyword – Overloading methods - Overloading constructors - Access Control –Static – Final

List of Exercise/Experiments:

1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff

   If the type of the EB connection is domestic, calculate the amount to be paid asfollows: First 100 units - Rs. 1 per unit 101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit > 501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid asfollows: First 100 units - Rs. 2 per unit 101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit > 501 units - Rs. 7 per unit

2. Arrays Manipulations: (Use Methods for implementing these in a Class)
   a. Find kth smallest element in an unsorted array
   b. Find the sub array with given sum
   c. Matrix manipulations – Addition, Subtraction, Multiplication
   d. Remove duplicate elements in an Array

   Accept an integer value N and print the Nth digit in the integer sequence 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.

   Example: The 11th digit in the sequence 12345678910111213…. is 0.

UNIT II	INHERITANCE, INTERFACES AND EXCEPTION HANDLING	15

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

List of Exercise/Experiments:

1. Develop a Java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, milesto KM and vice versa), time converter (hours to minutes, seconds and vice versa)using packages.
2. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. AddBasic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
3. Design a Java interface for ADT Stack. Implement this interface using array andbuilt-in classes. Provide necessary exception handling in both the implementations.
4. Write a Java Program to create an abstract class named Shape that containstwo integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extendsthe class Shape. Each one of the classes contains the methods print Area () thatprints the area of the given shape and Numberofsides() that prints the number ofsides of the given shape.
5. Write a Java program to apply built-in and user defined exceptions.

UNIT III	MULTITHREADING, I/O AND GENERIC PROGRAMMING	15

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

List of Exercise/Experiments:

1.Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

UNIT IV	STRING HANDLING AND COLLECTIONS	15

Lambda Expressions - String Handling – Collections: The Collection Interfaces,The CollectionClasses – Iterator – Map - Regular Expression Processing.

List of Exercise/Experiments:

1.String Manipulation:

a. Reversing a set of words and count the frequency of each letter in the string.

b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there shouldnot be any other character except 0 in the [0] sequence in a given binary string.

c. Remove all the occurrences of string S2 in string S1 and print the remaining.

d. Find the longest repeating sequence in a string

e. Print the number of unique string values that can be formed by rearranging theletters in the string S.

2. Write a Java program that correctly implements producer consumer problemusing the concept of inter thread communication.

3. Collections:

a. Write a program to perform string operations using ArrayList. Write functions forthe following

i. Append - add at end

ii. Insert – add at particular index

iii. Search

iv. List all string starts with given letter

b. Find the frequency of words in a given text.

UNIT V	JDBC CONNECTIVITY	15

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet,Prepared Statement, Named Parameter, Embedded SQL (Insert, Update, Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

List of Exercise/Experiments:

- Mini Project (using JDBC)

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Understand the object-oriented programming concepts and fundamentals ofJava.

CO2: Develop Java programs with the packages, interfaces and exceptions.

CO3: Build Java applications with I/O streams, threads andgenerics programming.

CO4: Apply strings and collections in developing applications.

CO5: Implement the concepts of JDBC.

TEXTBOOKS:

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, 2019.

REFERENCES:

1. Cay S. Horstmann, Gary Cornell, “Core Java Volume – I Fundamentals”, 11th Edition, Prentice Hall, 2019.

2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition,Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java,Third Edition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview

LIST OF EQUIPMENTS:

Java and Eclipse / NetBeans IDE or Equivalent

B.M.B ENGINEERING COLLEGE
அறிவே ஆக்கம்

22IT201	DATABASE MANAGEMENT SYSTEMS (Common to CSE/ IT/AIML)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand the basic concepts of Data modeling and Database Systems.
- To understand SQL and effective relational database design concepts.
- To learn relational algebra, calculus and normalization.
- To know the fundamental concepts of transaction processing, concurrency controltechniques, recovery procedure and data storage techniques.
- To understand query processing, efficient data querying and advanceddatabases.

UNIT I	DATABASE CONCEPTS	15

Concept of Database and Overview of DBMS - Characteristics of databases - Data Models, Schemas and Instances - Three-Schema Architecture - Database Languages and Interfaces - Introductions to data models types - ER Model- ER Diagrams - Enhanced ER Model - reducing ER to table Applications: ER model of University Database Application – Relational Database Design by ER- and EER-to-Relational Mapping.

List of Exercise/Experiments:

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting,updating and retrieving Tables and Transaction Control statements

UNIT II	STRUCTURED QUERY LANGUAGE	15

SQL Data Definition and Data Types – Constraints – Queries – INSERT, UPDATE, and DELETE in SQL - Views - Integrity Procedures, Functions, Cursor and Triggers - Embedded SQL - Dynamic SQL.

List of Exercise/Experiments:

1. Database Querying – Simple queries, Nested queries, Sub queries and Joins
2. Views, Sequences, Synonyms
3. Database Programming: Implicit and Explicit Cursors

UNIT III	RELATIONAL ALGEBRA, CALCULUS AND NORMALIZATION	15

Relational Algebra – Operations - Domain Relational Calculus- Tuple RelationalCalculus - Fundamental operations.

Relational Database Design - Functional Dependency – Normalization (1NF, 2NF3NF and BCNF) – Multivalued Dependency and 4NF – Joint Dependencies and 5NF

- De-normalization.

List of Exercise/Experiments:

1. Procedures and Functions
2. Triggers

UNIT IV	TRANSACTIONS, CONCURRENCY CONTROL AND DATA STORAGE	15

Transaction Concepts – ACID Properties – Schedules based on Recoverability, Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Transaction Recovery – Concepts – Deferred Update – Immediate Update.

Organization of Records in Files – Unordered, Ordered – Hashing Techniques – RAID – Ordered Indexes – Multilevel Indexes - B+ tree Index Files – B tree Index Files.

List of Exercise/Experiments:

1. Exception Handling
2. Database Design using ER modeling, normalization and Implementation for any application
3. Database Connectivity with Front End Tools

UNIT V	QUERY OPTIMIZATION AND ADVANCED DATABASES	15

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query

optimization using Heuristics.

Distributed Database Concepts – Design – Concurrency Control and Recovery –NOSQL Systems – Document-Based NOSQL Systems and MongoDB.

List of Exercise/Experiments:

1. Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

- Build Entity Model diagram. The diagram should align with the business andfunctional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), functions for enablingenterprise grade features.
- Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate settings

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Map ER model to Relational model to perform database design effectively.
CO2: Implement SQL and effective relational database design concepts.
CO3: Apply relational algebra, calculus and normalization techniques in databasedesign.
CO4: Understand the concepts of transaction processing, concurrency control,recovery procedure and data storage techniques.
CO5: Apply query optimization techniques and understand advanced databases.

TEXTBOOKS:

1. Elmasri R. and S. Navathe, “Fundamentals of Database Systems”, Pearson Education, 7th Edition, 2016.
2. Abraham Silberschatz, Henry F.Korth, “Database System Concepts”, TataMcGraw Hill , 7th Edition, 2021.

REFERENCES:

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Designand Application Programming, Pearson Education, 2013.Raghu Ramakrishnan, Gehrke "Database Management Systems", MCGraw Hill, 3rdEdition 2014.
2. Plunkett T., B. Macdonald, "Oracle Big Data Hand Book" , McGraw Hill, First Edition, 2013
3. Gupta G K , "Database Management Systems" , Tata McGraw Hill EducationPrivate Limited, New Delhi, 2011.
4. C. J. Date, A.Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2015.
5. Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi, Oracle NoSQLDatabase: Real-Time Big Data Management for the Enterprise, McGraw Hill Professional, 2013.
6. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Pearson, 6th Edition, 2015.
7. Database Management System Part – 1
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672 82022456_shared/overview
8. Database Management System Part – 2
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012767300 5629194241_shared/overview
9. Online Resources:
https://infyspringboard.onwingspan.com/web/en/page/home

LIST OF EQUIPMENTS:

1. MySql and Eclipse / NetBeans IDE or Equivalent

22GE211	PRODUCT DEVELOPMENT LAB - II (Common to All Branches)	L	T	P	C
		0	0	2	1

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The student batches should study the device/system/component and will do literature review to develop prototype idea. Further at the end of the semester they will make a final presentation to exhibit the conceptual design skills and the process to develop a product.

OBJECTIVES:

The Course will enable learners to:

- Use the innovative design methodology to articulate the product concepts.
- Summarize the requisite Engineering Principles for transforming concepts into products.
- Conduct basic tests to extract the qualitative and quantitative performance factors.

List of Exercise/Experiments

1. Study of Basic Engineering Design Concepts.
2. Conduct a literature survey on the implementation of the design concepts.
3. Prepare the design concepts for an identified literature gap.
4. Present the Product Idea Presentation – Phase II.

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Understand the working and capacity of various engineering systems.
CO2: Infer the outcomes in the product development process.
CO3: Perform basic engineering and material characterization tests.
CO4: Demonstrate the ability to provide conceptual design strategies for a product.
CO5: Implement the Science, Engineering, Technology and Mathematics (STEM) forproduct design.

22CH102	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to All Branches)	L	T	P	C
		2	0	0	MC

OBJECTIVES:

The Course will enable learners to:

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment.

UNIT I	NATURAL RESOURCES	7

Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - Types - Forest resources: Use and over-exploitation, deforestation and its impacts, Food resources: effects of modern agriculture, organic farming, Renewable energy sources - Solar, Wind, Geothermal, Tidal, OTE and Biomass.

Field activity -Tree plantation

UNIT II	POLLUTION AND WASTE MANAGEMENT	7

Pollution - Definition –causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards - nuclear accidents and holocaust -Role of an individual in prevention of pollution –Case studies.

Waste management- Municipal solid wastes, e- waste, plastic waste.

Field study – Solid waste management of the institution

UNIT III	BIODIVERSITY AND ITS CONSERVATION	6

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: In-situ and ex-situ method.

Field study – Biodiversity of the institution

UNIT IV	SUSTAINABILITY AND MANAGEMENT	5

Sustainability-concept, needs and challenges-Circular economy -Sustainable Development Goals- Concept of Carbon footprint, Environmental Impact Assessment, Clean Development Mechanism, solutions.

Field study – Carbon footprint of the institution

UNIT V	HUMAN POPULATION	5

Introduction - Population growth, variation among nations,population explosion, Environment and human health – endemic/epidemic/pandemic– Role of information technology in environment and human health.

Case Study – Pandemics of 21st century

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Investigate and use conservational practices to protect natural resources.

CO2: Identify the causes of pollutants and illustrate suitable methods for pollution abatement.

CO3: Adapt the values of biodiversity and its conservation methods.

CO4: Recognize suitable sustainable development practices and apply it in day-to-daylife.

CO5: Assess the impacts of human population and suggest suitable solutions.

TEXTBOOKS:

1. Anubha Kaushik and C.P. Kaushik, “Perspectives in environmental studies”,New Age International Publishers,2nd edition, 2021.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, NewDelhi, 2017.
3. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 3rd edition, Pearson Education, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Third Edition, Universities Press(I) Pvt. Ltd., Hyderabad, 2021.

REFERENCES:

1. William P.Cunningham & Mary Ann Cunningham Environmental Science: AGlobal Concern, McGraw Hill, 14th edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 2015.
3. G. Tyler Miller and Scott E. Spoolman, ―Environmental Science, CengageLearning India Pvt, Ltd., Delhi, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 2012.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainabledesign and development, Cengage learning, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022

SEMESTER III

21GE301	UNIVERSAL HUMAN VALUES II: UNDERSTANDING HARMONY	L	T	P	C
		2	1	0	3

OBJECTIVES:

The objective of the course is fourfold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE TOPICS:

The course has 28 lectures (2 lecture hours) and 14 practice sessions (2 Tutorial hour) in 5 Units:

UNIT I	**Course Introduction - Need, Basic guidelines, Content and Process for Value Education**	

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- 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.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT II	**Understanding Harmony in the Human Being – Harmony in Myself!**	

- 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.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with disease

UNIT III	**Understanding harmony in the family and society- Harmony in human-human relationship**	

- 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.

Include practice sessions to reflect on relationships in family, hostel and institutes extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT IV	**Understanding Harmony in the Nature and Existence - Whole existence as coexistence**	

- Understanding the harmony in 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.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	

- 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.

Include practice exercises and case studies will be taken up in practice (tutorial) sessions eg. To discuss the conduct as an engineer or scientist etc.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Would become more aware of themselves, and their surroundings (family, society, nature).

CO2: Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: Would have better critical ability.

CO4: Would become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).

CO5: Would be able to 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.

TEXT BOOK:

1. R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books, New Delhi, Second Edition 2019.

REFERENCES:

1. A Nagaraj, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.
2. E. F Schumacher, "Small is Beautiful", Vintage classics, London, 1993.
3. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, Third Edition 2020.
4. Maulana Abdul Kalam Azad, "India Wins Freedom", Oriental blackswan private limited, Hyderabad, 2020.
5. Mahatma Gandhi, "Hind Swaraj or Indian Home Rule", Maheswari Publications, Delhi 2020.
6. Romain Rolland, "The life of Vivekananda and the universal gospel", Publication house of Ramakrishna Math, Kolkata, Thirty second edition 2018.
7. Romain Rolland, "Mahatma Gandhi: The man who become one with the universal being ", Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.
8. Heaton, Dennis P. "The story of stuff." (2010): 553-556.
9. Gandhi, Mohandas Karamchand, "The story of my experiments with truth: An autobiography", Om Books International, 2018.
10. Andrews, Cecile, "Slow is beautiful: new visions of community, leisure, and joie de vivre", New society publishers, 2006.
11. Kumarappa, Joseph Cornelius, "The economy of permanence. CP", All India Village Industries Assn., 1946.
12. Vivekananda-Romain Rolland (English)
13. Gandhi-Romain Rolland (English)

22GE201	TAMILS AND TECHNOLOGY (Common to All Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES:

The Course will enable learners to:

- Recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- Highlight the concepts of design and construction technology during the Sangamage.
- Provide an overview of manufacturing technology and its role in Tamil society.
- Illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- Promote scientific Tamil and Tamil computing.

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

Designing and Structural construction House & Designs in household materials duringSangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III	MANUFACTURING TECHNOLOGY	3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3

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

TOTAL:15PERIODS

OUTCOMES:

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

CO1: Identify the role of weaving and ceramic technology in ancient Tamil Culture.

CO2: Assess the design and construction technology ideas in the current Tamil society.

CO3: Identify the different types of manufacturing technology used in Tamil society andtheir significance.

CO4: Classify agricultural and irrigation technologies in ancient Tamil society and its current relevance.

CO5: Discuss the fundamentals of scientific Tamil and Tamil computing.

TEXTBOOKS& REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).

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

22MA301	DISCRETE MATHEMATICS (Common to CSE, IT)	L	T	P	C
		3	1	0	4

OBJECTIVES:

The Course will enable learners to:

- Describe the arguments using connectives and rules of inference.
- Introduce the basic concept of counting and generating functions.
- Define the graphs and it's models.
- Understand the concept of group theory, lattices and Boolean algebra.

UNIT I	LOGIC AND PROOFS	15

Propositional logic - Propositional equivalences - Predicates and quantifiers - Nested quantifiers - Rules of inference - Introduction to proofs - Proof methods and strategy.

UNIT II	COMBINATORICS	15

Mathematical induction - Strong induction and well ordering The basics of counting - The pigeonhole principle - Permutations and combinations - Recurrence relations - Solving linear recurrence relations - Generating functions - Inclusion and exclusion principle and its applications.

UNIT III	GRAPHS	15

Graphs and graph models - Graph terminology and special types of graphs - Matrix representation of graphs and graph isomorphism - Connectivity - Euler and Hamilton paths.

UNIT IV	ALGEBRAIC STRUCTURES	15

Algebraic systems - Semi groups and monoids - Groups - Subgroups - Homomorphism's - Normal subgroup and cosets - Lagrange's theorem - Definitions and examples of Ringsand Fields.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	15

Partial ordering - Posets - Lattices as posets - Properties of lattices - Lattices as algebraic systems - Sub lattices - Direct product and homomorphism - Some special lattices - Boolean algebra.

TOTAL:75PERIODS

OUTCOMES:

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

CO1: Validate the arguments using connectives and rule of inference.
CO2: Solve linear recurrence relations.
CO3: Determine Euler's path and Hamilton paths.
CO4: Identify algebraic structures of groups, rings, and fields.
CO5: Interpret lattices as algebraic structures.

TEXTBOOKS:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 8th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2021.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2017.

REFERENCES:

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2014.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

22CS301	ADVANCED JAVA PROGRAMMING (Common to CSE, IT)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To use the functionalities of Collections and IO Streams
- To use the functionalities of Java Stream API and unit testing framework using Junits.
- To provide a framework to map object-oriented domain models to relational databases for web applications using ORM Hibernate tool.
- To provide infrastructure support using Spring Framework.
- To Implement Model – View – Controller design pattern using Spring MVC.

UNIT I	COLLECTIONS AND IO STREAMS	9+6

The NavigableSet interface, the Queue interface, the Dequeue interface – The Collection classes – PriorityQueue – ArrayDeque – EnumSet – Comparators – More Utility Classes –StringTokenizer - Date – Calendar – Comparable interface – Observer Interface – Streams Types of Streams - The Byte-stream I/O hierarchy - Character Stream Hierarchy – Random Access File class - the java.io.Console Class – Serialization – Dates - Numbers, and Currency - Working with Dates - Numbers and Currencies – Parsing - Tokenizing and Formatting - Locating Data via Pattern Matching, Tokenizing.

List of Exercises:

1. Write a Java program to create an ArrayList of integers and add elements to it. Display the contents of the ArrayList.
2. Write a Java program to create a HashSet of strings and perform various operations like adding, removing, and checking the presence of elements.
3. Write a program to copy the contents of one file to another file using FileInputStream and FileOutputStream

UNIT II	STREAM API AND JUNIT	9+6

Count -Parallel Streams - Declarative/Functional Style Approach - Stream Pipeline – Iterating with stream - Max, Min & Comparators - Distinct and Collectors.toSet() - Filtering and Transformations - Find Any Vs Find First - Reduce and Flatmap - Joining Strings Implementation of Stream in API". Junit - Introduction to JUnit, JUnit with Eclipse, Assert method, Annotations, Parameterized tests, Test suite, Test runner.

List of Exercises

1. Write a Java program to filter out the even numbers from a list of integers using the Stream API.
2. Create a program that uses the Stream API to find the average of a list of floating-point numbers.
3. Implement a Java program that uses the Stream API to count the number of occurrences of a specific word in a given text file.
4. Write a JUnit test case to check if a given string is palindrome or not.
5. Create a JUnit test case to verify the correctness of a method that calculates the factorial of a given number.
6. Implement a JUnit test case to ensure that a specific exception is thrown when invalid input is provided to a method.

UNIT III	HIBERNATE FRAMEWORK	9+6

Hibernate Framework - Hibernate - Mapping Types - Hibernate Inheritance Mapping - Collections Mappings - Association mapping - HCQL (Hibernate Criteria Query Language) – Hibernate Query Language (HQL) - Caching in Hibernate - Log4j in Hibernate.

List of Exercises

1. Write a Java program to create a Hibernate configuration file (hibernate.cfg.xml) and establish a database connection.
2. Implement a Java program to perform CRUD operations (Create, Read, Update, Delete) using Hibernate.
3. Develop a Java program to implement a one-to-many relationship between two entity classes using Hibernate mappings.
4. Write a Java program to perform transaction management using Hibernate, including rollback and commit operations.
5. Develop a Java program to configure and use Hibernate caching mechanisms for optimizing database access.
6. Write a Java program to integrate Hibernate with Spring framework and develop a web application with database operations.

UNIT IV	SPRING FRAMEWORK	9+6

Spring Framework - Dependency Injection by Constructor Example - Autowiring in Spring - Constructor Injection with Collection - Spring DAO - Inheriting Bean in Spring Dependency Injection by setter method.

List of Exercises

1. Create a basic Spring application that demonstrates dependency injection using constructor injection.
2. Write a program to demonstrate the use of Spring annotations like @Autowired, @Component, and @Configuration.
3. Implement a Spring bean that uses setter injection to inject dependencies.

UNIT V	SPRING MVC	9+6

Spring MVC - Spring Java Mail - Spring Security- Aspect Oriented Programming (AOP) - Web Services – postman - Design Patterns in Java

List of Exercises

1. Write a Spring MVC program to create a simple registration form with fields like name, email, and password, and validate the form inputs.
2. Implement a Spring MVC program that retrieves data from a database and displays it on a web page using the Model-View-Controller pattern.
3. Build a Spring MVC application that implements user authentication and authorization using Spring Security.

TOTAL:75 PERIODS

OUTCOMES:

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

CO1: Apply collections and IO Streams to efficiently manage and process data structures and perform input/output operations in Java.

CO2: Apply Java Stream API and Junits to streamline data manipulation and perform unit testing for robust code development.

CO3: Develop a Seamlessly integrate object-oriented programming with database operations for web applications using hibernate.

CO4: Construct the power of the Spring Framework to provide a solid foundation for building scalable and maintainable applications.

CO5: Organize application logic, user interface, and data flow using the Spring MVC framework for efficient and modular development.

TEXTBOOKS:

1. Craig Walls, "Spring in Action",5th Edition, Manning Publications, 2018
2. Paul deck, "Spring MVC: A Tutorial" , Brainy Software, 2016

REFERENCES:

3. Maurice Naftalin and Philip Wadler, "Java Generics and Collections" , O'Reilly Media inc., 2023
4. Joshua Bloch , "Effective Java" , Addison – Wesley Professional, 2017
5. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft , "Java 8 in Action: Lambdas, Streams, and functional-style programming" , Manning Publications, 2014
6. Christian Bauer and Gavin King ,"Java Persistence with Hibernate", Manning Publications, 2015
7. AmuthanG."Spring MVC: Beginner's Guide" ,Packt Publishing, 2014
8. PetarTahchiev, Felipe Leme, Vincent Massol, and Gary Gregory ,"JUnit in Action" , Manning Publications, 2010

WEB REFERENCES:

9. Java Developer Certification, https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013193384540020736264_shared/overview

ONLINE RESOURCES:

1. https://infyspringboard.onwingspan.com/web/en/page/home

LIST OF EQUIPMENTS:

1.Java Development Kit (JDK), IO classes, JUnit library, Spring Framework libraries and dependencies (such as spring-core, spring-context, spring-beans, Spring MVC framework.

22CS303	DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE, IT, AIML)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Critically analyze the efficiency of alternative algorithmic solutions for the sameproblem Illustrate brute force and divide and conquer design techniques.
- Explain dynamic programming for solving various problems.
- Apply greedy technique and iterative improvement technique to solve optimization problems
- Examine the limitations of algorithmic power and handling it in different problems.

UNIT I	INTRODUCTION	6+6

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving –Fundamentals of the Analysis of Algorithmic Efficiency – Asymptotic Notations and their properties. Analysis Framework –Mathematical analysis for Recursive and Non-recursive algorithms

List of Exercise/Experiments:

1. Perform the recursive algorithm analysis.
2. Perform the non-recursive algorithm analysis.

UNIT II	BRUTE FORCE ANDDIVIDE AND CONQUER	6+6

Brute Force - String Matching - Exhaustive Search - Knapsack Problem -Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort - Multiplication of Large Integers – Closest-Pair and Convex Hull Problems - Transform and Conquer Method: Heap Sort

List of Exercise/Experiments:

1. Write a program to search an element using binary search
2. Write a program to sort the elements using merge sort and find time complexity.
3. Write a program to sort the elements using quick sort and find time complexity.
4. Write a program to sort the elements using heap sort

UNIT III	DYNAMIC PROGRAMMING	6+6

Dynamic programming – Principle of optimality – Floyd‘s algorithm – Multi stage graph - Optimal Binary Search Trees - Longest common subsequence - Matrix-chain multiplication – Travelling Salesperson Problem – Knapsack Problem and Memory functions.

List of Exercise/Experiments:

1. Solve Floyd’s algorithm
2. Write a program to find optimal binary search tree for a given list of keys.
3. Solve the multi-stage graph to find shortest path using backward and forward approach
4. Write a program to find the longest common subsequence

UNIT IV	GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT	6+6

Greedy Technique – Prim‘s algorithm and Kruskal’s Algorithm –Huffman Trees. The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem

List of Exercise/Experiments:

1. Write a program to find minimum spanning tree using Prim’s algorithm
2. Implement Kruskal’s algorithm to find minimum spanning tree
3. Write a program to solve maximum flow problem

UNIT V	BACKTRACKING AND BRANCH AND BOUND	6+6

P, NP NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - SubsetSum Problem. Branch and Bound– LIFO Search and FIFO search - Assignment problem – Knapsack Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem

List of Exercise/Experiments:

1. Write a program to implement sum of subset problem.
2. Write a program to solve N-Queen problem
3. Solve the assignment problem using branch and bound technique
4. Solve knapsack problem using branch and bound technique

TOTAL:60PERIODS

OUTCOMES:

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

CO1: Solve mathematically the efficiency of recursive and non-recursive algorithms

CO2: Design and Analyse the efficiency of divide and conquer and transform andconquer algorithmic techniques

CO3: Implement and analyse the problems using dynamic programming

CO4: Solve the problems using and greedy technique and iterative improvementtechnique for optimization

CO5: Compute the limitations of algorithmic power and solve the problems usingbacktracking and branch and bound technique.

TEXTBOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.

REFERENCES:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein,Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.

2. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
3. http://nptel.ac.in/

LIST OF EQUIPMENTS:

Standalone PC with C/C++/Java

22CS304	OPERATING SYSTEMS (Common to CSE, IT, AIML)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Explain the basic concepts of operating systems and process.
- Discuss threads and analyse various CPU scheduling algorithms.
- Describe the concept of process synchronization and deadlocks.
- Analyse various memory management schemes.
- Describe I/O management and file systems.

UNIT I	INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES	6+6

Introduction: Computer system organization - architecture – Resource management - Protection and Security – Virtualization - Operating System Structures: Services - User and Operating-System Interface - System Calls - System Services - Design and Implementation - Building and Booting an Operating System – Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication - IPC in Shared-Memory Systems - IPC in Message-Passing Systems

List of Exercise/Experiments:

1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr,man, grep, sed, etc..
2. Programs using Shell Programming.
3. Implementation of Unix System Calls.
4. Implementation of IPC using message queue
   a. Get the input data (integer value) from a process called sender
   b. Use Message Queue to transfer this data from sender to receiver process
   c. The receiver does the prime number checking on the received data
   d. Communicate the verified/status result from receiver to sender process, thisstatus should be displayed in the Sender process.

Note: Simultaneously execute two or more processes. Don’t do it as a single process

UNIT II	THREADS AND CPU SCHEDULING	6+6

Threads & Concurrency: Overview - Multicore Programming - Multithreading Models - Thread Libraries - Implicit Threading - Threading Issues - CPU Scheduling: Basic Concepts – Scheduling Criteria - Scheduling Algorithms - Thread Scheduling - Multi-Processor Scheduling - Real-Time CPU Scheduling

List of Exercise/Experiments:

1. Write a program to implement the following actions using pthreads
   a. Create a thread in a program and called Parent thread, this parent thread creates another thread (Child thread) to print out the numbers from 1 to 20. The Parent thread waits till the child thread finishes
   b. Create a thread in the main program, this program passes the 'count' as arguments to that thread function and this created thread function has to print your name 'count' times.
2. Write C programs to implement the various CPU Scheduling Algorithms.

UNIT III	PROCESS SYNCHRONISATION AND DEADLOCKS	6+6

Process Synchronization: The critical-section problem – Peterson's Solution, Synchronization hardware, Mutex locks, Semaphores, monitors - Classic problems of synchronization: Bounded Buffer Problem - Reader's & Writer Problem, Dinning Philosopher Problem. Deadlock: System model - Deadlock characterization, Methods for handling deadlocks - Deadlock prevention - Deadlock avoidance - Deadlock detection - Recovery from deadlock.

List of Exercise/Experiments:

1. Process Synchronization using Semaphores. A shared data has to be accessed by two categories of processes namely A and B. Satisfy the following constraints to access the data without any data loss.
   a. When a process A1 is accessing the database another process of the same category is permitted.
   b. When a process B1 is accessing the database neither process A1 nor another 74 processB2 is permitted.
   c. When a process A1 is accessing the database process B1 should not be allowed toaccess the database. Write appropriate code for both A and B satisfying all the above constraints using semaphores.

   Note: The time-stamp for accessing is approximately 10 sec.
2. Bankers Algorithm for Deadlock Avoidance

UNIT IV	MEMORY MANAGEMENT	6+6

Memory Management: Contiguous Memory Allocation - Paging - Structure of the Page Table – Swapping - Virtual Memory: Demand Paging – Copy-on write – Page Replacement – Allocation of frames – Thrashing – Memory Compression

List of Exercise/Experiments:

1. Analysis and Simulation of Memory Allocation and Management Techniques
   i. First Fit ii. Best Fit iii. Worst Fit
2. Implementation of Page Replacement Techniques
   i. FIFO ii. LRU iii. Optimal page replacement

UNIT V	STORAGE MANAGEMENT	6+6

Mass Storage Structure: Overview of Mass Storage Structure- HDD scheduling – Swap Space Management, I/O systems: I/O Hardware, Application I/O interface, Kernel I/O Subsystem, File System Interface: File Concept – Access Methods – Directory Structure
– Protection, File-System Implementation: File-System Structure- File-System Operations - Directory Implementation - Allocation Methods - Free-Space Management,
- Case Study-Linux

List of Exercise/Experiments:

1. Simulation of File Allocation Techniques
   i. Sequential ii. Linked list iii. indexed
2. Implementation of File Organization Strategies
   Single level directory ii. Two level directory iii. Hierarchical level directory

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Implement the basic concepts of operating systems and process.
CO2: Analyze various CPU scheduling algorithms and thread mechanism.
CO3: Implement the concepts of process synchronization and deadlocks.
CO4: Design various memory management schemes to given situation.
CO5: Implement various I/O and file management techniques.

TEXTBOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating SystemConcepts" II, 10th Edition, John Wiley and Sons Inc., 2018.

2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.
REFERENCES:
1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition,Prentice Hall, 2018.
2. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.
LIST OF EQUIPMENTS:
Standalone desktops with C/C++/Java/Equivalent compiler.

22IT301	DESIGN THINKING	L	T	P	C
		3	1	0	4

OBJECTIVES:

The Course will enable learners to:

- Familiarize design thinking and its phases.
- Perform immersion activity in empathize phase of design thinking.
- Create problem statements in the define phase of design thinking.
- Ideate and find solutions to the problem defined.
- Develop a prototype and perform testing

UNIT I	INTRODUCTION	9

Introduction to design thinking - Importance of design thinking for business – Phases of design thinking – Experiential activity – Case study.

UNIT II	EMPATHIZE PHASE	9

Empathize phase - Steps involved - Immersion activity- Questionnaire – Empathy map for case study

UNIT III	DEFINE PHASE	9

Creation of personas in define phase – steps in problem statement creation – problem statement definition – Examples – Key problem statements.

UNIT IV	IDEATION PHASE	9

Ideation phase steps – Ideation games – Ideate to find solutions – Doodling – Storytelling in presenting ideas and prototypes.

UNIT V	PROTOTYPE AND TESTING	9

Importance of prototype in design thinking –Guidelines - Prototyping the idea – Value proposition statement – Testing in design thinking – Prototype tests – Documentation– Design thinking in functional work – Mapping design thinking to agile methodologies.

TOTAL: 45 Periods

OUTCOMES:

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

CO1: Understand the phases of design thinking process..
CO2: Conduct an immersion activity to create an empathy map
CO3: Define the key problems of the personas created.
CO4: Apply the ideation phase steps to present the prototype ideas
CO5: Create a prototype with value propositions and test the prototype

TEXTBOOKS:

1. Christian Müller- Roterberg, “Handbook of Design Thinking”, Kindle Direct Publishing, November 2018.
2. Dan Senor and Saul Singer, “Start-Up Nation”, Grand Central Publishing, Twelfth Edition, 2009.

REFERENCES:

1. NirEyal and Ryan Hoover, “Hooked: How to Build Habit-Forming Products”, Library of Congress, 2014
2. Corral, Luis &Fronza, Ilenia, “Design Thinking and Agile Practices for Software Engineering: An Opportunity for Innovation”, 2018.

22GE311	PRODUCT DEVELOPMENT LAB – III **(Design and Analysis Phase)** (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- To provide an adequate understanding of project/product concepts and creative design process.
- Create a methodology to develop solutions to complex systems.

The students can form a team of 3 or 4 to work on the approved topic by the faculty in-charge. All approved product/process topics should have the following stages as listed under activities. The faculty in-charge conducts a periodic review to endorse the work process and during the review, the faculty shall provide suggestions/ideas to improvise the project towards completion. An interim report (consisting of literature, photographs, proof of the work done, etc..) for all listed activities should be submitted by the team during periodic review for evaluation. A final project report is required at the end of the semester for evaluation.

LIST OF ACTIVITIES:

1. Develop the design stage for a product from the concept.
    - Researching it in-depth.
    - Ideating possible solutions.
    - Selecting a promising solution.
    - Make a mock-up model
    - Comprehend the design features of the mock-up model.
2. Evaluate the pros-cons of the mock-up (& with the existing product).
3. Generate the Design for Manufacturing and Assembly (DFMA) process route for the product with necessary interdisciplinary collaborations.

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1 Enhance their skills in design concepts, rules and procedures.
CO2 Develop their cognitive strategy to think, organize, learn and behave.
CO3 Demonstrate the ability to provide conceptual design strategies for a product.
CO4 Describe the procedure for designing a Mock-up model.
CO5 Recognize and apply appropriate interdisciplinary and integrative strategies for solving complex problems

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Equipment Name	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Centre lathe	2 Nos
6	Arc welding transformer with cables and holders	2 Nos
7	Plumbing tools	2 Sets
8	Carpentry tools	2 Sets
9	Multimeter	10 Nos
10	Drilling Machine	1 No
11	Solder Stations	5 Sets
12	Desoldering Machine	1 No
13	PCB Milling Machine	1 No
14	Variable Power Supply	1 No
15	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	10 Sets
16	Personal Desktop Computers	30 Nos
17	3D Modelling software – Creo/ AutoCAD/ etc.,	30 Licence

22CS311	APTITUDE AND CODING SKILLS – I (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- Develop vocabulary for effective communication and reading skills.
- Build the logical reasoning and quantitative skills.
- Develop error correction and debugging skills in programming.

List of Exercises:

1. English – Phase I

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase I

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase I

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase I

Logical, Compilation and Code reuse

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Develop vocabulary for effective communication and reading skills.
CO2: Build the logical reasoning and quantitative skills.
CO3: Develop error correction and debugging skills in programming.

SEMESTER IV

22MA401	PROBABILITY AND STATISTICS (Common to CSE, IT, AIML)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Provide the necessary basic concepts of random variables and to introduce somestandard distributions.
- Test the hypothesis for small and large samples.
- Introduce the concepts of Analysis of Variances.
- Understand the concept of statistical quality control.

UNIT I	ONE-DIMENSIONAL RANDOM VARIABLES	15

Basic probability definitions- Independent events- Conditional probability (revisit) - Random variable - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

List of Exercise/Experiments using R Programming:

1. Finding conditional probability.

Finding mean, variance and standard deviation.

UNIT II	TWO-DIMENSIONAL RANDOM VARIABLES	15

Joint distributions - Marginal and conditional distributions - Covariance - Correlation andlinear regression - Transformation of random variables.

List of Exercise/Experiments using R Programming:

1. Finding marginal density functions for discrete random variables.
2. Calculating correlation and regression.

UNIT III	TESTING OF HYPOTHESIS	15

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t and F distributions for mean and variance - Chi-square test- Contingency table (test for independent) - Goodness of fit.

List of Exercise/Experiments using R Programming:

1. Testing of hypothesis for given data using Z - test.
2. Testing of hypothesis for given data using t - test.

UNIT IV	DESIGN OF EXPERIMENTS	15

One way and Two-way classifications - Completely randomized design – Randomized block design - Latin square design.

List of Exercise/Experiments R Programming:

1. Perform one-way ANOVA test for the given data.
2. Perform two-way ANOVA test for the given data.

UNIT V	STATISTICAL QUALITY CONTROL	15

Control charts for measurements (X and R charts) - Control charts for attributes (p, c and npcharts) - Tolerance limits.

List of Exercise/Experiments using R Programming:

1. Interpret the results for X-Chart for variable data.
2. Interpret the results for R-Chart for variable data.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Calculate the statistical measures of standard distributions.

CO2: Compute the correlation & regression for two dimensional random variables.

CO3: Apply the concept of testing the hypothesis.

CO4: Implement the concept of analysis of variance for various experimental designs.

CO5: Demonstrate the control charts for variables and attributes**.**

TEXTBOOKS:

1. R.A. Johnson, I. Miller and J. Freund, "Miller and Freund's Probability andStatistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. J.S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGrawHill, 4th Edition, 2017.

REFERENCES:

1. J.L. Devore, "Probability and Statistics for Engineering and the Sciences",Cengage Learning, New Delhi, 9th Edition, 2016.
2. S.M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition, Elsevier, 2020.
3. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
4. R.E.Walpole, R.H.Myers, S.L. Myers and K.Ye, "Probability and Statistics for Engineers and Scientists". Pearson Education, Asia, 9th Edition, 2012

LIST OF EQUIPMENTS:

22IT401	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Understand the concept of Artificial Intelligence
- Familiarize with Knowledge based AI systems and approaches
- Apply the aspect of Probabilistic approach to AI
- Identify the Neural Networks and NLP in designing AI models
- Recognize the concepts of Machine Learning and its deterministic tools

UNIT I	PROBLEM SOLVING AND SEARCH STARTEGIES	9+6

Introduction: What Is AI, the Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, And The Structure of Agents. Solving Problems by Searching: Problem-Solving Agents, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions. Beyond Classical Search: Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions and Partial Observations, Online Search Agents and Unknown Environments. Constraint Satisfaction Problems: Definition, Constraint Propagation, Backtracking Search, Local Search, The Structure of Problems

List of Exercise/Experiments

1. Implementation of uninformed search algorithm (BFS and DFS).
2. Implementation of Informed Search algorithm (A* and Hill Climbing Algorithm)

UNIT II	KNOWLEDGE REPRESENTATION AND REASONING	9+6

Logical Agents: Knowledge-Based Agents, Propositional Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic. First Order Logic: Syntax and Semantics, Knowledge Engineering in FOL, Inference in First-Order Logic, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Planning: Definition, Algorithms, Planning Graphs, Hierarchical Planning, Multi-agent Planning. Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World

List of Exercise/Experiments

1. Implementation of forward and backward chaining.
2. Implementation of unification algorithms.

UNIT III	LEARNING	9+6

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks. Applications: Human computer interaction (HCI), Knowledge management technologies, AI for customer relationship management, Expert systems, Data mining, text mining, and Web mining, Other current topics

List of Exercise/Experiments

1. Numpy Operations
2. NumPy arrays
3. *NumPy Indexing and Selection*
4. NumPy Exercise:

(i) Write code to create a 4x3 matrix with values ranging from 2 to 13.

(ii) Write code to replace the odd numbers by -1 in the following array.

(iii) Perform the following operations on an array of mobile phones prices 6999, 7500, 11999, 27899, 14999, 9999.

a) Create a 1d-array of mobile phones prices

b) Convert this array to float type

c) Append a new mobile having price of 13999 Rs. to this array

d) Reverse this array of mobile phones prices

e) Apply GST of 18% on mobile phones prices and update this array.

f) Sort the array in descending order of price

g) What is the average mobile phone price.

UNIT IV	FUNDAMENTALS OF MACHINE LEARNING	9+6

Motivation for Machine Learning, Applications, Machine Learning, Learning associations, Classification, Regression, The Origin of machine learning, Uses and abuses of machine learning, Success cases, How do machines learn, Abstraction and knowledge representation, Generalization, Factors to be considered, Assessing the success of learning, Metrics for evaluation of classification method, Steps to apply machine learning to data, Machine learning process, Input data and ML algorithm, Classification of machine learning algorithms, General ML architecture, Group of algorithms, Reinforcement learning, Supervised learning, Unsupervised learning, Semi-Supervised learning, Algorithms, Ensemble learning, Matching data to an appropriate algorithm.

List of Exercise/Experiments

1. Build linear regression models to predict housing prices using python , using data set available Google colabs.
2. Stock Ensemble-based Neural Network for Stock Market Prediction using Historical Stock Data and Sentiment Analysis.

UNIT V	MACHINE LEARNING AND TYPES	9+6

Supervised Learning, Regression, Linear regression, Multiple linear regression, A multiple regression analysis, The analysis of variance for multiple regression, Examples for multiple regression, Overfitting, Detecting overfit models: Cross validation, Cross validation: The ideal procedure, Parameter estimation, Logistic regression, Decision trees: Background, Decision trees, Decision trees for credit card promotion, An algorithm for building decision trees, Attribute selection measure: Information gain, Entropy, Decision Tree: Weekend example, Occam's Razor, Converting a tree to rules, Unsupervised learning, Semi Supervised learning, Clustering, K – means clustering, Automated discovery, Reinforcement learning, Multi-Armed Bandit algorithms, Influence diagrams, Risk modeling, Sensitivity analysis, Casual learning.

List of Exercise/Experiments

Use Cases

Case Study 1: Churn Analysis and Prediction (Survival Modelling)
Cox-proportional models
Churn Prediction
Case Study 2: Credit card Fraud Analysis
Imbalanced Data
Neural Network
Case study 3: Sentiment Analysis or Topic Mining from New York Times
Similarity measures (Cosine Similarity, Chi-Square, N Grams)
Part-of-Speech Tagging
Stemming and Chunking
Case Study 4: Sales Funnel Analysis
A/B testing
Campaign effectiveness, Web page layout effectiveness
Scoring and Ranking
Case Study 5: Recommendation Systems and Collaborative filtering
User based
Item Based
Singular value decomposition–based recommenders
Case Study 6: Customer Segmentation and Value

Segmentation Strategies
Lifetime Value
Case Study 7: Portfolio Risk Conformance
Risk Profiling
Portfolio Optimization
Case Study 8: Uber Alternative Routing
Graph Construction
Route Optimization

TOTAL:45+30=75 PERIODS

OUTCOMES:

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

CO1: Able to build a model using AI and ML, and able to predict based on various events.
CO2: Working knowledge on tools and frameworks.
CO3: Provide a basic exposition to the goals and methods of Artificial Intelligence.
CO4: Study of the design of intelligent computational techniques.
CO5: Improve problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, computer vision, automatic programming and machine learning.

TEXTBOOKS:

1. Introduction to Artificial Intelligence and Machine Learning (IBM ICE Publications).
2. Stuart Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, Pearson Education *I* Prentice Hall of India, 2010.
3. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Third Edition, Tata McGraw-Hill, 2010.

REFERENCES:

1. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
2. Dan W.Patterson, “Introduction to Artificial Intelligence and Expert Systems”, PHI, 2006.
3. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd., 2000.

LIST OF EQUIPMENTS:

1. 8GB RAM, 50 GB HDD
2. Stable Internet Connection (At least 10Gbps) to work with Google Co labs

22IT402	COMPUTER ARCHITECTURE AND MICROPROCESSORS	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To learn the basics of building datapath.
- To understand the memory hierarchies, cache memories and virtual memories, and I/O systems
- To familiarize with 8086 Microprocessor

UNIT I	BASIC STRUCTURE OF A COMPUTER SYSTEM	9+6

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing modes.

List of Exercise/Experiments

1. To familiarize the use of QtSPIM simulator
2. To use basic instructions of MIPS to understand various addressing modes using QtSPIM simulator.

UNIT II	ARITHMETIC FOR COMPUTERS	9+6

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism.

List of Exercise/Experiments

1. To perform basic addition, subtraction, multiplication, and division programs in QtSPIM simulator using MIPS instructions.
2. To perform floating point addition and multiplication in QtSPIM simulator using MIPS instructions.

UNIT III	PROCESSOR AND CONTROL UNIT	9+6

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

List of Exercise/Experiments

1. Design an 8-bit ALU using MODELSIM
2. To implement Verilog code for 16-bit Single-Cycle MIPS processor

UNIT IV	MEMORY & I/O SYSTEMS	9+6

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB‘s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB.

List of Exercise/Experiments

1. Simulating cache read/write using Paracache simulator.
2. Learning address translation in virtual memory system using Paracache simulator.

UNIT V	INTRODUCTION TO 8086 MICROPROCESSOR	9+6

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String

Manipulation.

List of Exercise/Experiments

1. Write and execute 8086 ALP for performing Addition, Subtraction, Multiplication and division of two 8-bit numbers using 8086 Emulator.
2. Write and execute 8086 ALP for reversing the given number using 8086 Emulator.

TOTAL: 45 + 30 = 75 Periods

OUTCOMES:

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

CO1: Understand the basics structure of computers, operations and instructions.

CO2: Design arithmetic and logic unit.

CO3: Understand simple and pipelined datapath construction

CO4: Understand the various memory systems and I/O communication.

CO5: Understand the architecture and assembly programming of 8086 microprocessor

TEXTBOOKS:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.
3. Sunil Mathur, Microprocessor 8086-Architecture, Programming and Interfacing, Prentice Hall of India, 2011

REFERENCES:

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010
2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
3. Douglas V Hall, SSSP Rao, Microprocessors and Interfacing: Programming and Hardware, McGraw-Hill, 2017

LIST OF EQUIPMENTS:

1. QtSPIM simulator
2. Modelsim 18.1
3. Paracache simulator
4. EMU 8086 Emulator

22IT403	WEB DEVELOPMENT FRAMEWORKS	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand web semantics and related tools and framework
- Able to get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

UNIT I	ADVANCED JAVASCRIPT	9+6

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring

List of Exercise/Experiments

1) Create a JS Object for Bank Account (w attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
   - List down all the entries of the bank object
   - Check the existence of a key
   - If key found, get the value for the key
2) Spread Operator
   - Merge Customer and Account Arrays
   - Update the Customer Object with the new values
   - Develop a function that takes an Spread Argument and calculates total balance.

UNIT II	INTRODUCTION TO REACTJS	9+6

Class-Inheritance, Methods, Extended Class-Map, filter and Reduce Functions, Functions - Arrow Functions, Lambda Expressions , REST - Introduction, Why JSX, Hello World Apps, Project Structure

List of Exercise/Experiments

1) Create a list of Bank Objects (same kind of object you used in above lab, but in a array format)
   - Display the banks where balance is greater than 200
   - deduct 10% of the Bank account balance, as part of monthly service fees
   - Display the banks where balance is greater than 200 and branch code is “Chennai”
   - Add a new Bank to the given array
   - Delete a bank from the array (use splice operator)
   - Calculate the total balance of all bank accounts
2) Develop a Scientific calculator that does following operations
   - Rounded Value
   - Area of Circle
   - Calculating of Sin, Cos and Tan functions
   - Permiter of an Rectangle
   - Employ Arrow functions
   - Employ HOC

UNIT III	REACT COMPONENTS AND HOOKS	9+6

Class vs Functional Components, React Class Based Components – component DidMount, WillUpdate, shouldupate, didcatchetc - State - UseState, UseRef, USeEffect,UseHistory Usage and Props(difference, when to use what, mutable or immutabilty, direction of flow), PropTypes, Auxillary

Components, Controlled and Uncontrolled Components, Component Interaction (Parent to Child and Child to Parent), Iteration & Conditional Response

List of Exercise/Experiments

1) Create a collection of Customer by using
   - Weak Map and Map Collection in JS
   - Show Case the different feature set of the same.
2) Add Login Page, Dash Board Page, Admin Page
   - Enable React Routing
   - Add React Protected Route, for authorization

UNIT IV	**REACT LIBRARY - I**	**9+6**

Event Bubbleup - Component Wrapper - Integration of CSS Modules - Forms Validations(YUP, Formik, Standard), Events Handling, Data Binding

List of Exercise/Experiments

1) Develop a React application that has User Registration Form w field level validations, data submission to a rest api end point, boot strap for responsive.
   - Use YUP or Formik to implement the same

UNIT V	**REACT LIBRARY - II**	**9+6**

Custom Hooks, HTTP - Fetch, Axios, Services, Behaviour Subjects - StateLess, StateFull and Container Components, Error Handling - Build, Env, CORS, Unit Testing w React Testing Library - Introduction to react-native - Introduction to Story Book

List of Exercise/Experiments

1) Employ back end api for Login Page functionality (authentication). Post login, store the user context (received from the back end server) in browser's session storage as objects. And use the same as creds during protected route verification
   - On the dashboard page, have a grid of Students. The data has to be bought from back end API
   - Employ useref, useeffect &usestate, and useHistory
   1) Enable Exception Handling
   2) Enable HOC and Aux Components
   3) Implement React-Testing Library

Business Use Case Implementations

1) Student Management System
2) Retail Bank System
3) eCommerce System
4) Student LMS Management System

TOTAL:45+30=75 PERIODS

OUTCOMES:

At the end of the course, the students will be able to:

CO1: Personalize web pages using text formatting, graphics, audio, and video.

CO2: Hands on knowledge on Rest API , propTypes

CO3: Able to develop a web application using latest React Framework

CO4: Apply various React features including functions, components, and services.

CO5: Able to develop application using ReactJshooks .

TEXTBOOKS:

1) David Flanagan, Javascript The Definitive Guide, Paperback, 7th Edition, 2020.
2) David Choi ,Full-Stack React, TypeScript, and Node: Build cloud-ready web applications

using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020

3) Mehul Mohan, Advanced Web Development with React Paperback – 1 January 2020

REFERENCES:

1. PARENTAL WEBSITE - https://reactjs.org/
2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by Kirupa Chinnathambi
5. "React Up & Running" by StoyanStefanov
6. https://www.edureka.co/reactjs-redux-certification-training

ONLINE LEARNING PLATFORMS :

- CodePen,
- CodeSandbox (ß Preferred)
- Stackblitz.

LIST OF EQUIPMENTS:

- NodeJS (v9.11.2)
- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- ReactJS installation (v17)
- Chrome / FireFox Browsers (latest)
- Responsive using Media Queries & Bootstrap Material & Antdesign
- Design based Apps

22IT404	APPLICATION SYSTEM DESIGN WITH UML	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Understand the fundamentals of object-oriented modeling
- Capture the requirements specification for an intended software system
- Translate the analysis phase to design modeling
- Design with static UML diagrams.
- Design with the UML dynamic and implementation diagrams.
- Understand the concepts of Design Patterns

UNIT I	INTRODUCTION TO AN OBJECT-ORIENTED TECHNOLOGIES AND UML	9+6

Software development process: The Waterfall Model vs. The Spiral Model. -The Software Crisis, description of the real world using the Objects Model. -Classes, inheritance and multiple configurations. -Quality software characteristics. - Descriptionof the Object Oriented Analysis process vs. the Structure Analysis Model. Introduction to the UML Language. Standards. -Elements of the language. -General description of various models. -The process of Object Oriented software development.-Description of Design Patterns.

List of Exercise/Experiments

1. Develop Problem statement for software System

UNIT II	REQUIREMENT ANALYSIS AND STATIC DIAGRAMS	9+6

Analysis of system requirements. -Actor definitions. -Writing a case goal. –Use Case Diagrams. - Use Case Relationships. - Use case Modeling — Relating Use cases — include, extend and generalization – When to use Use-cases- The Class Diagram Model. -Attributes descriptions. - Operations descriptions. - Connections descriptions in the Static Model. - Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity. Package Diagram Model. - Description of the model. -White box, black box. -Connections between packagers. - Interfaces. - Create Package Diagram. Drill Down

List of Exercise/Experiments

1. Document the Software Requirements Specification (SRS) for the identifiedsystem
2. Identify use cases and develop the Use Case model.
3. Identify the conceptual classes and develop Class Diagram

UNIT III	INTERACTION DIAGRAMS	9+6

Description of goal. -Defining UML Method, Operation, Object Interface, Class. - Sequence Diagram. -Finding objects from Flow of Events. - Describing the process of finding objects using a Sequence Diagram. - Describing the process of finding objectsusing a Collaboration Diagram

List of Exercise/Experiments

1. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence Diagram

UNIT IV	DYNAMIC AND IMPLEMENTATION DIAGRAMS	9+6

Description of the State Diagram. -Events Handling. - Description of the Activity Diagram. - Exercise in State Machines. Component Diagram Model. - Physical Aspect. -Logical Aspect.- Connections and Dependencies. -User face. - Initial DB design in a UML environment. Deployment Model.- Processors. -Connections. - Components. -Tasks. -Threads. - Signals and Events

List of Exercise/Experiments

1. Draw relevant State Chart and Activity Diagrams for the same system.

2. Develop UML Component and Deployment diagram

UNIT V	DESIGN PATTERNS	9+6

Design Patters – SOLID Principle – Standard Architecture Principles - Java Blue Print Patterns – Structural. Behavioral and Creational Patterns – Reference Implementations

List of Exercise/Experiments

1. Evaluate the different pattern interactions between various physical components and the user, managing a design solution through visual representations.

To develop a mini-project by using the following Use Cases listed below:

Use Case 1
POS (Point of Sale) Terminal
Features to be handled:-
1. Order Entry,
2. Item Management and Categorization,
3. Tax Calculation,
4. Payment Mode, Payment Status, User Management

Use Case 2
Hotel Room Management
Features to be handled:-
1. Rooms type and Category
2. Check in and Check Out
3. Room occupation Status
4. Room Service Request
5. Guests Management and allocation Room
6. Billing Calculation, User management

Use Case 3
Banking Portal
1. Funds Transfer within Same Bank, Intra Bank
2. Forex Conversion
3. Bene Management
4. Customer and Accounts Management
5. Funds Transfer Transaction Status

Use Case 4
Mobile Phone Service Center
1. Mobile Phone Parts Management
2. Mobile Phone Models
3. Service Request Registration
4. Service Request Status Check
5. Service Request Engineer Allocation
6. Payment
7. Customer Management

TOTAL: 45+30= 75 PERIODS

OUTCOMES:

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

CO1: To understand business problem statement in object-oriented notation
CO2: Covert the analysis phase to design modeling.
CO3: Identify various scenarios based on software requirements
CO4: Implement Static diagrams and Dynamic modeling using UML Modeling
CO5: To build an extendable and scalable solution using Design patterns
CO6: Develop and implement simple applications that make use of classes, packages and interfaces

TEXTBOOKS:

1. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering: using UML, Patterns, and Java.., 2009
2. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software., First Edition.

REFERENCES:

1. Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, ―Design patterns: Elements of Reusable Object-Oriented Software‖, Addison-Wesley, 1995.
2. Martin Fowler, ―UML Distilled: A Brief Guide to the Standard Object Modeling Language‖, Third edition, Addison Wesley, 2000
3. Craig Larman, ―Applying UML and Patterns: An Introduction to Object- Oriented Analysis and Design and Iterative Development‖, Third Edition, Pearson Education, 2005
4. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

LIST OF EQUIPMENTS:

1. STANDALONE DESKTOPS 30
2. ArgoUML, StarUML Visual Paradigm Or Equivalent Eclipse IDE And Junit

22GE411	PRODUCT DEVELOPMENT LAB - IV (Prototype Phase) (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will be able learners to:

- Analyze the real-time problems in product development from an engineering perspective.
- Implement the DFMA process route to make and assemble the product.
- Test and qualify the product or a system with acquired knowledge.
- Identify the business opportunities for the developed product or process.

The student batch of PDD Lab 3 shall continue their product/ process design work under the guidance of the faculty in charge. All batches should cover the following stages of prototyping work as listed under activities. The faculty in charge shall conduct periodic reviews to endorse the work progress and during the review, the faculty shall provide suggestions/ideas to improvise the project towards completion. An interim report (consisting of BoM, Stages of Prototyping, photographs, proof of work done, etc..) for all listed activities should be submitted by the team during periodic review for evaluation. A final project report is required at the end of the semester and the evaluation is based on an oral presentation in front of the examiner panel constituted by the Head of the Department.

LIST OF ACTIVITIES:

1. Develop Engineering BoM for the approved industrial Mock-up from Phase III. Transform the Engineering BoM to develop a Prototype.
2. Devise / Plan an economically efficient manufacturing process to make the Prototype and testing.
3. Deliberation of the Product / Process outcome – Phase IV. Preparation and submission of a project report.

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1 Identify the real-time problems through literature.

CO 2 Develop feasible solutions for the problems.

CO 3 Evaluate the methods to develop solutions to the problem.

CO 4 Analyze the business opportunities for a new product.

CO 5 Prepare a detailed report for the experimental dissemination.

22CS411	APTITUDE AND CODING SKILLS – II (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- Develop advanced vocabulary for effective communication and reading skills.
- Build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

List of Exercises:

1. **English – Phase II**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase II**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase II**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations,Probability

4. **Automata Fix – Phase II**

Logical, Compilation and Code reuse

5. **Automata -Phase II**

Data Structure Concepts: Array and Matrices, Linked list, String processing andmanipulation, Stack/Queue, Sorting and Searching

Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Develop advanced vocabulary for effective communication and reading skills.
CO2: Build an enhanced level of logical reasoning and quantitative skills.
CO3: Develop error correction and debugging skills in programming.
CO4: Apply data structures and algorithms in problem solving.

22CS702	DATA ANALYTICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To explain the fundamentals of big data and data analytics
- To discuss the Hadoop framework
- To explain about exploratory data analysis and data manipulation tools and use it for developing applications
- To analyse and interpret streaming data
- To discuss various applications of data analytics

UNIT I	INTRODUCTION	9+6

Evolution of Big Data- Definition of Big Data-Challenges with Big Data- Traditional Business Intelligence (BI) versus Big Data- Introduction to big data analytics- Classification of Analytics- Analytics Tools- Importance of big data analytics.

List of Exercise/Experiments:

1. Download, install and explore the features of R/Python for data analytics.
2. Working with Numpy arrays

UNIT II	HADOOP FRAMEWORK	9+6

Introducing Hadoop- RDBMS versus Hadoop- Hadoop Overview-HDFS (Hadoop Distributed File System)- Processing Data with Hadoop- Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

List of Exercise/Experiments:

1. Working with Pandas data frames
2. Basic plots using Matplotlib

UNIT III	EXPLORATORY DATA ANALYSIS	9+6

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA –Data transformation techniques - Introduction to NoSQL – MongoDB: RDBMS Vs MongoDB – Data Types – Query Language – Hive – Hive Architecture – Data Types – File Formats - Hive Query Language (HQL) – RC File Implementation – User Defined Functions.

List of Exercise/Experiments:

1. Statistical and Probability measures - Frequency distributions, Mean, Mode, Standard Deviation, Variability, Normal curves, Correlation and scatter plots, Correlation coefficient, Regression.
2. Use the standard benchmark data set for performing the following:
   a)Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation,
   Skewness and Kurtosis.
   b)Bivariate Analysis: Linear and logistic regression modelling.
   c)Multiple Regression Analysis
   d)Compare the results of the above analysis for the two data sets.

UNIT IV	MINING DATA STREAMS	9+6

The data stream model – stream queries-sampling data in a stream-general streaming problem filtering streams-analysis of filtering- dealing with infinite streams- Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.

List of Exercise/Experiments:

1. Apply and explore various plotting functions on any data set.
2. Implement the following algorithms on real time stream data sets.

Support Vector Machine

Decision tree classifier

Clustering Algorithms

UNIT V	**APPLICATIONS**	**9+6**

Application: Sales and Marketing – Industry Specific Data Mining – microRNA Data Analysis Case Study – Credit Scoring Case Study – Data Mining Non tabular Data.

List of Exercise/Experiments:

1. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set. You can use Java/Python ML library classes/API
2. Mini Project: The project should contain the following components

- Realtime dataset
- Data preparation & Transformation
- Handling missing Data
- Data Storage
- Algorithm for data analytics
- Data visualization: Charts, Heatmap, Crosstab, Treemap

TOTAL: 45 + 30 = 75 PERIODS

OUTCOMES:

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

CO1: Understand the basics of big data, including its definition, challenges, and differences from traditional BI.

CO2: Use R and Python to analyze data sets and perform basic statistical analyses and visualizations.

CO3: Compare the functionalities of RDBMS and Hadoop in data processing and resource management.

CO4: Conduct exploratory data analysis (EDA) and understand its role compared to classical and Bayesian analysis.

CO5: Implement various data stream mining algorithms for real-time data analysis.

CO6: Develop real-world applications of big data analytics, covering data preparation, storage, analytics, and visualization.

TEXT BOOKS:

1. Subhashini Chellappan, Seema Acharya, “Big Data and Analytics”, 2nd edition, Wiley Publications, 2019.
2. Suresh Kumar Mukhiya and Usman Ahmed, “Hands-on Exploratory Data Analysis with Python”, Packt publishing, March 2020.

3. Jure Leskovek, Anand Rajaraman and Jefrey Ullman," Mining of Massive Datasets. v2.1", Cambridge University Press, 2019.
4. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data II: A Practical Guide To Data Visualization, Advanced Data Mining Methods, and Applications, Wiley 2009.

REFERENCES:

1. Nelli, F., Python Data Analytics: with Pandas, NumPy and Matplotlib, Apress, 2018.
2. Bart Baesens," Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", John Wiley & Sons, 2014.
3. Min Chen, Shiwen Mao, Yin Zhang, Victor CM Leung, Big Data: Related Technologies, Challenges and Future Prospects, Springer, 2014.
4. Michael Minelli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends", John Wiley & Sons, 2013.
5. Marcello Trovati, Richard Hill, Ashiq Anjum, Shao Ying Zhu, "Big Data Analytics and cloud computing – Theory, Algorithms and Applications", Springer International Publishing, 2016.

LIST OF EQUIPMENTS:

R / Python

22IT501	DATA COMMUNICATIONS AND COMPUTER NETWORKS (Lab Integrated)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- Understand the fundamentals of Data communication and networks
- Analyze the Transmission Media and Switching media
- Compare Error detection and correction process
- Configure network topologies and network devices
- Create and configure small computer network

UNIT I FUNDAMENTALS OF DATA COMMUNICATION AND COMPUTER NETWORK 9+6

Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol- Protocols, Standards, Standard organizations. Bandwidth, Data Transmission Rate, Baud Rate and Bits per second. Modes of Communication (Simplex, Hall duplex, Full Duplex). Analog Signal and Digital Signal, Analog and Digital transmission: Analog To Digital, Digital To Analog Conversion Fundamental Of Computer Network: Definition And Need Of Computer Network, Applications, Network Benefits. Classification of Network: LAN, WAN, MAN Network Architecture: Peer To Peer, Client Server Network

List of Exercises/Experiments

1. Configure Peer-to-Peer Network with at least three hosts

UNIT II TRANSMISSION MEDIA AND SWITCHING 9+6

Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable- Fiber-Optic Cable Unguided Transmission Radio Waves, Microwaves, Infrared, Satellite - Line-of-Sight Transmission Point to Point, Broadcast Multiplexing: Frequency-Division Multiplexing Time –Division Multiplexing. Switching: Circuit-Switched Packet -Switched networks

List of Exercises/Experiments

1. Create detailed standard network cable including cross cable and test by using cable tester.

UNIT III **ERROR DETECTION, CORRECTION AND WIRELESS COMMUNICATION** **9+6**

Types of Errors: Single Bit Error and Burst Error, Redundancy Error Detection: Longitudinal Redundancy Check (LRC), Vertical Redundancy Check (VRC), Cyclic Redundancy Check (CRC) Forward 3.3

Error Correction: Forward error Correction IEEE standards: 802.1, 802.2, 802.3, 802.4, 802.5 Wireless LANs: 802.11 Architecture, MAC Sub1ayer, Addressing Mechanism Bluetooth Architecture: Pico net, Scatter net Mobile Generations: IG, 2G, 3G, 4G and 5G

List of Exercises/Experiments

1. Connect Computers using given topology with wired Media
2. Connect Computers using wireless media
3. Write a C program to CRC Error Detection
4. Create a Network Using Bluetooth-(Pico net/Scatter net)

UNIT IV **NETWORK TOPOLOGIES, DEVICES AND OSI MODEL** **9+6**

Network Topologies: Introduction, Definition, Selection, Criteria, Types of Topology-

i) Bus ii) Ring iii) Star iv) Mesh v) Tree vi) Hybrid, Network Connecting Devices: Hub, Switch, Router, Repeater, Bridge, Gateway, Modem, Wireless infrastructure, Components, and OSI Reference Model.

List of Exercises/Experiments

1. Share Printer and Folder in a network and transfer a file from one computer to another
2. Install Operating System (Windows/Linux/Red hat/Ubuntu)
3. Configure File Server
4. Configure Client to File Server and use file services

5. Setting up a wireless network

UNIT V TCP/IP MODEL LAYERED ARCHITECTURE 9+6

TCP/IP Model: Layered Architecture- Data Link Layer, Nodes and links, services, two categories of links-two sub layers-Link Layer addressing-three types of address-Address Resolution Protocol-Network layer-Address: Address space-Classful and Classless addressing, Dynamic Host Configuration Protocol-Network Address Resolution-Transport Layer Protocol-Transport layer services-Connectionless and Connection Oriented Protocol-Address Mechanism in Internet IP Addressing-IP Address Classes-Classless IP Addressing-Sub netting- Super netting-Masking
IPV4 and IPV6

List of Exercises/Experiments

1. Configure Static and Dynamic IP addresses
2. Configure DHCP Server
3. Basie TCP/IP Utilities and Network commands ipconfig, ping, tracert, netstat, pathping, route
4. Install Wireshark and configure as packet sniffer
5. Set access rights and security permissions for user
6. Create IPV6 based small computer network using a simulator (preferably open source based simulator)

Suggestive list of Projects:

1. Create a small Network install, configure various devices and perform at least one peer-to-peer service and client/server service over it.
2. Prepare a report on recent and widely used unguided media in industries depending on Cost, speed, efficiency, and reliability.
3. Design layout of a Network for department, Deciding upon type of network, number/length of components with their specifications.

TOTAL: 45+30=75 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the functioning of data communication and computer network.

CO2: Apply knowledge to choose appropriate transmission media and switching techniques as required

CO3: Analyze the transmission errors with respect to IEEE standards.

CO4: Configure various networking devices.

CO5: Configure different TCP/IP services

TEXTBOOKS:

1. Forouzan Behrouz A, Data Communications and Networking with TCP/IP Protocol Suit, 6th Edition, Tata McGraw Hill, New Delhi, 2022.
2. Tanenbam Andrew S, Computer Networks, PHI Learning Pvt ltd, NewDelhi, 5th Edition, 2011.

REFERENCES:

1. Tanenbam Andrew S, Computer Networks, PHI Learning Pvt ltd, NewDelhi, 5th Edition, 2011.
2. Godbole Achyut, Data Communication and Networks, Tata McGraw Hill, New Delhi, 2006, ISBN : 0070472971
3. Comer Douglas. E ,Internetworking with TCP/IP Principles, Protocols and Architectures, PHI Learning Pvt Ltd, Delhi ISBN: 81-203-2065-4

E- RESOURCES:

a. www.nptelvideos.in/2012/11/data-communication.html
b. http://www.myrendingroom.eo.in/notes-and-studyinaterial/6S-dcii/750-dfldlOg-tO- analog-conversion-techniques.html
c. http://www.tutorial-reports.com/wireless/wlanwifi/wifi architecture.php
d. http://standards.ieee.org/about/get/802/802.11.html

e. www.tutorialspoint.com/data communication computer network/
f. http://www.studytoniglit.cont/computer-networks/overview-of-computer-networks
g. http://whirlpool.net.au/wiki/windows nw diag cmds
h. http://npte1.ac.in/downloads/106105080/
i http://scanftree.com/programs/c/c-program-to-implement-crc-cyclic-redundancy-code/

LIST OF EQUIPMENTS:

1. Computer System
2. Network Connecting Device, Transmission Media
3. Network Cable tester, Crimping Tool, RJ 45 Connectors, Ethernet Cable
4. Wireshark, Sniffing Tool

22IT503	MANAGING CLOUD AND CONTAINERIZATION (Lab Integrated)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners:

1. To understand the basics of cloud computing, the evolution of AWS from existing technologies, and the services provided by AWS.
2. To learn about AWS security services and Identity and Access Management (IAM), including IAM users, groups, roles, and policies.
3. To acquire skills in using Amazon S3 for cloud storage and AWS EC2 for compute services, including managing instances, storage classes, and lifecycle management.
4. To understand networking fundamentals and implement virtual private clouds (VPCs), load balancing with different types of load balancers, and auto scaling to optimize resources and enhance security.
5. To learn DevOps concepts and benefits, use Docker for containerization, and integrate AWS container services and CI/CD pipelines for automated system updates and lifecycle management.

UNIT I INTRODUCTION TO AWS 9+6

Introduction to AWS (Cloud basics) - Introduction to Cloud Computing, Services provided by AWS, Future of AWS, AWS Account Creation, Identity & Access Management - AWS Security Services Introduction, Introduction & Function of IAM, IAM users, groups, roles, MFA, Types of policies in IAM.

List of Exercises/Experiments

1. Create an IAM group named 'Server-L1-Team' with 'Amazon EC2 Read Only Access' and 'Auto Scaling Read Only Access' policies, and add an IAM user named 'Server-L1- User1' to the group.

2. Create an IAM role named 'DemoUser' with 'ec2.amazonaws.com' as the trust entity, and attach the 'AmazonS3FullAccess' and 'Amazon VPC Read Only Access' policies.
3. Enable MFA for an IAM user and set password policies to include requirements such as at least one uppercase letter, one lowercase letter, one number, and one special character.
4. Creating Custom policy and inline policy using any one service (EC2 or S3)

UNIT II AMAZON S3 **9+6**

Amazon S3 - Cloud storage, Types, Benefits, Bucket permission & Object permission, Static website hosting, Object versioning, Storage Classes, Life Cycle management.

List of Exercises/Experiments

1. Create a new S3 bucket in the Frankfurt region and upload a text file named 'eventlogs.txt'.
2. Disable "Block Public Access" for the bucket and enable public read access for the 'eventlogs.txt' file.
3. Host a static webpage in the S3 bucket using the static website hosting feature. Also mention the Life Cycle plan applied for the same S3 bucket created.

UNIT III AWS ELASTIC COMPUTE CLOUD **9+6**

AWS Elastic Compute Cloud - AWS EC2 Introduction, EC2 Instances creation, EC2 Instance protection, EBS, Snapshots, MyAMI, EIP.

List of Exercises/Experiments

1. Create a 5 GB EBS volume, attach it to a Windows EC2 instance, and partition the EBS volume.

2. Launch a Linux EC2 instance with a t2.micro instance type and demonstrate the remote connection to the EC2 instance. Ensure Protection by enabling Stop protection and termination protection.

3. Create an EC2 instance in the "us-east-1" region with the following requirements - Name tag and key pair name: "ec2instance1", AMI: "Amazon Linux 2023", Instance type: t2.micro or t3.micro, Allow SSH (port 22) traffic for PuTTY remote connection, Allow HTTP (port 3389) traffic from the internet for web requests.

UNIT IV VIRTUAL PRIVATE CLOUD 9+6

Virtual Private Cloud - Networking Fundamentals, VPC and its Components, Create VPC components, Public, Private Subnets, Elastic Load Balancers - Introduction, Benefits, Types of load balancers, Classic Load Balancer, Application Load Balancer, Network & Gateway Load Balancer, AWS Autoscaling - Types of Scaling Policies, how autoscaling works, Launch Configuration, Autoscaling Group. AWS Cloud Front - Introduction and Benefits of CloudFront, working with distributions, working with policies, Adding, removing, or replacing content.

List of Exercises/Experiments

1. Configure an AWS Application Load Balancer to evenly distribute traffic to EC2 instances across multiple availability zones within the Ohio region.
2. Create a launch template and auto-scaling group in the eu-west-3 region to facilitate dynamic scaling of EC2 instances based on demand.
3. Configure AWS Cloud Front to deliver website content stored in an S3 bucket located in the ap-northeast-1 region to users across all edge locations, optimizing content delivery and reducing latency.

UNIT V DEVOPS AND AWS CONTAINER SERVICES 9+6

Introduction to DevOps & Docker - What is Development, Operations, DevOps, DevOps benefits, Docker introduction, Docker Architecture, Images and

containers, Docker Run Static sites. Docker & AWS Container Services - Docker Images creations, Images from Docker Files, Usage of Docker Networks, Usage of Docker Composes, What is AWS ECR and How it works?, What is AWS ECS and How it works?, What is AWS Fargate and How it works?, What is AWS EKS and How it works? AWS CI & CD Pipeline - Introduction to pipeline, Test Driven Development, Continuous Integration, Continuous Delivery, Continuous Deployment, Rolling Deployments.

List of Exercises/Experiments

1. Deploy an AWS ECS cluster with infrastructure based on the AWS EC2 launch type in the Tokyo region, facilitating containerized application deployment and management.
2. Create a simple AWS pipeline using CodeCommit, CodeDeploy, and CodePipeline, enabling automated code deployment and continuous integration/continuous deployment (CI/CD) workflows.
3. Store a Docker image in the AWS Elastic Container Registry (ECR), providing a secure and scalable repository for managing Docker images and facilitating container deployments on AWS services like ECS and EKS.
4. Create a customized Docker image of Nginx using Docker file and Host a static website using the same.

TOTAL: 45+30=75 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of the basic global infrastructure of the AWS Cloud, including regions, availability zones, and edge locations.

CO2: Identify and recommend appropriate AWS Cloud services for various use cases, optimizing solutions based on the specific needs of applications and workloads.

CO3: Interpret the components and architecture of Docker containers and understand their role in supporting compute container implementations within AWS.

CO4: Examine common infrastructure servers, implement strategies for high availability, and leverage AWS scaling options to ensure reliable and scalable applications.

CO5: Understand the significance of automation, cultural practices, and metrics in DevOps, and apply these principles to create efficient and effective DevOps workflows using AWS tools and services.

TEXTBOOKS:

1. Mark Wilkins, “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud”, 2019.
2. Sean P. Kane, Karl Matthias, “Docker: Up & Running: Shipping Reliable Containers in Production”, O’Reilly Media Inc, 2015.
3. Jennifer Davis and Ryn Daniels, “Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale”, 2016, O’Reilly Media Inc.
4. Sunil Gulabani, “Amazon Web Services Bootcamp: Develop a Scalable, Reliable, and Highly Available Cloud Environment with AWS”,Packt Publishing, 2018
5. Amit Shah and AurobindoSarkar,“Learning AWS”, Packt Publishing, 2017

REFERENCES:

1. Ardian, “Using Docker: Developing and Deploying Software with Containers”, O’Reilly Media Inc, 2015.
2. Sean Keery, Clive Harber, Marcus Young, “Implementing Cloud Design Patterns for AWS”, Second Edition, Packt Publishing, 2019
3. Michael Charge “Docker Easy: The Complete Guide on Docker World for Beginners”, 2020
4. NikitSwaraj, “AWS Automation Cookbook” Packt Publishing Limited, 2017

LIST OF EQUIPMENTS/SOFTWARE:

1. AWS Cloud Service

22CS511	ADVANCED APTITUDE AND CODING SKILLS - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop vocabulary for effective communication and reading skills.
- To build the logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.

LIST OF EXERCISES:

1. English – Phase I Advanced

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase I Advanced

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase I Advanced

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase I

Logical, Compilation and Code reuse

TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop vocabulary for effective communication and reading skills.

CO2: Build the logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

22MC501	INDIAN CONSTITUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- To have some knowledge about Indian Constitution.
- To understand the concept of fundamental rights
- To learn about Lok Sabha and Rajya Sabha
- To have some knowledge about Legislative Assembly and Legislative Council
- To learn about Local Self Government

UNIT I	INTRODUCTION	9

Meaning and Importance of Constitution, Preamble and Salient Features of the Constitution

UNIT II	FUNDAMENTAL RIGHTS	9

Fundamental Rights, Right to Equality, Right to Freedom, Right against exploitation, Right to freedom of religion, Cultural and Educational Rights, Right to Constitutional Remedies and Duties, Directive Principles of State Policy.

UNIT III	LOK SABHA AND RAJYA SABHA	9

Union Government – Lok Sabha and Rajya Sabha Composition, Powers, and functions: The President, The Prime Minister, and Supreme Court: Role Position and Powers/ functions.

UNIT IV	LEGISLATIVE ASSEMBLY AND LEGISLATIVE COUNCIL	9

State Government - Legislative Assembly and Legislative Council: Composition, Powers and functions: The Governor, Chief Minister and High Court: Role, Position and Powers/ functions

UNIT V	LOCAL SELF GOVERNMENT	9

Local self-Government, Panchayat Raj System in India; Election Commission; Public Service Commissions, Role, powers, and function

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Interpret the knowledge on Indian Constitution.
CO2: Demonstrate the knowledge gained through fundamental rights concept.
CO3: Relate the concept of Lok Sabha and Rajya Sabha.
CO4: Illustrate the concept of Legislative Assembly and Legislative Council.
CO5: Analyze the concept of Local Self Government.

TEXT BOOK:

1. M V Pylee, An Introduction to The Constitution of India, Vikas Publishing House Pvt. Ltd., 5th Edition, 2007.

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, 19th Edition Reprint 2009.
2. Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, 7th Edition, 2015.

22IT601	MOBILE ARCHITECTURE AND DEVELOPMENT (Lab Integrated)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- Explain Mobile Architecture and various mobile platforms
- Develop Android application with basic building blocks
- Familiarize in the Graphics and Multimedia used for Android application development
- Test the developed app and publishing for users
- Explain the development of app for iOS and Windows platform

UNIT I	GETTING STARTED WITH MOBILITY	6+6

Introduction & Need Cross Mobile Platform Development, Native vs Cross Platform Development, Benefits and Drawbacks, Popular frameworks in the market – Cordova, Xamarin, Flutter, react native, Capacitor, Android Kotlin etc

List of Exercises/Experiments

1. Develop a Responsive User Login and Registration Page using HTML/CSS(with Media Queries)/ES6 only. The developed application should be able to render in multi device mode(portrait / Landscape)
2. Develop a Dashboard page (ref → Mobile Dashboard designs, themes, templates and downloadable graphic elements on Dribbble)
    a. Design the page using figma
    b. Develop the page & show case the fluid and responsive layouts in multiple device mode.

UNIT II	TYPESCRIPT FOUNDATION	6+6

Introduction, Object Oriented (Classes, Interface, Inheritance, Interface, Association), Access Modifiers Optional/Read Only/Mandatory Properties , Data Types - Union/Tuple/Date/Null/Undefined/Any/Unknown/Boolean/Never

List of Exercises/Experiments

1. Create an application in typescript that will handle the salary processing for a corporate firm. The solution should be able to generate salary per month based on attendance, IT deductions, employee contributions etc. The solution should employ.

a. Functional Programming & Object oriented design, Arrays, Union Data Types, Tuples etc
b. Usage of any/unknown/never

UNIT III	TYPESCRIPT ADVANCED	6+6

Var vs Let, Asyn & Await, Promise, Observable, Arrays, Arrow Functions Narrowing, Spread Operator, Custom Types, Conditional Types, Duck Typing, Modules, Unit Testing

List of Exercise/Experiments

1. Refer to Salary Processing application. Implement following modules
    a. Create a large Employees array (predefined data), and use the array functions to scan, search given fields, and perform agreement functions like max salary, min attendance etc
    b. Load the same Employee array data using HTTP Calls (using mock api server like “JSON-Server”)
    c. Unit Testing using JEST and RTL

UNIT IV	REACT NATIVE (CROSS PLATFORM DEV FRAMEWORK)	6+6

React – Native – Introduction, how its different from other frameworks like Android Kotlin, Flutter etc. React Fundamentals, Vite Tooling for project setup, React Native – App, State, Props, Styling, FlexBox, List View, Text Input, Scroll View, Images, Http, Buttons, Animations, Router, layout and Flexbox, height and width.

List of Exercise/Experiments

1. Develop a Policy Bazaar or Twitter or Amazon clone applications that will have
    a. User authentication Screen (employ Rest AP Services for the Login operation & employ json-server for the same)
    b. Dashboard View (employ mock data for displaying various dashboard metrics)
    c. Employ Code Reusability, Functional Programming and any applicable animations where needed.

UNIT V	TESTING IN REACT NATIVE	6+6

Interaction – handling touches, gesture responder, networking and security, Async Data, Subject and Behavior Subject, Testing – RTL and Jest, Debugging, performance engineering, platform specific code base. Native Components- Android Native UI Components .State Management, Exception

Handling in React Native. Deployment – Headless JS, publishing to google store, Communication between native and React Native

List of Exercises/Experiments

1. In the application developed in Unit IV, extend the application with
    a. Face based authentication
    b. Scanning a QR Code by employing Camera Function
    c. Storing transient data using sqllite or device storage
    d. Ads Integration
2. And finally, create an .apk file and publish the same

TOTAL: 30+30=60 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze mobile internals and their ecosystem to understand their functionalities and interactions.

CO2: Design mobile applications with offline support, local databases, and VPN connectivity, ensuring robustness and efficiency.

CO3: Apply industry-facing frameworks such as Xamarin and NativeScript to create advanced mobile solutions.

CO4: Integrate mobile application components to address complex user requirements and enhance user experience.

CO5: Assess mobile application performance for various platforms to meet industry standards.

CO6: Develop innovative mobile applications

TEXTBOOKS:

1. React Native in Action: Developing iOS and Android apps with JavaScript Paperback – 1 April 2019
2. React Native Cookbook – 2nd Edition Paperback – 31 January 2019

REFERENCES:

1. Anubhav Pradhan, Anil V Deshpande" Composing Mobile Apps Learn|Explore|Apply using Andriod", Wiley Publications 1st Edition 2014.
2. Xamarin Studio for Android Programming: A C# Cook book by Mathieu Nayrolles

22IT602	EMBEDDED SYSTEMS AND INTERNET OF THINGS (Lab Integrated)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The Course will enable learners:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).

  To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I	8-BIT EMBEDDED PROCESSOR	6+6

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II	EMBEDDED C PROGRAMMING	6+6

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III	IOT AND ARDUINO PROGRAMMING	6+6

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV	IOT COMMUNICATION AND OPEN PLATFORMS	6+6

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V	APPLICATIONS DEVELOPMENT	6+6

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

EXERCISES:

2. Test data transfer between registers and memory.

3. Perform ALU operations.

4. Write Basic and arithmetic Programs Using Embedded C.

5. Introduction to Arduino platform and programming

6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)

7. Introduction to Raspberry PI platform and python programming

8. Interfacing sensors with Raspberry PI

9. Communicate between Arduino and Raspberry PI using any wireless medium

10. Setup a cloud platform to log the data

11. Log Data using Raspberry PI and upload to the cloud platform

12. Design an IoT based system

COURSE OUTCOMES:

CO1: Explain the architecture of embedded processors.

CO2: Write embedded C programs.

CO3: Design simple embedded applications.

CO4: Compare the communication models in IOT

CO5: Design IoT applications using Arduino/Raspberry Pi /open platform.

TOTAL: 30+30=60 PERIODS

TEXTBOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, 2nd Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

REFERENCES:

1. Michael J. Pont, “Embedded C”, Pearson Education, 2007.
2. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
3. Andrew N Sloss, D. Symes, C. Wright, “Arm System Developer's Guide”, Morgan Kauffman/ Elsevier, 2006.
4. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015

22CS611	ADVANCED APTITUDE AND CODING SKILLS - II	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop advanced vocabulary for effective communication and reading skills.
- To build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

LIST OF EXERCISES:

1. English – Phase II Advanced

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase II Advanced

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase II Advanced

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase II

Logical, Compilation and Code reuse

5. Automata - Phase II

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop advanced vocabulary for effective communication and reading skills.
CO2: Build an enhanced level of logical reasoning and quantitative skills.
CO3: Develop error correction and debugging skills in programming.
CO4: Apply data structures and algorithms in problem solving.

22CS603	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Familiarize with Engineering Ethics and Human Values.
- Impart knowledge on codes of ethics, safety, responsibilities and rights of engineers.
- Give awareness on global issues related to environmental ethics, computer ethics, weapons development and corporate social responsibility

UNIT I	HUMAN VALUES	9

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II	ENGINEERING ETHICS	9

Senses of „Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III	ENGINEERING AS SOCIAL EXPERIMENTATION	9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law - The Challenger Case Study.

UNIT IV	SAFETY, RESPONSIBILITIES AND RIGHTS	9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Case Studies: Chernobyl and Bhopal Disasters - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V	GLOBAL ISSUES	9

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to: CO1: Summarize the importance of human values in work place.

CO2: Discuss the senses of engineering ethics, moral dilemmas, moral autonomy and uses of ethical theories.

CO3: Describe the role of engineers as responsible experimenters and necessity of codes of ethics in engineering.

CO4: Explain safety, risk, responsibilities and rights in the society.

CO5: Analyze the global issues related to environmental ethics, computer ethics, weapons development and the role of engineers as expert witnesses and advisors.

CO6: Apply ethics in society and discuss the ethical issues related to engineering.

TEXT BOOK:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2017.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2013.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2012

2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2018.

3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2017.

4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2008.

22IT701	MICROSERVICE ARCHITECTURE (Lab Integrated)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- To understand the Microservice Architecture.
- To understand the Microservice Design and pattern.
- To understand the JEE Framework.
- To understand the Microservice Implementation.
- To understand the usage of Docker with Microservices.

UNIT I INTRODUCTION TO MICROSERVICE 6+6

Introduction to Microservice and how it differs from Distributing Computing, Understand the current Monolithic Architecture Design and its advantage and pit falls, Places of Usage, Feature Set, Pros and Cons. Introduction, Qualities of Microservice Architecture, Place of Usage, Points to be taken care, Core JEE and Microservice Patterns, Pros and Cons. Controller, Error Handler, Validation, Rest API Client.

List of Exercises/Experiments

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop
3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management – eMall

UNIT II MICROSERVICES DESIGN 6+6

Messaging - Introduction to Messaging based Integration, Places of Usage, Pub Sub Model, P2P Integration, Request and Reply Model, Exception Handling and Dead Letter Channel, Transaction Support.
Design Patterns-Decompose by business capability, Decompose by subdomain, Database per Service, Shared database, Saga, API Composition, CQRS, Domain event, Event sourcing, Strangler Application, Anti-corruption layer, Consumer-driven contract test, Consumer-side contract test, Multiple service instances per host, Service instance per host, Service instance per VM, Service instance per Container, Serverless deployment, Service deployment platform.

List of Exercises/Experiments

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop
3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management – eMall

UNIT III JEE FRAMEWORK 6+6

Maven Build framework - Why Maven and Features, Goal, Profile, Life Cycle, Parent- Child, Plugins. Introduction to Spring Framework, Spring Core - IOC, DI, Life Cycle, Autowire, Parent/Child. Spring Boot - MVC, REST Controller, Global Error Handling, HTTP Response Code, URI Patterns and HTTP Verbs. Spring AOP, Spring Configuration, Spring JPA - Entity Mapping, Association Mapping, Inheritance Mapping, JPA/Hibernate,@Query, Join Query, Pagination, CRUD Operation.

List of Exercises/Experiments

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop
3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management – eMall

UNIT IV MICROSERVICE IMPLEMENTATION 6+6

Eureka Service Registry Configuration and Setup.

Spring Cloud Ribbon - Client-Side LB. Spring Cloud Config - Centralized Versioned Configuration. Spring Feign Client - Declarative REST Client. Spring Boot - Spring Configuration (Eureka, Port, JPA cfgs). Spring RestController, Feign Rest Client, Spring Hystrix Fault Tolerant, Fall Back Implementation, Hystrix Configuration, Hystrix Dashboard. Spring Cloud Bus - Dynamic Configuration Changes.

List of Exercises/Experiments

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop
3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management – eMall

UNIT V MICROSERVICE SECURITY AND INTEGRATIONS 6+6

Integration with Spring MS Components, RabMQ Exchanges/Queue. API Gateway Pattern, Spring Cloud Gateway, Caching Options, Redirection, Security, Integrating with Service Registry. Sleuth, Zipkin and Spring Admin.Docker Containers - Image, Containers, Linking, Volume, Networks, Logs, K8, Apache Kafka - Producers, Consumers, Queries, Streaming, Case Study - Project Execution using Microservice.

List of Exercises/Experiments

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop
3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management – eMall

TOTAL: 30 + 30 = 60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the principles of Microservices to understand their necessity and architectural design.
CO2: Design applications integrating Microservice pattern.
CO3: Analyze and comprehend Spring Boot to apply its functionalities effectively.
CO4: Apply knowledge of Eureka to configure Spring Cloud.
CO5: Design Applications using Docker Microservices.

TEXTBOOKS:

1. Microservices: Flexible Software Architecture by Eberhard Wolff, 2016.
2. Microservice Patterns and Best Practices: Explore patterns like CQRS and event sourcing to create scalable, maintainable, and testable Microservices by Vinicius Feitosa Pacheco, 2018
3. Microservices with Spring Boot and Spring Cloud: Build resilient and scalable microservices using Spring Cloud, Istio, and Kubernetes, 2nd Edition by Magnus Larsson, 2021.

REFERENCES:

1. Building Microservices: Designing Fine-Grained Systems by Sam Newman, Second Edition, 2021.
2. Hands-On Microservices with Spring Boot and Spring Cloud: Build and deploy Java microservices using Spring Cloud, Istio, and Kubernetes, by Magnus Larsson, 2019
3. Essentials of Microservices Architecture: Paradigms, Applications, and Techniques, 1st Edition, Kindle Edition by Chellammal Surianarayanan, Gopinath Ganapathy, Raj Pethuru .

22IT711	PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP	L	T	P	C
		0	0	6	3

COURSE 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 skills of the students.

This course is a four months immersive program to keep up with the industry demand and to have critical 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, approaches and methodologies.

- Collaborate in teams with other students working on the same topic
- Have a dedicated mentor to guide

COURSE OUTCOMES:

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

CO1: Upskill in emerging technologies and apply to real industry-level use cases

CO2: Understand agile development process

CO3: Develop career readiness competencies, Team Skills / Leadership qualities

CO4: Develop Time management, Project management skills and Communication Skills

CO5: Use Critical Thinking for Innovative Problem Solving

CO6: 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 and 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

Activity Name	Activity Description	Time (weeks)
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**

22MC701	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
- Make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

UNIT I	INTRODUCTION TO TRADITIONAL KNOWLEDGE	9

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge.

UNIT II	PROTECTION OF TRADITIONAL KNOWLEDGE	9

The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT III	LEGAL FRAMEWORK AND TK	9

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

UNIT IV	TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY	9

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge.

UNIT V	TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS	9

Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Illustrate the concepts of Indian traditional knowledge.
CO2: Apply the concept of protection of traditional knowledge.
CO3: Analyze the legal framework and traditional knowledge.
CO4: Interpret the concept of traditional knowledge and intellectual property.
CO5: Analyze and apply traditional knowledge to their day-to-day life.

TEXT BOOK:

1. Amit Jha, Traditional Knowledge System in India, Atlantic Publishers, 2002.

REFERENCES:

1. Kapil Kapoor, Michel Danino, Knowledge Traditions and Practices of India, Central Board of Secondary Education, 2012.

VERTICAL I
DATA SCIENCE

22AM001	INTRODUCTION TO GENERATIVE AI	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of Generative AI.
- To build Generative AI systems to generate images.
- To understand the concept used in Generative AI Models.
- To use various Generative AI models.
- To compare and use the various Large Language Models.
- To understand the basics of Prompt Engineering.

UNIT I	INTRODUCTION	9

Generative Models – Image transformation – Challenges - Deep Neural Networks – Perceptron – back propagation – CNN – RNN – Optimizer.

UNIT II	IMAGE GENERATION	9

Creating encodings of images – variational objective – Inverse Autoregressive flow – Importing CIFAR – Creating the network from TensorFlow 2.

UNIT III	GENERATIVE ADVERSARIAL NETWORKS	9

Generative Adversarial Networks – Vanilla GAN – Improved GANs – Progressive GAN – Challenges – Paired style transfer – Unpaired style transfer – Deepfakes – Modes of operation – key feature set – High level flow – Replacement – Re-enactment.

UNIT IV	LARGE LANGUAGE MODELS	9

Overview of LLMs - Transformers – GPT – Types of LLMs – Key concepts – other Transformers – T5 – Generative Pre-Training Models – Multi-modal Models – DALL.E 2

UNIT V	PROMPT ENGINEERING	9

Basics – In-Context Learning – In-Context Prompting – Techniques – Image Prompting – Prompt Hijacking – Challenges.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Elaborate the basic concepts of Generative AI.
CO2: Build Generative AI systems to generate images.
CO3: Apply the concepts used in Generative AI Models.
CO4: Use various Generative AI models.
CO5: Compare and use the various Large Language Models.
CO6: Analyze the basics of Prompt Engineering.

TEXT BOOKS:

1. Ben Auffarth, Generative AI with Lang Chain, Packt Publishing, 2023.
2. Amit Bahree, Generative AI in Action, Manning Publication, First Edition, 2023.

REFERENCES:

1. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, 2023.
2. Numa Dhamani and Maggie Engler, Introduction to Generative AI, Manning Publication, First Edition, 2024.
3. Valentina Alto, Modern Generative AI with ChatGPT and OpenAI Models, Packt publications, 2024.

22AM004	INTRODUCTION TO DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To elaborate the fundamentals of data science process.
- To demonstrate various python libraries for data science
- To discuss the various classification algorithms.
- To discuss the clustering and outlier detection approaches.
- To present data using visualization tools in Python.

UNIT I	INTRODUCTION	9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data

UNIT II	PYTHON LIBRARIES FOR DATA SCIENCE	9

Launching the IPython Shell - Launching the Jupyter Notebook - IPython Magic Commands - The Basics of NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series – High performance Pandas.

UNIT III	CLASSIFICATION	9

Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule-Based Classification – Model Evaluation and Selection.

Bayesian Belief Networks – Classification by Backpropagation – Support Vector Machines – Associative Classification – K-Nearest-Neighbor Classifiers – Fuzzy Set Approaches - Multiclass Classification - Semi-Supervised Classification.

UNIT IV	CLUSTERING AND OUTLIER DETECTION	9

Cluster Analysis – Partitioning Methods – Evaluation of Clusters – Probabilistic Model-Based Clustering – Outliers and Outlier Analysis – Outlier Detection Methods – Statistical Approaches – Clustering and Classification-Based Approaches.

UNIT V	DATA VISUALIZATION	9

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Interpret the fundamentals of data science process.
CO2: Apply python libraries for data science applications.
CO3: Apply and interpret basic classification algorithms.
CO4: Outline clustering and outlier detection approaches.
CO5: Present and interpret data using visualization tools in Python.
CO6: Implement basic data science techniques using Python.

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.

2. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2012.
3. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Kindle Edition, 2017.

REFERENCES:

1. Roger D. Peng, R Programming for Data Science, Lulu.com, 2016.
2. Laura Igual, Santi Seguí, "Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications", 1st Edition, Springer, 2017.
3. Peter Bruce, Andrew Bruce, "Practical Statistics for Data Scientists: 50 Essential Concepts", 3rd Edition, O'Reilly, 2017.
4. Avrim Blum, John Hopcroft, Ravi Kannan, "Foundations of Data Science", 1st Edition, Cambridge University Press, 2020.

NPTEL:

5. Data Science for Engineers - https://onlinecourses.nptel.ac.in/noc24_cs53/preview
6. Foundation of Data Science - https://onlinecourses.swayam2.ac.in/imb24_mg31/preview
7. Python for Data Science - https://onlinecourses.nptel.ac.in/noc24_cs54/preview

22AM905	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- To understand the basics of image processing techniques for computer vision and video analysis.
- To illustrate the techniques used for image pre-processing.
- To discuss the various image Segmentation techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the motion analysis techniques for video analytics.

UNIT I	INTRODUCTION	9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT II	IMAGE PRE-PROCESSING	9

Pixel brightness transformations - Geometric transformations - Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Detection of corners (interest points) - Detection of maximally stable extremal regions - Image restoration.

UNIT III	SEGMENTATION	9

Thresholding - Edge-based segmentation - Region-based segmentation – Matching - Evaluation issues in segmentation - Mean shift segmentation - Active contour models.

UNIT IV	OBJECT RECOGNITION	9

Knowledge representation - Statistical pattern recognition - Neural nets - Syntactic pattern recognition - Recognition as graph matching - Optimization techniques in recognition - Fuzzy systems - Boosting in pattern recognition - Random forests - Image understanding control strategies.

UNIT V	MOTION ANALYSIS	9

Differential motion analysis methods - Optical flow - Analysis based on correspondence of interest points - Detection of specific motion patterns - Video tracking - Motion models to aid tracking.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the basics of image processing techniques for computer vision and video analysis.
CO2: Illustrate the techniques used for image pre-processing.
CO3: Analyze the various image Segmentation techniques.
CO4: Understand the various Object recognition mechanisms.
CO5: Elaborate on the motion analysis techniques for video analytics.
CO6: Apply image processing techniques in real-world applications.

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.
2. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
4. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press,2012.

22AM904	TEXT AND SPEECH ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the tools and techniques for performing text and speech analytics in diverse contexts.
- To understand the tools and technologies involved in developing text and speech applications.
- To demonstrate the use of computing for building applications in text and speech processing.
- To use information Retrieval Techniques to build and evaluate text processing systems.
- To apply advanced speech recognition methodologies in practical applications.

UNIT I	TEXT PROCESSING	9

Speech and Language Processing - Regular Expression - Text normalization – Edit Distance - Lemmatization – Stemming – N-gram Language Models - Vector Semantics and Embeddings.

UNIT II	TEXT CLASSIFICATION	9

Text Classification Tasks – Language Model – Neural Language Models – RNNs as Language Models – Transformers and Large Language Models.

UNIT III	QUESTION ANSWERING AND DIALOGUE SYSTEMS	9

Information Retrieval – Dense Vectors – Neural IR for Question Answering – Evaluating Retrieval-based Question Answering – Frame-based Dialogue Systems – Dialogue Acts and Dialogue State – Chatbots – Dialogue System Design.

UNIT IV	TEXT TO SPEECH SYNTHESIS	9

Automatic Speech Recognition Task – Feature Extraction for ASR: Log Mel Spectrum – Speech Recognition Architecture – CTC - ASR Evaluation: Word Error Rate – TTS – Speech Tasks.

UNIT V	SPEECH RECOGNITION	9

LPC for speech recognition - Hidden Markov Model (HMM) - Training procedure for HMM- subword unit model based on HMM - Language models for large vocabulary speech recognition - Overall recognition system based on subword units - Context dependent subword units- Semantic post processor for speech recognition.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply the fundamental techniques in text processing for various NLP tasks.
CO2: Implement advanced language models and improve text classification accuracy.
CO3: Designing text processing systems using state-of-the-art techniques.
CO4: Design, implement, and evaluate ASR and TTS systems.
CO5: Apply advanced speech recognition methodologies in practical applications.
CO6: Use information Retrieval Techniques to build and evaluate text processing systems.

TEXT BOOKS:

1. Jurafsky, D. and J. H. Martin, Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition Pearson Publication, Third Edition, 2022.
2. Lawrence Rabiner, Biing-Hwang Juang and B.Yegnanarayana, "Fundamentals of Speech Recognition", Pearson Education, 2009.

REFERENCES:

1. John Atkinson-Abutridy, Text Analytics: An Introduction to the Science and Applications of Unstructured Information Analysis, CRC Press, 2022.

2. Jim Schwoebel, NeuroLex, Introduction to Voice Computing in Python, 2018
3. Lawrence R. Rabiner, Ronald W. Schafe, Theory and Applications of Digital Speech Processing, First Edition, Pearson, 2010.
4. Srinivasa-Desikan, Bhargav. Natural Language Processing and Computational Linguistics: A practical guide to text analysis with Python, Gensim, spaCy, and Keras. Packt Publishing Ltd, 2018.

22AM906	STREAM PROCESSING AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- To outline the framework for real time stream processing.
- To learn various algorithms for data streaming.
- To identify frequent item sets by mining from data streams.
- To introduce approaches to evaluate stream learning algorithms.
- To use tools for distributed data flow management.
- To design solutions to stream processing problems.

UNIT I	INTRODUCTION TO DATA STREAMS	9

Data Stream Models – Bounds of Random variables – Poisson Process – Maintaining Simple Statistics from Data Streams – Sliding Window and computing statistics over sliding windows – Data Synopsis – Sampling – Histograms – Wavelets – DFT - Change Detection: Tracking Drifting Concepts - Monitoring the Learning Process.

UNIT II	STREAMING ALGORITHMS	9

Clustering Examples: Basic Concepts - Partitioning Clustering – Hierarchical Clustering - Micro Clustering – Grid Clustering - Clustering Variables - The Very Fast Decision Tree Algorithm (VFDT) - The Base Algorithm, Analysis of the VFDT Algorithm, Extensions to the Basic Algorithm: Processing Continuous Attributes, Functional Tree Leaves, Concept Drift.

UNIT III	FREQUENT PATTERN MINING	9

Introduction – Heavy Hitters - Mining Frequent Itemsets from Data Streams - Landmark Windows - Mining Recent Frequent Itemsets - Frequent Itemsets at Multiple Time Granularities - Sequence Pattern Mining - Reservoir Sampling for Sequential Pattern Mining over data stream.

UNIT IV	EVALUATING STREAMING ALGORITHMS	9

Learning from Data Streams - Evaluation Issues - Design of Evaluation Experiments - Evaluation Metrics - Comparative Assessment - Evaluation Methodology in Non-Stationary Environments.

UNIT V	DATA FLOW MANAGEMENT	9

Distributed Data Flows – Apache Kafka – Apace Flume - Processing Streaming Data – Storing Streaming Data – Delivering Streaming Metrics.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Outline the framework for real time stream processing.
CO2: Elaborate various algorithms for data streaming.
CO3: Illustrate frequent item sets by mining from data streams.
CO4: Apply the metrics and procedures to evaluate a model.
CO5: Use tools for distributed data flow management.
CO6: Develop solutions for real-world problems using streaming data.

TEXT BOOKS:

1. Joao Gama, "Knowledge Discovery from Data Streams", CRC Press, 2010.
2. Byron Ellis, Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data, First Edition, WILEY Big Data Series, 2014.

REFERENCES:

1. Andrew Psaltis, Streaming Data: Paul Lewis, First Edition, Manning Publication, 2017.
2. Bugra Gedik, Deepak S. Turaga, Henrique C. M. Andrade, Fundamentals of Stream Processing: Application Design, Systems, and Analytics, Cambridge University Press, 2014.
3. Charu C. Aggarwal, "Data Streams: Models and Algorithms", Kluwer Academic Publishers, 2007.
4. David Luckham, "The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems", Addison Wesley, 2002.

22CS936	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Understand the basics of deep neural networks.
- Implement deep learning models.
- Elaborate CNN and RNN architectures of deep neural networks.
- Familiarize auto encoders in neural networks.
- Learn about the deep generative models.
- Apply Deep Learning to solve real-world problems.

UNIT I	NEURAL NETWORKS	9

Introduction – Data Representation -Tensor Operations – Gradient-based Optimization – Architecture – Keras – Shallow Neural Networks.

UNIT II	DEEP NETWORKS	9

Deep feedforward networks - Learning XOR - Gradient based learning - Hidden Units – Architecture Design – Back Propagation – Regularization – Parameter Norm Penalties – Constrained Optimization – Under-Constrained Problems – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter Tying and Sharing – Bagging and Other Ensemble methods – Dropout – Adversarial Training.

UNIT III	CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS	9

Convolution Operation – Pooling – Infinitely Strong prior – Variants – Structured Output – Data Types – Efficient Convolutional Algorithms – Random or Unsupervised features – Neuroscientific Basis - Computational Graphs - RNN - Bidirectional RNN – Encoder-Decoder - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks - Long Term Dependencies - Leaky Units - Strategies for multiple time scales – LSTM and Gated RNNs - Optimization for Long Term Dependencies.

UNIT IV	AUTOENCODERS	9

Auto encoders: Undercomplete auto encoders - Regularized auto encoders – Power, Layer Size and Depth - Stochastic encoders and decoders – Denoising Auto encoders - Learning with auto encoders – contractive Auto encoders – Applications of auto encoders.

UNIT V	DEEP GENERATIVE MODELS	9

Boltzmann Machine – Restricted Boltzmann Machine – Deep Belief Networks – Deep Boltzmann Machines - Boltzmann Machines for Real-Valued Data – Convolutional Boltzmann Machines - Boltzmann Machine for Structured or Sequential Outputs – Directed Generative Nets – Evaluating Generative Models.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Demonstrate the basics of deep neural networks to solve real world problems. CO2: Implement deep learning models.
CO3: Elaborate CNN and RNN architectures of deep neural networks. CO4: Use auto encoders in neural networks.
CO5: Illustrate the various deep generative models.
CO6: Apply deep generative models to solve real world problems.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.

22AM923	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- To understand the foundations of the recommender system.
- To learn about collaborative filtering.
- To discuss content-based recommendation systems.
- To elaborate on the evaluation paradigms for a recommendation system.
- To make students design and implement a recommender system.

UNIT I	INTRODUCTION TO RECOMMENDER SYSTEMS	9

Introduction - Basic Models of Recommender Systems - Domain-Specific Challenges in Recommender Systems - Cold-Start Problem – Attack-Resistant Recommender Systems – Group – Multi-Criteria – Active-Learning – Privacy - Application Domains.

UNIT II	COLLABORATIVE FILTERING	9

Neighborhood-Based Collaborative Filtering - Key Properties - Predicting Ratings – Clustering - Dimensionality Reduction - A Regression Modeling - Graph Models – Model-based Collaborative Filtering - Decision and Regression Trees - Rule-Based Collaborative Filtering - Naive Bayes Collaborative Filtering – Latent Factor Models.

UNIT III	CONTENT-BASED RECOMMENDATION	9

Basic Components of Content-Based Systems - Preprocessing and Feature Extraction - Learning User Profiles and Filtering - Content-Based Versus Collaborative Recommendations - Using Content-Based Models for Collaborative Filtering.

UNIT IV	DESIGN EVALUATION	9

Evaluating Paradigms – General Goals of Evaluation Design-Design Issues in Offline Recommender Evaluation-Accuracy Metrics in Offline Evaluation-Limitations of Evaluation Measures.

UNIT V	TYPES OF RECOMMENDATION SYSTEMS	9

Content-based Recommender Systems – Basic Components – Constraint-based Recommender Systems – Context-sensitive Recommender Systems – Social and Trust-Centric Recommender Systems.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Elaborate the foundations of the recommender system.
CO2: Use collaborative filtering to design recommendation systems.
CO3: Discuss content-based recommendation systems.
CO4: Elaborate on the evaluation paradigms for a recommendation system.
CO5: Use appropriate type of recommendation systems to solve real-world problems.
CO6: Design, implement and evaluate a recommendation algorithm.

TEXT BOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Jannach D., Zanker M., FelFering A., Friedrich G., Recommender Systems: An Introduction, Cambridge University Press, First Edition, 2011.

REFERENCES:

1. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.
2. Ricci, F., Rokach, L. and Shapira, B., Introduction to recommender systems handbook. In Recommender systems handbook, Springer, 2011.
3. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer, First Edition, 2013.

22CS935	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Outline an overview of exploratory data analysis and phases involved in data analytics
- Acquire an in-depth knowledge in EDA techniques
- Experiment the data visualization
- Describe the methods of time series analysis
- Explain the basics of tree and hierarchical representation of big data

UNIT I	EXPLORATORY DATA ANALYSIS	9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA

UNIT II	EDA TECHNIQUES	9

Visual Aids For EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques -Descriptive Statistics-types of kurtosis, quartiles, Grouping Datasets-data aggregation, group wise transformation.

UNIT III	VISUALIZING DATA	9

The Seven Stages of Visualizing Data, Processing-load and displaying data – functions, sketching and scripting, Mapping-Location, Data, two sided data ranges, smooth interpolation of values over time

UNIT IV	TIME SERIES ANALYSIS	9

Overview of time series analysis-showing data as an area, drawing tabs, handling mouse input, Connections And Correlations – Preprocessing-introducing regular expression, sophisticated sorting, Scatterplot Maps-deployment issues

UNIT V	TREES, HIERARCHIES, AND RECURSION	9

Treemaps - treemap library, directory structure, maintaining context, file item, folder item, Networks and Graphs-approaching network problems-advanced graph example, Acquiring data, Parsing data

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain the overview of exploratory data analysis and phases involved in data analytics
CO2: Explore in-depth knowledge in EDA techniques **CO3:**
Apply the visualization techniques in data **CO4:** Describe
the methods of time series analysis
CO5: Represent the data in tree and hierarchical formats
CO6: Apply tools is visualization to represent data.

TEXT BOOKS:

1. Suresh Kumar Mukhiya and Usman Ahmed, “Hands-on Exploratory Data Analysis with Python”, Packt publishing , March 2020.
2. Ben Fry, “Visualizing Data”, O’reilly publications, 2007.

22AM003	COGNITIVE SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand cognitive computing.
- To know about design principles and NLP for Cognitive systems.
- To distinguish between Big Data and Cognitive computing.
- To discuss implications of cognitive computing in business.
- To develop applications of cognitive computing.

UNIT I	FOUNDATIONS OF COGNITIVE SCIENCE	9

Foundation of Cognitive Computing: cognitive computing as a new generation- the uses of cognitive systems- system cognitive- gaining insights from data- Artificial Intelligence as the foundation of cognitive computing- understanding cognition.

UNIT II	DESIGN PRINCIPLES FOR COGNITIVE SYSTEMS AND NLP IN COGNITIVE SYSTEMS	9

Components of a cognitive system- building the corpus- bringing data into cognitive system- machine learning- hypotheses generation and scoring- presentation and visualization services.
Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system- semantic web- Applying Natural language technologies to Business problems.

UNIT III	BIG DATA Vs COGNITIVE COMPUTING	9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data- defining big data- architectural foundation- analytical data warehouses- Hadoop- data in motion and streaming data- integration of big data with traditional data.

UNIT IV	THE BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING	9

Preparing for change- advantages of new disruptive models- knowledge meaning to business- difference with a cognitive systems approach- meshing data together differently- using business knowledge to plan for the future- answering business questions in new ways- building business specific solutions- making cognitive computing a reality- cognitive application changing the market- IBM Watson as a cognitive system.

UNIT V	APPLICATIONS OF COGNITIVE COMPUTING	9

Build a cognitive health care application - Build a cognitive application on Smarter cities - Applicate Cognitive Computing principle in building a Government related application.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Elaborate the concepts of cognitive science and computing.
CO2: Design and Implementation of Cognitive Systems.
CO3: Apply NLP in cognitive systems.
CO4: Integrate Big Data and Cognitive computing.
CO5: Discuss implications of cognitive computing in business.
CO6: Develop various applications of cognitive computing.

TEXT BOOKS:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive computing and Big Data Analytics” , Wiley, 2015.

REFERENCES:

1. Vijay Raghvan, Venu Govindaraju, C.R. Rao, “Cognitive Computing: Theory and Applications“, Elsevier publications, North Holland Publication, 1st Edition, 2016.
2. Mallick, Pradeep Kumar, Borah, Samarjeet, "Emerging Trends and Applications in Cognitive Computing”, IGI Global Publishers, 2019.

VERTICAL II

CYBER SECURITY

22CS901	ETHICAL HACKING (Lab Integrated)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Understand Information Security, Cyber threats, attacks, web security.
- Know about different modes of hacking tools and phases of penetration tests and Methodologies.
- Gain the knowledge of the use and availability of tools to support an ethical hack.
- Gain the knowledge of interpreting the results of a controlled attack.

UNIT I	FUNDAMENTALS OF ETHICAL HACKING	6+6

Overview of Cyber threats – Data and Network Security Attacks – Threats: MAC spoofing – Access control Network protocol and services-Hacking terms - Ethical Hacking overview –Modes of Ethical Hacking – Ethics and Legality.

List of Exercise/Experiments:

1. Setup a honey pot and monitor the honey pot on network
2. Write a script or code to demonstrate SQL injection attacks
3. Write a code to demonstrate DoS attacks

UNIT II	HACKING METHODOLOGY RECONNAISSANCE	6+6

Foot printing: Reconnaissance - Footprinting theory – Penetration test – Phases of Penetration test - Methods of Footprinting – Network Information gathering process – Terminologies of Foot printing –Footprinting through search engine directives – Whois tool –NetCraft – Extract Information from DNS - Foot printing from Email servers – Shodan – Dig –MetaGooFil – Social Engineering.

List of Exercise/Experiments:

1. Performing footprinting using Google Hacking, website information, information about an archived website, to extract contents of a website, to trace any received email, to fetch DNS information.
2. Create a social networking website login page using phishing techniques

UNIT III	SCANNING AND ENUMERATION	6+6

Scanning: Concept of Nmap - - Port scanning with Nmap – Subnet - Scanning IPs with Nmap Pings and Ping sweeps – Port - Three way handshake – NmapSyn scanning – Nmap TCP Scan – Nmap UDP Scan - Bypass of IPS and IDS – Nmap Script Engine Enumeration: Service Fingerprinting – Vulnerability Scanners – Basic Banner Grabbing – Common Network services – SMTP – DNS – RPCBIND Enumeration – SMB – NetBIOS

List of Exercise/Experiments:

1. Implement Passive scanning, active scanning, session hijacking, cookies extraction using Burp suit tool
2. Use port scanning. network scanning tools,IDS tool, sniffing tool and generate reports.

UNIT IV	SYSTEM AND NETWORK VULNERABILITY	6+6

Metasploit – Penetration testing with framework Metasploit – Scan services to identify vulnerabilities – Scan FTP services – Scan HTTP services – Exploitation – Post

exploitation techniques – Meterpreter – Rootkit – Backdoor – Password hashes – Privilege Escalation - Scanning vulnerable services with Nessus

List of Exercise/Experiments:

1. Penetration Testing using Metasploit and metasploitable
2. Creating a simple keylogger in python
3. Creating a virus
4. Creating a trojan.
5. Install rootkits and study variety of options

UNIT V	SOFTWARE VULNERABILITY (OWASP 10)	6+6

Fundamentals of OWASP Zed Attack Proxy (ZAP) – Web app vulnerability scan - Code Injection Attacks – Broken Authentication – Sensitive Data Exposure – XML External Entities – Broken Access Control – Security misconfiguration – Website pen testing - Cross Site Scripting (XSS) – Insecure Deserialization – Using Components with known vulnerabilities – Insufficient logging and monitoring.

List of Exercise/Experiments:

1. Install jcrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric Crypto algorithm, Hash and Digital/PKI signatures studied in theory Network Security And Management
2. Hacking a website by Remote File Inclusion
3. Disguise as Google Bot to view hidden content of a website
4. To use Kaspersky for Lifetime without Patch

TOTAL: 30+30=60 PERIODS

OUTCOMES:

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

CO1: Understand the basics of information security, threats and its attacks
CO2: Understand the fundamentals of ethical hacking with the hacking methodologies
CO3: Analyze the phases of the penetration test with the methods
CO4: Understand the vulnerabilities and use the frameworks to identify vulnerabilities by service scan
CO5: Understand the web security issues with the fundamentals of OWASP

TEXTBOOKS:

1. McClure, S., Scambray, J. and Kurtz, G., 2012. Hacking Exposed Network Security Secrets and Solutions. New York: McGraw-Hill.
2. Engebretson, P., 2013. The Basics Of Hacking And Penetration Testing. Amsterdam: Syngress, an imprint of Elsevier.

REFERENCES:

1. Zaid Sabih, Learn Ethical Hacking from Scratch, 2018, PACKT publishing, ISBN: 978-1-78862-205-9
2. Harsh Bothra, Hacking be a hacker with ethics, Khanna Publishing, 2016, ISBN: 978-03-86173-05-8

LIST OF SOFTWARE:

1. Metasploit Framework (MSF)
2. WireShar
3. Nmap
4. John the Ripper
5. Burp suite or OWASP ZAP
6. Kali Linux

22CS902	SOCIAL NETWORK SECURITY (Lab Integrated)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Learn the Concepts of Social Network Security
- Understand the methods of Social Network Anonymization
- Learn the techniques for security and privacy in social networks
- Learn the security challenges in social networks
- Explore the Tools to learn about the social network security implementation

UNIT I	INTRODUCTION TO SOCIAL NETWORK SECURITY	6+6

Introduction – Social Networking Applications – Social media Websites – Social Network Representation –Building Social Authority –Privacy and Information sharing – Controlling Application privacy – Cybercrime – Information Leakage – False information – Content Management in Social Networks

List of Exercise/Experiments:

1. Explore a Social network analysis tools to learn about the users and networks
2. Learn a program / tool to illustrate information leakage

UNIT II	SOCIAL NETWORK ANONYMIZATION	6+6

Social Networks - Privacy in Social Networks – Social Network Representation – Social Network Analysis - Data Anonymization – Challenges in Anonymization – Privacy preservation – Social Network Anonymization Factors – Anonymization Algorithms – Link Anonymization techniques –Background Knowledge Attacks – Anonymity in Modern Social Networks

List of Exercise/Experiments:

1. Experiment a link anonymization technique
2. Explore ARX anonymization tool

UNIT III	ANALYZING AND SECURING SOCIAL NETWORKS	6+6

Supporting Technologies - Aspects of Analyzing and Securing Social Networks - Techniques and Tools for Social Network Analytics - Social Network Analytics and Privacy Considerations - Access Control and Inference for Social Networks - Social Media Integration and Analytics Systems - Social Media Application Systems - Secure Social MediaSystems - Secure Social Media Directions.

List of Exercise/Experiments:

1. Implement a program for network access control to illustrate malware attacks
2. Create a simple social network application to show authentication mechanisms
3. Create an application for the following scenario: “Social networking users are presented with two apparently similar emails or websites. They must first identify the differences between them and then decide which one is a scam attempting to steal their information or money.”

UNIT IV	SECURITY CHALLENGES IN SOCIAL NETWORKS	6+6

Identity manipulation – Threats from third party applications - Trust in Social Networking Sites - Viruses, Phishing Attacks and Malwares-Tracking users – Privacy of Data – Identity Federation Challenges –Social media threats – Location disclosure – Spoofing – Profile cloning – Fake product sale – Cyber bullying – Prevention Strategies

List of Exercise/Experiments:

1. Implement a program in python to estimate trust of social network users group
2. Write a SQL injection program in python/JAVA to handle session hijacking
3. Create an application using any social network platform to demonstrate profile cloning concept.

UNIT V	**SOCIAL NETWORK SECURITY TOOLS**	**6+6**

Analysis Tools for Social Media - AutoMap – Gephi – ORA Lite – ORA Pro – Wolfram Alpha – Social Media Data Collection –Blog Trackers –Crowd Tangle – MalTego – Pulse – SCRAAWL - Fact and Image Trackers – Google Fact Check Tools – Bot Mitigation – BotSlayer – Social Cyber Security

List of Exercise/Experiments:

1. Perform fact checking of social networking content using google fact checking tools
2. Explore a tool that helps protect websites from bot traffic and bot attacks.
3. Create a fake news tracker program to collect, detect and help visualize fake news data from any social network

TOTAL:30+30=60 PERIODS

OUTCOMES:

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

CO1: Develop security applications of social networks.
CO2: Implement data anonymization techniques
CO3: Analyze and secure social networks
CO4: Handle security challenges in social networks
CO5: Develop security tools for social networks
CO6: Create newer social networking applications

TEXTBOOKS:

1. Brij B. Gupta, Somya Ranjan Sahoo, “Online Social Networks Security-Principles, Algorithm, Applications, and Perspectives”, First Edition, 2021.
2. Bhavani Thuraisingham, SatyenAbrol, Raymond Heatherly, Murat Kantarcioglu, Vaibhav Khadilkar, Latifur Khan, “Analyzing and Securing Social Networks”, First Edition, 2020.
2. B. K. Tripathy, Kiran Baktha, “Security, Privacy, and Anonymization in Social Networks: Emerging Research and Opportunities”, IGI Global Publication, 2019.
3. Michael Cross, “Social Media Security, Leveraging Social Networking While Mitigating Risk”, Elsevier Publication, First Edition, 2013.

REFERENCES:

1. El-Sayed M. El-Alfy ; Mohamed Eltoweissy ;Errin W. Fulp ; Wojciech Mazurczyk, "Nature-Inspired Cyber Security and Resiliency: Fundamentals, Techniques and Applications", IET Publication, 2019.
2. https://sites.google.com/view/social-cybersec/tools?pli=1
3. Yaniv Altshuler, "Security and Privacy in Social Networks", Springer , 2013.

LIST OF EQUIPMENTS:

1. **Software Required:**
   Python
2. **Software Tools Required:**
   Shield Square
   BotSlayer
   GOOGLE FACT CHECK TOOLS
   ORA-PRO

22CS904	CLOUD AND DATA SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Learn the basics of cloud security, including the shared responsibility model and identity management.
- Set up a secure cloud infrastructure with features like virtual private clouds and security groups.
- Develop skills for identifying and managing security incidents in the cloud, adhering to best practices.
- Safeguard application data at rest and in transit using encryption.
- Understand the features of Database Security and Security in Data Warehouses.

UNIT I	INTRODUCTION TO SECURITY IN CLOUD	9

Introduction to Security, Security in the Cloud, Security design principles, Shared responsibility model, Activity: Shared Responsibility Model, Identity and Access Management (IAM) fundamentals, Authenticating and Authorizing with IAM, Examples of authorizing with IAM, Additional authentication and access management services, Using Organizations.

UNIT II	SECURING INFRASTRUCTURE	9

Structure of a three-tier web application, virtual private cloud (VPC), Setting up public and private subnets and internet protocols, Security groups, Network access control lists (ACLs), Load balancers, Protecting compute resources- Cloud service models: IaaS, PaaS, SaaS.

UNIT III	INCIDENT RESPONSE AND RISK MANAGEMENT	9

Identifying an incident, Services that support the discovery and recognition phase, AWS Config and AWS Lambda, Services that support the resolution and recovery phase, Best practices for handling an incident.

UNIT IV	SECURING CLOUD: DATA SECURITY	9

Overview of Data Security in Cloud Computing- Common Risks with Cloud Data Security- Data Encryption: Applications and Limits- Cloud Data Security: Sensitive Data Categorization- Authentication and Identity- Data Categorization and the Use of Data Labels- Cloud Data Storage.

UNIT V	DATABASE SECURITY	9

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems.

TOTAL:45 PERIODS

OUTCOMES:

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

CO1: Understand security principles in cloud computing.

CO2: Implement infrastructure security measures in cloud environments.

CO3: Demonstrate incident response and risk management techniques in cloud systems.

22CS905	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Learn how to acquire digital forensic evidence.
- Learn how to investigate different digital artifacts and write reports
- Understand network forensics processes and procedures
- Understand mobile forensics processes and procedures.
- Able to analyze SIM cards and analyze mobile file systems.

UNIT I	ACQUIRING DIGITAL FORENSICS EVIDENCE	9

Types of Computer-Based Investigations - The Forensic Analysis Process- Acquisition of Evidence - Computer Systems- Case Study: Use The Sleuth Kit and Autopsy to retrieve data from file disk

UNIT II	DIGITAL FORENSICS INVESTIGATION& REPORTING	9

Computer Investigation Process–Windows Artifact Analysis–RAM Memory Forensic Analysis–Email Forensics-Investigation Techniques–Internet Artifacts- Case Study: Use DumpIt to acquire memory

UNIT III	NETWORKING FORENSICS	9

Characteristics in the network world–Identifying threats to the enterprise–Data breach surveys–Defining network forensics–Differentiating between computer forensics and networkforensics–Digital footprints–Collecting network traffic using tcp dump–Collecting networktraffic using Wireshark–Collecting network logs–Acquiring memory using FTK Imager- Tapping into network traffic–Packet sniffing and analysis using Wireshark–Packet sniffing andanalysis using Network Miner

UNIT IV	MOBILE FORENSICS FUNDAMENTALS	9

Mobile Devices vs. Computer Devices in the World of Forensics–Living in the Cloud: The Place to Hide and Store Mobile Data–Preparing, Protecting, and Seizing Digital Device Evidence

UNIT V	ANALYSING MOBILE INTERNALS	9

Analyzing SIM Cards - Advanced Android Analysis - Advanced iOS Analysis-Case Study: Use Andriller or equivalent to extract data from Android

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to: CO1: Understand how to acquire digital forensic evidence.

CO2: Understand how to investigate different digital artifacts and write reports

CO3: Understand network forensics processes and procedures. CO4: Understand mobile forensics processes and procedures. CO5: Analyze SIM cards and analyze mobile file systems.

CO6: Understand Digital forensic techniques for comprehensive documentation and reporting.

TEXTBOOKS:

1. William Oettinger, “Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence”, Packt Publishing, 1stEdition, 2020
2. Samir Datt, “Learning Network Forensics”, Packt Publishing, 1st Edition, 2016

REFERENCES:

1. Lee Reiber, “Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation”, McGraw Hill, 2ndEdition, 2018.
2. Rohit Tamma, Oleg Skulkin, Heather Mahalik, Satish Bommisetty, “Practical Mobile Forensics”, Packt Publishing, 3rdEdition, 2018
3. Gerard Johansen, “Digital Forensics and Incident Response: Incident response tools and techniques for effective cyber threat response”, Packt Publishing, 3rdEdition, 2022

22CS906	VULNERABILITY ANALYSIS AND PENETRATION TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- To learn the tools that can be used to perform information gathering.
- To identify operating systems, server applications to widen the attack surface and perform vulnerability assessment activity and exploitation phase.
- To learn how vulnerability assessment can be carried out by means of automatic tools or manual investigation.
- To learn the web application attacks starting from information gathering to exploitation phases.
- To learn how to metasploit and meterpreter are used to automate the attacks and penetration testing techniques.

UNIT I	INTRODUCTION	9

Introduction- Vulnerability Assessment- Understanding the Risks Posed by Vulnerabilities Detecting Vulnerabilities via Security Technologies- Categories of Penetration Testing - Types of Penetration Test – Structure of Penetration Testing Reports - Information Gathering Techniques - Active, Passive and Sources of Information Gathering - Approaches and Tools - Traceroutes, Neotrace, Whatweb, Netcraft, Xcode Exploit Scannerand NSlookup. Host discovery - Scanning for open ports and services - Types of Port.

UNIT II	NETWORK VULNERABILITY ASSESSMENT	9

Project Scoping-Assessing Vulnerability assessment timeline-NVAT-Prioritizing risks and threats Assessment Methodology-Top down and Bottom up Examination-Case study with assessment report- Case Study: Web Based Email Attacks.

UNIT III	MOBILE APPLICATION SECURITY	9

Types of Mobile Application Key challenges in Mobile Application and its impact Need for mobile application penetration testing Mobile application penetration testing methodology Android and ios Vulnerabilities - OWASP mobile security risk - Exploiting WM - BlackBerry Vulnerabilities - Vulnerability Landscape for Symbian - Exploit Prevention - Handheld Exploitation

UNIT IV	WIRELESS NETWORK VULNERABILITY ANALYSIS	9

WLAN and its inherent insecurities Bypassing WLAN Authentication uncovering hidden SSIDs MAC Filters Bypassing open and shard authentication - Attacking the client caffe latte attack Deauthenticating the client cracking WEP with the hirte attack AP-less WPA cracking - Advanced WLAN Attacks Wireless eavesdropping using MITM session hijacking over wireless - WLAN Penetration Test Methodology

UNIT V	PENETRATION TESTING	9

Introduction to Kali and Backtrack-Linux tools – Attack Machine- Phases of penetration test-reconnaissance extracting information from DNS-scanning-pings and ping sweeps-port scanning- NMap-Vulnerability scanning.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand vulnerability assessment principles and methods.
CO2: Analyze network vulnerabilities and prioritize risks.
CO3: Evaluate mobile application security challenges and methodologies.
CO4: Assess wireless network vulnerabilities and conduct penetration testing.
CO5: Apply penetration testing methodologies using appropriate tools.
CO6: Demonstrate ethical considerations in penetration testing practices.

TEXTBOOKS:

1. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015.
2. Dr. Patrick Engebretson, The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing made easy, Syngress publications, Elsevier, 2013.

REFERENCES:

1. Steve Manzuik, Andre Gold, Chris Gatford, “Network Security Assessment from Vulnerability to Patch”, Syngress Publishing Incorporation, 2007.
2. Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016.
3. Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver, June 2016.

22IT960 **INFORMATION SECURITY**

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION TO SECURITY AND NUMBER THEORY 9

Basics of Security – CIA Triad – Threats, Attacks and Services – Classical Cryptography – Substitution and Transposition ciphers – One-time Pad– Number Theory – Modular Arithmetic – Euclidean Theorem – Extended Euclidean Theorem – Algebraic Structures – Galois Field – Primality test –Pseudo randomness - Fermat's Theorem – Euler's Theorem – Chinese Remainder theorem – Logarithms – Elliptic Curve Arithmetic.

Suggested Activities: In-class activity - Practice cryptanalysis of classical cryptography and break the classical algorithms using cryptographic attack.

In-class activity - Solve modular exponentiation and multiplicative inverse using Fermat and Euler theorem.

Practical - Classical cryptography algorithms using Cryptool. Suggested Evaluation Methods: Assignments on cryptanalysis of classical cryptography, additive Inverse, Multiplicative Inverse, and modular exponentiation using the theorem. Quiz on classical cryptography and number theory. Demonstration of the classical cryptography algorithms using Cryptool.

UNIT II SYMMETRIC CRYPTOGRAPHY 9

Modern Cryptography – Symmetric Cipher – Block and Stream Cipher – Feistel Ciphers – Data Encryption Standard (DES) – DES Structure – Key Generation – Simplified DES – Linear and Differential cryptanalysis –CPA, CCA– Advanced Encryption Standard (AES)– Analysis of AES.

Suggested Activities:

 Explain the importance of key size and explore some examples with brute force attack to break the key.

 Demonstrate the working of DES and AES algorithms using CrypTool.

 Demonstrate various cryptographic attacks on DES and AES. Suggested Evaluation Methods:

 Assignments on key generation, linear and differential cryptanalysis of symmetric cryptography.

 Quiz on modes of operation and internal structure of DES and AES.

UNIT III ASYMMETRIC KEY CRYPTOGRAPHY 9

Public Key Cryptosystems – RSA Algorithm – ElGamal Cryptosystems – Diffie-Hellman key exchange – Elliptic curve cryptography – Hash functions – Hash algorithms – Secure Hash Algorithm: SHA – MD5 – Message Authentication Codes – zero knowledge protocols - Introduction to Quantum Cryptography– Threshold Cryptography.

Suggested Activities:

 Highlight the mathematics behind RSA, Diffie-Hellman Key exchange and Elliptic Curve Cryptography.

 Demonstrate the Hash code generation using MD5 and SHA 256 algorithm.

 Practical - Verify the Message Integrity using Hashing Techniques such as MD5 and SHA256.

 Case studies on Quantum and Threshold Cryptography.

Suggested Evaluation Methods:

 Assignments on RSA and ECC generation for encryption and decryption process.

 Quiz on mathematics behind the public key algorithms, Quantum, and Threshold Cryptography.

UNIT IV

SECURITY APPLICATIONS **9**

Digital Signatures Schemes– Digital Certificate – Key Management – Kerberos – Key Agreement and Distribution – PKI – X.509 Certificate – E-Mail Security – PGP – S/MIME – IP security – Virtual Private Network (VPN) – Web Security – Secure Socket Layer (SSL) – Transport Layer Security – Secure Electronic Transaction (SET)

Suggested Activities:

 Case studies on understand the components of X.509 Certificate

 Demonstrate IP security and configure VPN connection.

 Implement the SSL/TLS in Web Server for a Web Application. Suggested Evaluation Methods: Assignment on configuration of IP security and VPN connection in networks

 Quizzes on Key Management, SSL, TLS

UNIT V SYSTEM SECURITY **9**

Malwares – Password Management – Firewall – Intrusion Detection System and types – Intrusion Prevention System –– Penetration testing: concept, types, steps – OWASP top ten vulnerabilities – Secure Coding. Suggested Activities:

 Teaching with case studies: access control and cloud security.

 Configure the Access Control List and use firewall, mitigate DoS attack.

 Understand the safety measures during the implementation of security in WLAN.

 Simulate the importance of various security standards in WLAN.

Suggested Evaluation Methods: Assignments on buffer overflow, malicious software, and types of IDS.

 Quizzes on firewall generation, WLAN security and cloud security.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs) On completion of the course, the students will be able to

CO1. Apply the basic security algorithms and policies required for a computing system.

CO2. Predict the vulnerabilities across any computing system and hence be able to design security solution for any computing system.

CO3. Identify any network security issues and resolve the issues.

CO4. Manage the firewall and WLAN security.

CO5. Evaluate the system related vulnerabilities and mitigation.

CO6. Design secured web applications in real-time.

TEXTBOOKS:

1. William Stallings, “Cryptography and Network Security Principles and Practices”, Pearson/PHI, Seventh Edition, 2023.

REFERENCES:

1. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education, 2004.

2. Pfleeger and Pfleeger, “Security in computing”, Third Edition, PHI/Pearson, 2018.

3. Behourz Forouzan, Debdeep Mukhopadyay, “Cryptography and Network Security”, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010.

4. Gilles van Assche, “Quantum Cryptography and Secret-Key Distillation”, Cambridge University Press, 2010.

5. Oded Goldreich, Foundations of Cryptography (two volumes) Cambridge university Press, 2004.

6. Patrick Engebretson, “The basics of Hacking and Penetration Testing”, Elsevier, 2011

22IT961 ARTIFICIAL INTELLIGENCE IN CYBERSECURITY **L T P C**

3 0 0 3

UNIT I OVERVIEW OF CYBERSECURITY 9

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security Attacks– Policy, Mission and Vision of Cyber security Program. Cyber security management system – goals, technology categories – perimeter defense and encryption. Cyber security management framework.

Suggested Activities

External learning on the statistics of cyber attacks

External learning on reconnaissance for cyber security

Suggested Evaluation Methods

Assignment on NIST Cybersecurity framework

UNIT II MALWARE ANALYSIS 9

Understanding Malware – Defining Malware Classification – Static and dynamic malware analysis –Feature Generation and classification - Malware detection using decision trees – Random forest malware classifier – Clustering malware with k-means – Detecting metamorphic malware with HMMs.

Suggested Activities

Study on best practices for Malware analysis

Demonstration of Malware detection

Suggested Evaluation Methods

Group project on malware detection

UNIT III NETWORK PROTECTION 9

Introduction to Intrusion detection – Types of IDS– IDS threat taxonomy - IDS Evaluation Metrics - AI based techniques for ID - Detecting DDos Attack – Credit Card fraud detection – Counterfeit bank note detection – Ad blocker –IoT device type identification – Deepfake recognition. Anomaly Detection – Types of anomalies – Anomaly detection with data and algorithms – Challenges in Anomaly detection.

Suggested Activities

Discussion papers on Deepfake recognition

Demonstration of intrusion detection and anomaly detection.

Suggested Evaluation Methods

Assignment on Penetration testing

UNIT IV APPLICATION SECURITY 9

Phishing Webpage and Email detection - Introduction to detecting spam – Spam filters – Perceptron based spam filter – Spam detection with SVMs – Phishing detection using logistic regression and decision trees – Spam detection with Naïve Bayes. Suggested Activities Video lectures on Spam detection Demonstration of email URL Phishing Suggested Evaluation Methods Programming assignment on predicting Spam or Ham.

UNIT V CASE STUDIES 9

Alert management – Raw data analysis – Risk Exposure Assessment – Cyber threat Intelligence.- Problems of AI in Cyber Security – Future of AI in Cybersecurity. Case studies

Suggested Activities

Tutorial on Adversarial machine learning

Case studies

Suggested Evaluation Methods

Assignment on security issues in AI

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students will be able to (5-6 outcomes)

1. Grasp the fundamentals of Cyber security
2. Knowledge of malware and countermeasures
3. Ability to detect Intrusion and Anomaly detection using AI algorithms
4. Able to realize Application security using AI
5. Gain knowledge of other roles of AI in Cyber security

TEXT BOOKS

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021 (Unit 1)
2. Clarence Chio, David Freeman, “ Machine Learning and Security : Protecting Systems with Data and Algorithms”, O’Reilly publication, !st Edition, ISBN -1491979909

REFERENCES

1. Apruzzese, Giovanni, et al. "The role of machine learning in cybersecurity." Digital Threats: Research and Practice 4.1 (2023): 1-38.

2. Sumeet Dua, Xian Du, “Data Mining and Machine Learning in Cybersecurity”, CRC Press Publication, 1st Edition, ISBN 9781439839423

3. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011

4. Research papers on AI for Cyber Security

22CS927	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

UNIT I	NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS	9

Software Assurance and Software Security – Threats to software security – Sources of software insecurity – Benefits of Detecting Software Security – Properties of Secure Software – Memory Based Attacks: Low-Level Attacks Against Heap and Stack – Defense Against Memory-Based Attacks

UNIT II	SECURE SOFTWARE DESIGN	9

Requirements Engineering for secure software- SQUARE process Model- Tools- SQUARE Final Results- Requirement Elicitation and Prioritization- The Critical Role of Architecture and Design- Issues and Challenges - Software Characterization - Threat Analysis - Architectural Vulnerability Assessment.

UNIT III	SECURITY RISK MANAGEMENT	9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.

UNIT IV	SECURITY TESTING	9

Software Security Testing- Contrasting Software Testing and Software Security Testing- Functional Testing- Risk-Based Testing-Secure Software Development Life Cycle- Unit Testing, Testing Libraries and Executable Files, Integration Testing, System Testing.

UNIT V	SECURE PROJECT MANAGEMENT	9

Governance and security – Adopting an enterprise software security framework – Security and project management – Maturity of Practice-Case Study: Implement the SQL Injection attack and Buffer Overflow attack..

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Analyze low-level memory attacks and implement corresponding defenses.
CO2: Implement requirements engineering and architectural vulnerability assessment.
CO3: Evaluate and mitigate risks throughout the software development lifecycle.
CO4: Implement various testing techniques to ensure software security
CO5: Apply enterprise security frameworks in project governance.
CO6: Analyze case studies to understand real-world security threats in project management.

TEXTBOOKS:

1. Julia H. Allen, Software Security Engineering, Pearson Education, 2009.
2. Evan Wheeler, Security Risk Management: Building an Information Security Risk Management Program from the Ground Up, First edition, Syngress Publishing, 2011.

REFERENCES:

1. Rajib Mall," Fundamentals Of Software Engineering", 5th Edition, PHI Learning, 2018.
2. Jon Erickson,"Hacking:The Art of Exploitation",2nd Edition, No Starch Press, 2008.
3. Mike Shema,"Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First Edition, Syngress Publishing,2012.
4. Bryan Sullivan and Vincent Liu,"Web Application Security, A Beginner's Guide",Kindle Edition, McGraw Hill,2012.
5. Lee Allen,"Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide(Open Source:Community Experience Distilled)", Kindle Edition, Packt Publishing,2012.
6. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)", Addison-Wesley Professional, 2006.

22CS928	NETWORK DESIGN AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Understand the basic networking principles.
- Explore various networking devices and protocols required for network design and management.
- Gain knowledge in logical and physical designs for scalable LAN and WAN networks
- Study two novel networking technologies: SDN and DTN.
- Learn network programming in UNIX C.

UNIT I	NETWORKING PRINCIPLES	9

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Collision detection and collision avoidance, Hidden and Exposed Terminals – Switched networks – Datagrams, Virtual circuits, Cell switching and Label switching – Wireless Networks – Infrastructure based, ad hoc and hybrid – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios –Applications, Quality of Service – End to end level and network level solutions.

UNIT II	PHYSICAL NETWORK DESIGN	9

LAN cabling topologies – Ethernet Switches – High speed and Gigabit and 10Gbps – Building cabling topologies and Campus cabling topologies – Routers, Firewalls and L3 switches –Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks

UNIT III	LOGICAL DESIGN AND MANAGEMENT	9

IPv4 and IPv6 Dynamic Addressing –Hierarchical routing – VLSMand CIDR – Transition from IPv4to IPv6 – NAT and DHCP – Static and Dynamic routes – RIP, OSPF and BGP – VPN –RMON andSNMP

UNIT IV	INNOVATIVE NETWORKS	9

Software Defined Networks – Evolution of switches and control planes – Centralized and distributed data and control planes – OpenFlow and SDN Controllers – Network FunctionVirtualization – Needs of the Data Centres – SDN solutions for data centres - Delay Tolerant Networks – Overlay architecture – Bundle Protocol – Opportunistic routing and Epidemic routing

UNIT V	NETWORK PROGRAMMING IN UNIX C	9

Socket address structures – Byte ordering and byte manipulation functions – Elementary TCP sockets – socket, connect, bind, listen, accept and close functions – TCP client and server – Elementary UDP sockets –recvfrom and sendto functions , connect function with UDP – Raw sockets – Client-server design alternatives – Iterative and Concurrent servers.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand advanced multiplexing methods like DWDM and OFDM.
CO2: Evaluate network protocols for efficient data transmission.
CO3: Develop logical and physical designs for scalable LAN and WAN networks.
CO4: Apply strategies for transitioning from IPv4 to IPv6.
CO5: Investigate Software Defined Networks and Delay Tolerant Networks.
CO6: Gain proficiency in network programming using socket APIs in C.

TEXTBOOKS:

1. Larry Peterson and Bruce Davie, “Computer Networks: A Systems Approach”, 5th edition, Morgan Kauffman, 2011
2. ParitoshPuri, M.P.Singh,”A survey paper on routing in delay tolerant networks”, International Conference on Information and Computer Networks (ISCON), 2013.

REFERENCES:

1. Paul Goransson, Chuck Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kauffman, 2016.
2. W.Richard Stevens, Bill Fenner and Andrew M Rudoff, “Unix Network Programming: The Sockets Networking API: Volume 1 “, 3rd Edition, Addison Wesley, 2003.
3. Ying Dar Lin, Ren-Hung Hwang and Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill, 2011.

22CS929	FAULT TOLERANT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Create understanding of the fundamental concepts of fault tolerance systems
- Learn basic techniques for achieving fault tolerance in hardware
- Have in-depth understanding in software fault tolerance systems
- Gain knowledge in design & testing of fault tolerance systems
- Develop skills in modelling and evaluating fault tolerant architectures in Real time systems

UNIT I	INTRODUCTION	9

Faults, Errors and Failures - Levels of Fault tolerance - Dependability measures - Dependability evaluation - Fault Tolerant techniques - Hardware redundancy - Information redundancy - Software redundancy- Time redundancy -Software Testing.

UNIT II	HARDWARE FAULT TOLERANCE	9

The Rate of Hardware Failures - Failure Rate, Reliability, and Mean Time to Failure - Canonical and Resilient Structures - Poisson Processes - Markov Models Fault-Tolerance Processor-Level Techniques - Byzantine failures.

UNIT III	SOFTWARE FAULT TOLERANCE	9

Single-Version Fault Tolerance – N Version programming - Recovery Block Approach - Exception-Handling - Software Reliability Models - Check pointing - Optimal Checkpointing - Checkpointing in Distributed Systems, Shared-Memory Systems and Real-Time Systems.

UNIT IV	DESIGN DIVERSITY & TESTING	9

Fault tolerant Control and coordination algorithms design – F-T system abstractions and functions- Pitfalls- Practical application- Modeling and analysing F-T Distributed systems - Software fault insertion testing- Fault manager- Categorization of Software faults, Errors, and failures- SIFT methodology and Test plans

UNIT V	FAULT TOLERANCE IN REAL TIME SYSTEMS	9

Time- Space tradeoff - Fault tolerant scheduling algorithms - Fault tolerant ATM switches - Fault tolerant Routing and sparing Techniques - Yield and reliability enhancement for VLSI/WSI array processors. Case studies: Non-stop systems, Stratus systems, Cassini command and data sub system, IBM G5, Itanium

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the need for fault tolerance systems.
CO2: Evaluate hardware fault tolerance techniques and their reliability metrics.
CO3: Apply software redundancy and fault tolerance methods in program design.
CO4: Develop fault-tolerant algorithms and architectures for dependable systems.
CO5: Design and implement fault injection testing methodologies for software reliability.
CO6: Implement fault-tolerant algorithms for real-time applications and analyze their tradeoffs.

TEXTBOOKS:

1. E.Dubrova, “Fault-Tolerant Design”, Springer, 2013.
2. I. Korenand, M.Krishna, ”Fault Tolerant Systems”, Morgan Kaufmann, 2nd Edition, November 2020.

REFERENCES:

1. Kjetil Norvag, “An Introduction to fault tolerant systems”, IDI Technical report, July 2000.
2. Olga Goloubeva , Maurizio Rebaudengo , Matteo Sonza Reorda , Massimo Violante, “Software-Implemented Hardware Fault Tolerance”, Springer, 2006.

22CS930	ENTERPRISE CYBER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Learn the fundamentals of cryptography.
- Learn the key management techniques and authentication approaches.
- Explore the network and transport layer security techniques.
- Understand the application layer security standards.
- Learn the real time security practices.

UNIT I	INTRODUCTION TO CYBERSECURITY	9

Cyber Security – Need of Cybersecurity in Organizations – CIA Triad- Confidentiality, Integrity, Availability; Reason for Cyber Crime –Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes- A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II	NETWORK SECURITY BASICS	9

Network Security Concepts- Basics of Networks- Common Types of Network Attacks- Introduction to Firewalls- Types of Firewalls- IDS/IPS- Virtual Private Networks (VPN's)- Secure configuration and management of network devices. Case Study: Install Kali Linux on Virtual box.

UNIT III	SECURE COMMUNICATION PROTOCOLS	9

Encryption Principles- Cryptography, Cryptanalysis, Feistel Cipher Structure. Block Encryption algorithms: DES, triple DES, and AES. Transport-Level Security: Secure Sockets Layer (SSL), Transport Layer Security TLS). Electronic Mail Security- Pretty Good Privacy (PGP), S/MIME. Securing wireless networks: WPA, WPA2, WPA3.

UNIT IV	INTRUSION DETECTION AND PREVENTION SYSTEMS	9

IDPS- Need of Intrusion Detection Systems in Cyber Security- Types of IDPS: Network-based and Host-based. Configuring and Managing IDPS for threat detection using Honeypots. Case Study: Setup a honey pot and monitor the honey pot on network.

UNIT V	WEB APPLICATION SECURITY	9

Introduction to Web Application Vulnerabilities – Cross Site Scripting (XSS) – SQL injection- Denial of Service (DoS)- Web Application Testing - Types of Penetration Tests- OWASP and OWASP Top.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understanding the core concepts and importance of cybersecurity in organizational settings.

CO2: Acquire the knowledge common network attacks and deploy appropriate security measures.

CO3: Implement encryption and secure communication protocols for data integrity and confidentiality.

CO4: Deploy and manage Intrusion Detection and Prevention Systems for threat detection.

CO5: Identify and mitigate common web application vulnerabilities.

CO6: Conduct penetration tests to evaluate the security posture of web applications.

TEXTBOOKS:

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education, 2018.

REFERENCES:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Ravi Das and Greg Johnson, “Testing and Securing Web Applications”, 2021.
3. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, O’Reilly Media, Inc, 2020.

VERTICAL III

FULL STACK ENGINEERING

22IT903	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To introduce the basics and necessity of software testing.
- To provide various testing techniques along with concepts of software bugs and its impact.
- To develop and validate a test plan.
- To build a testing team required.
- To understand the need for and challenges in test automation and to develop testing scripts.

UNIT I	TESTING PRINCIPLES AND AXIOMS	6+6

Testing as a Process – Testing Axioms –Software Testing Principles – Origins and Cost of Defects – Defect Classes and Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention Strategies.

List of Exercise/Experiments

- Flipped classroom on testing axioms.
- Identify and analyze syntax error, semantic error, bug and defect for programs.
- Identify the various types of errors, bugs and defects for a case study.

UNIT II	BLACK BOX, WHITE BOX TESTING AND TEST ADEQUACY	6+6

Test Case Design Strategies – Black Box Approach – Boundary Value Analysis – Equivalence Class Partitioning – State-Based Testing – User Documentation Testing – White Box Approach – Static Testing vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Cyclomatic Complexity – Test Adequacy Criteria.

List of Exercise/Experiments

- Flipped classroom on test adequacy criteria.
- External learning – Exploring white box testing tools like veracode, eclemma, rcunit, cppunit, Junit, JSUnitetc.
- Analyzing the cyclomatic complexity of code segments.
- Assignments on white box testing tools like Selenium, Appium, Robotium and carrying out simple BBT and WBT using tools.
- Solving problems related to cyclomatic complexity.

UNIT III	LEVELS OF TESTING	6+6

Unit Test – Planning – Designing the Unit Test Process – Running the Unit Tests and Recording Results – Integration Test Planning – Scenario Testing – Defect Bash Elimination System Testing – Acceptance Testing – Performance Testing – Regression Testing – Internationalization Testing – Ad-Hoc Testing – Alpha, Beta Tests

List of Exercise/Experiments

- External learning – Exploring the integration testing tools for various programming languages – VectorCAST/C++, CITRUS (Java), FitNesse (open source), Rational test integration tester, Protractor (Angular, Angular JS), Jasmine (JavaScript), Spock (Java) and the regression testing tools – Sahi Pro, Watir, IBM Rational Regression Tester, TestDrive etc.
- Flipped classroom on alpha and beta testing.
- Analyzing various levels of testing required for a software product.

UNIT IV	TEST MANAGEMENT	6+6

Organization Structures For Testing Teams – Testing Services – Test Planning Attachments – Locating Test Items – Test Management – Reporting Test Results – The Role of Three Groups in Test Planning and Policy Development – Introducing the Test Specialist – Skills Needed by a Test Specialist – Building a Testing Group.

List of Exercise/Experiments

- Flipped classroom on reporting test results.
- External learning – Exploring the organization structures and organizational behaviour in the context of software testing.
- Analyzing how to build testing groups for various types of projects and organizations.

UNIT V	TEST AUTOMATION	6+6

Software Test Automation – Skill Needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Test Metrics and Measurements – Project, Progress and Productivity Metrics – Maintenance of Documents During Testing.

List of Exercise/Experiments

- Flipped classroom on Test metrics and measurements.
- External learning – Exploring the risks involved in automated testing and exploring the ways to improve your testing skills apart from using testing tools.
- Practical – Install and learn popular software testing tools like Selenium, WinRunner, LoadRunner, Performance Tester etc.
- Learning to write test scripts.

TOTAL: 30+ 30=60PERIODS

OUTCOMES:

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

CO1: Obtain an insight to software testing.

CO2: Apply both black box testing and white box testing.

CO3: Understand and apply multiple levels of testing.

CO4: Understand the role of a tester as an individual and as a team member.

CO5: Apply software testing for large projects using automated testing tools.

CO6: Maintain documentation on testing.

TEXTBOOKS

1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Fourth Edition, CRC Press, 2013.
2. Dorothy Graham, Mark Fewster, "Experiences of Test Automation: Case Studies of Software Test Automation", Pearson Education, 2012.

REFERENCES:

1. Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing", Third Edition, John Wiley & Sons, 2012.

2. SrinivasanDesikan, Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2009. .
3. Boris Beizer, “Software Testing Techniques”, Dream Tech Press, 2009.
4. Mauro Pezze, Michal Young, “Software Testing and Analysis Process Principles and Techniques”, Wiley India, 2008.
5. Ali Mili, FairouzChier, “Software Testing: Concepts and Operations”, Wiley, 2015.

22IT902	SERVER-SIDE PROGRAMMING (Lab Integrated)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the fundamentals of JEE concepts and usage of build tools like Maven.
- To acquire knowledge on core technologies like IOC, DI and AOP.
- To develop and deploy application in frameworks like Spring, Spring MVC and Building RESTServices with spring MVC
- To understand Logging process, ORM framework and build secure applications using JWT andOAUTH

UNIT I INTRODUCTION TO JAKARTA ENTERPRISE EDITION (FORMERLY CALLED AS JAVA EE) 6+6

Java EE 8 Platform Overview - Distributed Multi-tiered Applications- Web and Business Components-Java EE Containers – services & types - Java EE Application Assembly and Deployment – Packaging Applications, Java EE modules - Getting Started with Web applications Model View Controller (MVC)

Architecture and Packaging – Web application deployment descriptor (web.xml file) - Web Application Archive (*.WAR file), Java Archive (*.JAR), Enterprise Application archive (*.EAR). Build Tools: Maven, Configuration, Archetype, Local Maven Repository and Mvn Repository, Dependency Plugins.

UNIT II CORE TECHNOLOGIES AND FRAMEWORKS 6+6

Introduction to Spring Core, Spring Architecture, Bean Container, Inversion of Control, IOC Container, Bean Definition, Bean Scope, Bean Life Cycle, Dependency Injection-Constructor Injection and property Injection, Auto-wiring, Aspect Object Programming (AOP), Spring MVC, Building a REST services with spring, using http calls (GET, POST, PUT, etc) with annotations: Controller, Rest Controller, Get Mapping, Post Mapping, Put Mapping and Delete Mapping, Error handling for REST, Logging with Log4J. Case Study: Performing CURD operation using spring MVC and RESTFUL

services. Introduction to Tools

UNIT III DATA PERSISTENCE 6+6

Object/Relation Mapping using Simple JDBC Integration with native SQL commands, JNDI(Java Naming and Directory Interface), JNDI Data source Configuration, Application Deployment in Tomcat with JNDI.

UNIT IV HIBERNATE 6+6

Introduction, Integrating and configuring Hibernate, understanding connection pool, ORM Architecture, Spring Data, JPA vs Hibernate, JPA annotations, Entity Manager, Entity Relationships – Many To One Relation, One To Many Relation, One To One Relation and Many To Many Relation. Building a sample application using JPA.

UNIT V WEB SECURITY FRAMEWORK 6+6

JSON Web Token (JWT), JWT structure and configuration. OAUTH2, Architecture, Authentication grant, Obtaining Access Token, Accessing a protected resource, OAuth Registry, Extensibility. Case Study: Develop a Spring based application with JWT-OAUTH2.

TOTAL: 30+30 = 60 PERIODS

OUTCOMES:

At the end of the course, the students will be able to:

CO1: Analyze the concepts of JEE and create tools using Maven.

CO2: Implement core technologies in real-world applications.

CO3: Develop real-world applications utilizing frameworks such as Spring and Spring MVC.

CO4: Integrate logging processes and Spring Security into real-world applications.

CO5: Evaluate the effectiveness of different frameworks in real-world scenarios.

CO6: Design secure and efficient applications using advanced JEE concepts and tools.

LIST OF EXERCISES

Prerequisites:

1. Developing simple application in Maven.

2. Implement Spring IOC.
3. Implement Spring JDBC.
4. Create a web application using Spring MVC.
5. Implement Data Persistence using JPA and Hibernate.
6. Creating RESTFUL services and Test using Postman or SoapUI
7. Usage of Java Naming and Directory Interface
8. Implement Logging using Log4j.
9. Implement Spring Security using JWT and OAUTH2

Use Cases:

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop
3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management - eMall

Details of use cases will be provided to the students through Lab Manual.

TEXTBOOKS:

1. Kogent Learning Solutions Inc.,"Java Server Programming Java EE7 (J2EE 1.7): BlackBook", Dream Tech Press, 2014.
2. Jim Keogh, “J2EE: The Complete Reference”, McGraw Hill, 2002
3. Geoffroy Warin, “Mastering Spring MVC 4”, Packt Publishing, 2015

REFERENCES:

1. Christian Bauer, Gavin King, and Gary Gregory, “Java Persistence with Hibernate”, SecondEdition, Manning publication, 2015
2. Joseph B.Ottinger, Jeff LinWood, Dave Minter, “ Beginning Hibernate: for Hibernate 5”, 4th Edition, Apress, 2016
3. Laurentiu Spilca, “Spring Security in Action, Manning Publication, 2020

E-RESOURCES:

1. https://www.baeldung.com/rest-with-spring-series
2. https://www.coursera.org/courses?query=spring%20framework
3. https://www.gangboard.com/spring-and-hibernate-courses

22IT910	REST APPLICATION DEVELOPMENT USING SPRING BOOT AND JPA (Lab Integrated)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The Course will enable learners:

- To provide comprehensive knowledge of RESTful APIs and the HTTP methods used in the Spring Boot framework.
- To cover advanced querying techniques using JPA, including LIKE queries, and to manage CRUD operations using JPQL.
- To explore various relational mappings in JPA, such as one-to-one and one-to-many associations, and their practical implementations.
- To implement and manage Spring AOP applications using annotation-based configurations for method interception and post-execution operations.
- To build production-grade Spring Boot applications with integrated security using JWT, detailed API documentation with SwaggerUI and OpenUI, and effective logging practices.

UNIT I	INTRODUCTION TO REST API	6+6

RESTful APIs – overview about data exchange between client and server - separating concerns between handling HTTP requests and executing business logic - retrieving server resources via HTTP requests - injection of property values - self-contained application - serialization and deserialization – JSON properties - managing data access.

List of Exercises/Experiments:

1. Develop a RESTful API for retrieving a welcome message, emphasizing the basics of data exchange between client and server.
2. Implement a RESTful API to acknowledge the user's favorite color choice, highlighting property value injection principles.

3. Create a Spring Boot application that retrieves and displays application information, demonstrating the usage of the @Value annotation to inject property values from the application configuration file.

4. Construct a RESTful API for student details retrieval, illustrating the utilization of @JsonIgnore annotation, focusing on advanced JSON property handling and data access control.

UNIT II	ADVANCED DATA MANAGEMENT WITH JAVA AND MYSQL	6+6

Build production-grade applications – MYSQL - mapping Java classes to relational database - repository interface - data access operations – retrieving data from the database –mapping of request body to entity - retrieve an entity - capture data from API requests - building complex queries using keywords.

List of Exercises/Experiments:

1. Develop a web application for managing patient details using RESTful APIs, implementing POST and GET operations.

2. Create a web application for managing product details using RESTful APIs, enabling POST and GET operations.

3. Build an application for managing employee details using RESTful APIs, supporting POST, PUT, and DELETE operations.

UNIT III	ADVANCED JPA QUERIES AND ANNOTATIONS	6+6

Pagination & Sorting using JPA, @Transient Annotation, Queries using JPA, Starts and Ends with query using JPA, JPQL with @Query Annotation, custom JPQL queries.

List of Exercises/Experiments:

1. Develop a web application for pagination and sorting of children details using RESTful APIs, implementing POST and GET operations.

2. Create a web application for managing Person details using JPA methods via RESTful APIs, enabling POST and GET operations.

3. Retrieve person details using JPQL with conditions for names starting or

ending with specific patterns.

4. Build a web application for managing Person details using custom JPQL queries via RESTful APIs, supporting POST and GET operations.

UNIT IV	JPA ASSOCIATIONS AND MAPPING	6+6

JPA Mapping of One-to-One Associations - fetching entities using queries – Loading optimization technique - Two-way One-to-One Relationship Mapping with JPA - single entity instance associated with multiple instances - Adding Data with One-to-One and One-to-Many Associations using JPA.

List of Exercises/Experiments:

1. Develop a Spring Boot application with "Person" and "Address" entities, where each person has exactly one address. Utilize Spring JPA to establish a one-to-one mapping between these entities.
2. Create a Spring Boot application with "Author" and "Book" entities, where each author can have multiple books, and each book belongs to only one author. Use Spring JPA to establish a one-to-many bidirectional mapping between these entities.
3. Build a Spring Boot application with "Employee" and "Address" entities, ensuring that each employee has exactly one address, and each address belongs to only one employee. Establish a one-to-one mapping between these entities using Spring JPA and utilize the Criteria API to retrieve employee details efficiently

UNIT V	SPRING BOOT ESSENTIALS: API SECURITY, LOGGING, AOP, AND BUILD MANAGEMENT	6+6

SwaggerUI with Spring Boot, OpenUI with Spring Boot, Logging with Spring Boot, Changing Log Level, Logging Request and Response- Managing Spring Boot Logging Configuration - Aspect-Oriented Programming (AOP) Concepts - Method Parameter Handling - Post- Execution Operations - Returning Data Handling - Comprehensive Advice Handling. API security using JWT, Gradle for build management, Sonar Lint for coding standards and guidelines.

List of Exercises/Experiments:

1. Develop a web application for managing Employee and Payroll details via

RESTful APIs. Utilize Spring JPA to establish a one-to-one mapping between Employee and Payroll entities. Demonstrate the usage of Swagger for API documentation and interaction.

2. Develop a Spring Boot application focused on handling person details and integrate comprehensive logging capabilities to track application activities effectively.

3. Explore the implementation of Aspect-Oriented Programming (AOP) in a Spring application to enhance the behavior of a service method and demonstrate its impact on application functionality.

TOTAL: 30+30=60 PERIODS

COURSE OUTCOMES:

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

CO1: Create simple applications using RESTful APIs and effectively manage HTTP methods within the Spring Boot framework.

CO2: Apply database connectivity with JPA, utilizing advanced queries to interact with the database.

CO3: Build applications using Spring Boot and perform CRUD operations efficiently using JPQL

CO4: Demonstrate the implementation of various relational mappings in JPA, including one- to-one and one-to-many associations

CO5: Develop real-time applications that integrate user interfaces and utilize Spring AOP for method interception and advice handling.

TEXTBOOKS:

1. Raja CSP Raman, Ludovic Dewailly, “Building RESTful Web Services with Spring 5”, Packt Publishing, 2018.

2. Leonard Richardson, Sam Ruby “RESTful Web Services” O'Reilly Media, 2008.

3. Ludovic Dewailly, “Building a RESTful Web Service with Spring: A hands-on guide to building an enterprise-grade, scalable RESTful web service using

the Spring Framework", Packt Publishing, 2015
4. Raja CSP Raman, Ludovic Dewailly, "Building RESTful Web Services with Spring 5 - Second
5. Edition: Leverage the power of Spring 5.0, Java SE 9, and Spring Boot 2.0", Packt Publishing, 2018
REFERENCES:
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.
3. Greg L. Turnquist, "Learning Spring Boot 2.0", Packt Publishing, 2021
4. Sourabh Sharma, "Modern API Development with Spring and Spring Boot", Packt Publishing, 2021
LIST OF EQUIPMENTS/SOFTWARE:
1. Java Persistence API, Spring Boot

22IT904	DEVOPS (Lab Integrated)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Understand the concepts of DevOps and the issues it resolves
- Learn the DevOps tools set
- Learn to Develop automation using Maven
- Understand Continuous Delivery and Continuous Deployment
- Understand Docker Containerization

UNIT I INTRODUCTION 6+6

What Is DevOps, Architecture, Life Cycle, Workflow and Principles, Tools, CI, CD and CD Pipelines Linux Introduction, Basic Commands, Scripting

UNIT II TOOLS SET 6+6

Maven Build Management, Goals, Profiles, Plugins, LifeCycles, Configuration, Parent/Child - SCM Tools - GitHub, Init, CheckIn, Merge, Pull, Push, Local and Remote Repo, Pull Request, Tagging Strategy – Unit Testing – Unit Testing scropts - Artifact Repository - Release Management aligned Repos, Private and Public Repos Monitoring - Tools like nagios to assist in monitoring and managing the deployed instances

UNIT III TESTING AUTOMATION 6+6

Maven with Unit / Integration / Performance Testing - Report Generation and Configuration

UNIT IV DEPLOYMENT AND MONITORING – DOCKER 6+6

Docker Introduction, Images, Containers, Docker Hub, Links, Volume, Network, Interactive Sessions - K8 - Single and Cluster Mode, Secrets,

Persistence Volume and Claim, Replica Factor, Services, Pods, Deployments, logs, Kubernetes

UNIT V DEPLOYMENT AND MONITORING – JENKINS 6+6

SonarQube integration with Project and Jenkins

Jenkins - Setup and Configuration, Jobs - Continuous Integration, Continuous Delivery and Continuous Deployment Configuration

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the concept of DevOps Architecture.

CO2: Apply the DevOps Tools in real time applications.

CO3: Build Maven with Unit, Integration and Performance Testing

CO4: Deploy and monitor using Docker

CO5: Deploy and monitor using Jenkins

CO6: Integrate DevOps workflows by leveraging continuous integration and continuous deployment (CI/CD) pipelines to enhance efficiency, collaboration, and quality in software development and operations.

EXCERCISES:

Prerequisite:

Develop a Sample Spring Boot
Project with following aspects
REST API End Points

- Ex Funds Transfer Service
- Query Fund Transfer Status

Junit Test Cases
Selenium Test Cases

DockerFile

Scripts for Docker Image and Container Cleanup / Creation

Maven Pom file with Docker integrations

Software Installation: -

- Java 8
- Maven Latest
- VS Code / Eclipse STS
- Jenkins
- SonarQube
- Docker and Kubernetes
- Git Client
- Nagios Network Mentoring Tool

Reference https://docs.semaphoreci.com/examples/java-spring-continuous-integration/

Exercise 1:

- Install Jenkins
- Configure Jenkins for Maven, Java, GitHub,SonarQube and SonarScanner
- Setup Continuous Integration on Jenkins for the above said project and show case the build stability in the form of
    - Build Stability
    - Test Case Success / Regression
    - Code

Quality Check using

SonarQube Points to be

observed: -

- Build Stability
- Finger Prints
- Test Case Results
- Workspace
- Application Logs
- Jenkins Pre / Post Actions
- Email Notifications
- Sonar Qube Report Analysis

Exercise 2:

- Install Groovy
- Create a Pipelines in Jenkins which will perform following steps
  - Configure Java/Maven/Private Repo
  - Git Clone of the above said project
  - Maven Build
  - Maven Test
  - Sonar Scanner (if quality if OK then proceed, else exit with error message)
  - Repo Setup and Install Libraries in the Repo
  - Docker Clean Containers
  - Docker Clean Images
  - Docker Build
  - Docker Run Container

- Points to be observed: -
  - Build Stability
  - Finger Prints

- Test Case Results
- Workspace
- Application Logs
- Jenkins Pre / Post Actions
- Email Notifications
- Sonar Qube Report Analysis
- Time Taken for each Steps
- Process Refinement

REFERENCES:

1. Jennifer Davis and Ryn Daniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, 1st Edition, O'Reilly Publications.
2. Gene Kim, Patrick Debois et al., The DevOPS Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, IT Revolution Press; Illustrated edition, 2016.

22CS601	COMPILER DESIGN (Lab Integrated)	L	T	P	C
		3	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Study the different phases of compiler
- Understand the techniques for tokenization and parsing
- Understand the conversion of source program into an intermediate representation
- Learn the different techniques used for run time environment and code generation
- Analyze various code optimization techniques

UNIT I	INTRODUCTION TO COMPILERS	9 + 3

Introduction-Structure of a Compiler-Role of the Lexical Analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens-The Lexical Analyzer Generator LEX-Finite Automata - Regular Expressions to NFA-Optimization of DFA based pattern matches -Conversion from NFA to DFA - Minimization of DFA.

List of Exercise/Experiments:

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.

UNIT II	SYNTAX ANALYSIS	9 + 3

Role of the Parser - Context-free grammars – Derivation Trees – Ambiguity in Grammars and Languages- Writing a grammar – Types of parsing - Top-Down Parsing – Predictive parser or LL(1) Parser –Bottom-Up Parsing – Shift Reduce Parser - LR Parsers - SLR, CLR, LALR Parser - Parser Generators YACC.

List of Exercise/Experiments:

1.Design a lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces, tabs and new lines, comments etc.

UNIT III	INTERMEDIATE CODE GENERATION	9 + 3

Syntax Directed Definitions - Evaluation Orders for Syntax Directed Definitions – Application of Syntax Directed Translation - Intermediate Languages - Syntax Tree – Three Address Code – Implementation of Three address code – Declarations - Translation of Expressions - Type Checking.

List of Exercise/Experiments:

1. Implement a Lexical Analyzer using Lex Tool
2. Design Predictive Parser for the given language

UNIT IV	RUN-TIME ENVIRONMENT AND CODE GENERATION	9 + 3

Run Time Environment: Storage Organization-Storage allocation strategies - Access to nonlocal data on stack - Heap management - Parameter Passing - Issues in the design of Code Generator – Design of simple Code Generator -Register allocation and assignment.

List of Exercise/Experiments:

1. Implement an Arithmetic Calculator using LEX and YACC
2. Generate three address code for a simple program using LEX and YACC.

UNIT V	**CODE OPTIMIZATION**	**9 + 3**

Principle sources of optimization – Peep hole Optimization – DAG construction -Basic blocks and flow graph - Optimization in Basic blocks – Data flow analysis.

List of Exercise/Experiments:

1. Generate three address code for a simple program using LEX and YACC.
2. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
3. Implement back-end of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.

TOTAL: 45 +15 = 60 PERIODS

OUTCOMES:

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

CO1: Understand the structure and role of lexical analyzers in the compilation process.

CO2: Design and implement different parsers and the generators like YACC for automating parser construction.

CO3: Understand syntax-directed definitions and their applications in intermediate code generation.

CO4: Analyze the different techniques used for efficient assembly code generation.

CO5: Design efficient code by implementing different code optimization techniques

CO6: Apply DAG technique to optimize the basic blocks used for data flow analysis

TEXT BOOK:

1.Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, ¯Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education Limited, 2014.

REFERENCES:

1.Randy Allen, Ken Kennedy, ¯Optimizing Compilers for Modern Architectures: A Dependence-based Approach‖, Morgan Kaufmann Publishers, 2002.

2.Steven S. Muchnick, ¯Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint, 2003.

3.Keith D Cooper and Linda Torczon, ¯Engineering a Compiler‖, Morgan Kaufmann Publishers, Elsevier Science, 2004.

4.V. Raghavan, ¯Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.

5. Allen I. Holub, ¯Compiler Design in C‖, Prentice-Hall Software Series, 1993.

LIST OF EQUIPMENTS:

C/C++

22IT906	FRONT END ENGINEERING	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To understand web semantics and related tools and framework
- Able to get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

UNIT I	INTRODUCTION	6+6

An Introduction to HTML5 – Tags, Link, Images, Forms, Label, Sections, Media, Structure, CSS3 inline, internal, BoxModel, Targeting Elements, Flex Model, Responsive andFluid Layout, Media Queries—An introduction to JavaScript(ES6)– Data Types– Conditionals and Loops – Functions – Classes and Objects – Inbuilt Methods – Arrays –Regular Expressions – Arrow Functions – Debugging in browsers – JS HTML DOM – JSBrowser BOM – Introduction to AJAX and JSON – JS vs JQuery – Why JS Frameworks –Scope and Function Context- Closures- Java Script Design Pattern.

UNIT II	WEB FRAMEWORK (ANGULAR) – I	6+6

TypeScript – Static Typing, User Defined Data Types, Lambda Expression and Functional Programming, String, Number, Boolean, Union, Tuple, Object Oriented Programming Inheritance, Interface, Access Modifiers, Let vs Var, Arrays, Generics, Duck Typing, Any/ Unknown, TS Config.

UNIT III	WEB FRAMEWORK (ANGULAR) – II	6+6

Introduction to Single Page Application(SPA) and Angular Architecture, SPA's Components and Templates, Interpolation and 2way databinding, Modules, Forms (Template/Reactive), Promise and Observable, CLI Features, i18n, Workspace Structure

UNIT IV	WEB FRAMEWORK (ANGULAR) – III	6+6

Service Definition and Injection, Routes and Navigation, Data Integrity enablement, Flux/Redux, Security, Pipes and Directives, Behavior Subject, Logging and Exceptions handling, Performance Engineering, Unit Testing using Jasmine and Karma, Responsive Web design using Bootstrap and MD

UNIT V	NODEJS (SERVER SIDE) WITH SERVER SIDE	6+6

NodeJS Introduction and Installation, YARN Integration, Imports and Modules, ExpressJS, JWT/OAUTH2.0 based security, Routes and Middleware, DB Integration–Config–Reactive DB Operations – CRUD, Exception Handling, Transaction Management, Logging and Audit, Deployment

List of Exercise/Experiments

1. Java Script (with DOM Manipulation, Field Validations, AJAX Calls where required, Mathematical Calculations, Decision Support etc)
2. CSS3 for Styling
3. HTML5 for presentation
4. Custom Web Fonts for UX Experience
5. Usage of Frameworks like BootStrap, Bulma, Material Design for Responsive Layout

Use Case 1:

Retail banking Application Modules

- Login and Logout
- Bean Creation
- Funds Transfer
- Funds Transfer Status

Use Case 2:

Library Management Modules

- Login and Logout
- Browsing the Book Catalogue
- Student Can able to lend books
- Student can able to return the books
- Admin Can able to add Books, remove damaged books, add users
- Payment of Late / Subscription Fees

Use Case 3: Student Management

- Login and Logout
- Admin to Add Students, Departments
- Admin to assign Students to a department and Semester
- Admin to upload Student Marks
- Student can able to view the details, marks sheet
- Student can able to mark attendance for today's date

TOTAL: 30+ 30=60 PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentswill beable to:

CO1: Personalize web pages using text formatting, graphics, audio, and video.

CO2:Hands on knowledge on Typescript

CO3: Able to develop a web application using latest Angular Framework

CO4:Apply various Angular features including directives, components and services.

CO5: Able to develop data driven back end API using NodeJS as the coreplatforms.

TEXTBOOKS

1. Sukesh Marla,"A Journey to Angular Development Paperback ",BPB Publications.
2. Yakov Fain AntonMoiseev,"AngularDevelopmentwithTypeScript",2nd Edition

REFERENCES:

1. DoguhanUluca,"Angular6 for Enterprise-Ready Web Applications: Deliver production-ready and cloud-scale Angular webapps",1st Edition, Kindle Edition
2. AdamFreeman,"ProAngularJS(Expert'sVoiceinWebDevelopment)Paperback" ,7 April 2014
3. NateMurray,FelipeCoury,AriLerner,CarlosTaborda,"ng-book:TheCompleteGuideto Angular", 2018.
4. https://www.edureka.co/blog/angular-tutorial/
5. https://www.javatpoint.com/angular-7-tutorial

22IT905	SERVER-SIDE ENGINEERING	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To Learn why server-side JavaScript is useful
- To Create basic web applications with Node.js
- To Build an HTTP server using the core modules in Node.js
- To Use stream I/O to efficiently serve the web pages
- To Test the reliability of the application with unit tests
- To Interface to a PostgreSQL and MongoDB database and a web service

UNIT I	ECMA SCRIPT 6	6+6

Let/Var/Const, Arrays, Functions, Object Oriented- Java Script Object Operations, Assignments- Events, Call Back Functions- AJAX, TimeOut, String, Date - If-Else, Comparisons - Maps& Sets, Errors - Hoisting, Strict Mode - Arrow Function, HOC - JSON, Debugging, Scope - NameSpaces& Modules - Spread Operator – DeStructuring -Closures - Promise/Async Await - DOM Manipulation/Traversal.

UNIT II	NODEJS - I	6+6

NodeJS Introduction - NodeJS Architecture, Hello World application, When to use nodeJs, Installation of NodeJS - NPM – Node Package Manager, CLI Commands,

UNIT III	NODEJS - II	6+6

Global vs local installation, Uninstall, search - package.json file (scripts/dependencies/version selectors(~^* etc), private/public) - Console – REPL (try our all basic JS commands)- Globals – OS – Timer – Errors – Streams – File Streams – Path – StringDecoder – Query String – ZLIB – Assertion.

UNIT IV	APPLICATION PROGRAMMING INTERFACE	6+6

Introduction to REST API – HTTP Verbs – Http Status Code – REST URI Patterns - ExpressJS – Exposing REST APIs, Basic Routing, Static files. Request and Response, JSON Content Type, Handling HTTP Headers, Reading values from Query String/Http-Headers, Middleware - Security – Authentication and Authorization, JWT Token & OAUTH2 implementation.

UNIT V	MONGODB : THE DEVELOPER DATA PLATFORM	6+6

Introduction to MongoDB, NoSQLvs SQL (CAP Theorem), Driver Installation, Create Database, Create Collection, Insert / Delete / Update / Fetch Operation, Join Query Operation, Transactions, Limit, Drop Collection, Aggregations, Indexing/Search - Unit Testing the Rest API with Mocha &Sinon

List of Exercise/Experiments

1) Develop a Library Management purely in JS, and deploy it to NodeJS implementation.
2) The developed solution should be user i/p driven
3) The data generated or presented should be fetched from a file system
4) Develop a REST API for Form based Login Service (username and password, POST)
5) Develop a ready only API for fetching List of Countries
6) Develop a ready only API for querying a Countries list based in ID/Name

7) Develop a Rest API for Update a Customer Object
8) Develop a REST API for removing a Country object.
9) Create a Database and Collection – for Flower Ecommerce Web Site
10) Design and Develop Entities for the same (adhere to specific nosql design aspect)
11) Trigger a Join Query between Orders, and Order Items Details , and try to generate a top sales based on volume and cost report
12) Create an Index for Orders collection, and show case that the query performance gets improved before & after index creation.
13) Show case the Mongodb Transaction aspect in a multi update scenario.

To develop the following Web application

1) Student Management System
2) Retail Bank System
3) eCommerce System

TOTAL: 30+30=60PERIODS

OUTCOMES:

At the end of the course, the students will be able to:

CO1:Learn a javascript code that executes in strict mode only
CO2: Able to build an HTTP server using the core modules in Node.js
CO3: Learn how Node.js is architected to allow high scalability with asynchronous code
CO4:Hands on knowledge on Rest API , propTypes
CO5:Able to develop a Full Stack web application using latest Node.js and MongoDB

TEXTBOOKS:

1) Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node 2nd ed. Edition
2) https://www.manning.com/books/getting-mean-with-mongo-express-angular-and-node-second-edition
3) https://nodejs.dev/en/learn/ (Parental Website)

REFERENCES:

1) https://www.tutorialspoint.com/nodejs/index.htmMongoDB Tutorial
2) https://www.mongodb.com/
3) https://github.com/mongodb/mongo

LIST OF EQUIPMENTS:

1) A local installation of Node.js
2) NeoColab
3) NodeJS (v9.11.2)
4) Github as code repository
5) Visual studio code as IDE
6) A recent version of Google Chrome or Mozilla Firefox
7) Admin/root or sudoer privileges to install additional features during the class

22IT907	SCALABLE MESSAGING INFRASTRUCTURE - APACHE KAFKA	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners:

- To Install and setup Kafka servers
- To configure Kafka and build a secure application
- To use Kafka API and Kafka Stream API for Data Processing.
- To handle exceptions in Kafka

UNIT I	EAI DESIGN PATTERN	9

Integration Styles-Messaging Systems-Message Transformation-Messaging Endpoints - Messaging – Pipes & Filter – Publish & Subscriber – Router and Translator – Invalid message channel – dead letter channel – messaging bridge – message bus – request reply – Correlation Identifier – Command and Document Message.

UNIT II	INTRODUCTION TO KAFKA	9

Introduction to Kafka – Kafka architecture – why Kafka , different between Kafka and JMS - Kafka Installation – Cli Commands (Publish/Consumer actions) - Core Kafka APIs – Producer - API/Consumer API/Streams API/Connector API

UNIT III	KAFKA CONFIGURATION	9

Kafka Topics – Partition – Replication – Cluster setup - Kafka Message topic setup – Immutable – Append Only – Message Durability – Message Offset - Kafka Consumers / Consumer Group, Message acknowledgement (& its levels) - Kafka Security – Securing data exchange.

UNIT IV	KAFKA EXCEPTION HANDLING	9

Spring Boot – Configuration - Kafka Template – JSON &Serializer/De-Serializer, Connection options – By Partion Id, By Offset, By Message Format , By Topic Name - Message Exception Handling / Re-Try / Post Back etc.

UNIT V	REALTIME DATA PROCESSING	9

Kafka Streams - Stream Processing – Time and State – Stream – Table Durability – Time windows - KSQL – Introduction to KSQLDB – Create a Stream – Streaming Queries – Creating a Materialize View – Inserting a data to a Stream – Querying a Data – Stream Processing .

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Model a Kafka development environment
CO2: Create applications using Kafka.
CO3: Acquire knowledge of Kafka Ecosystem and its components
CO4:Implement data integration among multiple systems using Kafka
CO5: Develop Standalone Applications using Kafka.

TEXTBOOKS:

1. Ted Dunning&Ellen Friedman , Streaming Architecture: New Designs Using Apache Kafka and Mapr Streams Paperback – 20 May 2016
2. Raul Estrada, Apache Kafka Quick Start Guide: Leverage Apache Kafka 2.0 to simplify real-time data processing for distributed applications Paperback – 1 January 2018

REFERENCES:

1. Raul Estrada, Apache Kafka 1.0 Cookbook: Over 100 practical recipes on using distributed enterprise messaging to handle real-time data Paperback – 1 January 2017
2. Bill Bejeck , Kafka Streams in Action: Real-time apps and micro services with the Kafka Streams API Paperback – 16 September 2018

22IT908	USABILITY DESIGN OF SOFTWARE APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of User Centered Design, their relevance and contribution to business.
- To study the principles of heuristic evaluation.
- To develop a mobile or web-based application.
- To understand the facets of User Experience (UX) Design
- To apply iterative approach in Product development.

UNIT I	INTRODUCTION TO USER CENTERED DESIGN	9

Basics of User Centred Design-Elements-Models and approaches-User Centred Design Principles-Usability-UCD Process-Analysis tools: personas, scenarios, and essential use cases with examples-User-Centred Design and Agile aspects of User Centred Design.

UNIT II	INTERACTIVE DESIGN EVALUATION	9

Introduction to Interactive Design process – Interactive design in practice – Introducing evaluation – Evaluation: Inspection, Analysis and Models – Inspection: Heuristic Evaluation: 10 Heuristic Principles, Examples.

UNIT III	DEVELOPMENT OF APPLICATION	9

Case Study: Development of any application like mobile or web based on User Centred Design – Design lifecyle: Establishing Requirements, Design, Prototyping and Construction.

UNIT IV	UX RESEARCH	9

Understanding users, their goals, context of use, environment of use. Research Techniques: Contextual Enquiry, User Interviews, Competitive Analysis for UX.

UNIT V	ITERATIVE PRODUCT DEVELOPMENT	9

The Problem with Complexity - Iterative Product Development - Scenarios and Persona Technique, Design Thinking Technique: Discovery and brainstorming - Concept Development – Prototyping Techniques : Paper, Electronic, Prototyping Tools – Review and feedback.

TOTAL 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Analyse the importance of User-Centred design.
CO2: Perform design evaluation by applying the heuristic principles.
CO3: Develop an application focusing on the design aspects.
CO4: Implement the various UX research techniques.
CO5: Apply iterative product development in real world applications

TEXT BOOKS:

1. Jenny Preece, Helen Sharp and Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 4th Edition
2. Alan Cooper and Robert Reimann,About Face: The Essentials of Interaction Design, 4thEdition

REFERENCES:

1. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, Observing the User Experience: A Practitioner's Guide to User Research, 2nd Edition
2. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond. 2nd Edition
3. Jonny Schneider,Understanding Design Thinking, Lean, and Agile

22IT909	CAPSTONE DESIGN PROJECT	L	T	P	C
		0	0	12	6

OBJECTIVES:

- To build an HTTP server using the core modules in Node.js
- To test the reliability of the application with unit tests
- To interface a PostgreSQL and MongoDB database
- To gain knowledge on latest JS based web frameworks
- To use Kafka API and Kafka Stream API for Data Processing
- To implement complex mobile/web applications

Lab Exercises - Pre Requisites

List of Exercise/Experiments: SERVER-SIDE ENGINEERING

1) Develop a Library Management purely in JS, and deploy it to NodeJS implementation.
2) The developed solution should be user i/p driven
3) The data generated or presented should be fetched from a file system
4) Develop a REST API for Form based Login Service (username and password, POST)
5) Develop a ready only API for fetching List of Countries
6) Develop a ready only API for querying a Countries list based in ID/Name
7) Develop a Rest API for Update a Customer Object
8) Develop a REST API for removing a Country object.
9) Create a Database and Collection – for Flower Ecommerce Web Site
10) Design and Develop Entities for the same (adhere to specific nosql design aspect)
11) Trigger a Join Query between Orders,and Order Items Details , and try to generate a top sales based on volume and cost report
12) Create an Index for Orders collection, and show case that the query performance gets improved before & after index creation.
13) Show case the mongodb Transaction aspect in a multi update scenario.

List of Exercise/Experiments: FRONT END ENGINEERING

1. Java Script (with DOM Manipulation, Field Validations, AJAX Calls where required, Mathematical Calculations, Decision Support etc)
2. CSS3 for Styling
3. HTML5 for presentation
4. Custom Web Fonts for UX Experience
5. Usage of Frameworks like BootStrap, Bulma, Material Design for Responsive Layout

List of Exercise/Experiments: SCALABLE MESSAGING INFRASTRUCTURE APACHE KAFKA

1. Implementation of an Application such as Student Information System using Inheritance, Virtual Functions and Abstract Classes.
2. Install Kafka on the system

3. Using CLI, try to
    a. Create a Topic with n+1 partition.
    b. Try to send a simple string message to a topic
    c. Try to send a JSON object to a Topic
    d. From the consumer side, showcase the ability to read the message from topic
    e. Create a cluster kafka setup, and show case the option of topic failure in case of a node going down.
4. Develop a REST based Spring application, that store the request message payload to a Kafka Topic
5. Develop a Listener under Spring Boot, that will
    a. Connect to a Topic and read the message as & when its received
    b. Connect to a Topic + a specific Partition ID
    c. Connect to a Topic + specific Offset
    d. In the same Spring Boot app, try to handle Transactional support when reading message from the Kafka Topics, and have a proper Exception Handling mechanism for reporting & retry options.
6. Develop a application in Spring Boot, that will create a mock stream of financial data, such as
    a. Credit Card transaction initiation message to a topic (streaming)
    b. There should a be listener to this above topic, which will query the transaction data, and process the same. The processed transaction data pushed into another queue
    c. We should able to query the above topics, and print the total number of transactions being
7. Show case the ability to Query the data(streaming data) from different topics, (using sql join like syntax)

List of Exercise/Experiments: USABILITY DESIGN OF SOFTWARE APPLICATIONS

1. Product Appreciation Assignment – Evaluating the product from User Centred Design aspects such as functionality, ease of use, ergonomics, and aesthetics.
2. Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.
3. Students will identify a project in the given domain (Healthcare, E-Commerce, Online Learning Platforms, Gaming, Point-of-Sale, Smart Things) and its related website or mobile app to redesign. They will take this redesign project through the design lifecycle:
   Discovery
   Define
   Design
   Implement (Design Prototype)
   Usability Testing
   The below design methods and techniques will be imparted w.r.t. the group project selected by the students
4. Presentation of Persona for the group project.
5. Task flow detailing for the project.
6. Project Prototyping Iteration 1.
7. Project Prototyping Iteration 2.
8. Final presentation of solution (Mobile or Web Application).

	Capstone Design Project	

To develop the following Web Applications

1. Retail Banking Application Modules
   - Login and Logout
   - Bean Creation
   - Funds Transfer
   - Funds Transfer Status
2. Library Management Modules
   - Login and Logout
   - Browsing the Book Catalogue
   - Student Can able to lend books
   - Student can able to return the books
   - Admin Can able to add Books, remove damaged books, add users
   - Payment of Late / Subscription Fees
3. Student Management
   - Login and Logout
   - Admin to Add Students, Departments
   - Admin to assign Students to a department and Semester
   - Admin to upload Student Marks
   - Student can able to view the details, marks sheet
   - Student can able to mark attendance for today's date

4. Application Log Analytics using Scalable Messaging Infrastructure Apache Kafka.
5. Fraud detection using Scalable Messaging Infrastructure Apache Kafka.
6. Credit Card Issuance using Scalable Messaging Infrastructure Apache Kafka.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Create a Full Stack web application using Node.js and MongoDB.
CO2: ApplyvariousAngularfeaturesincludingdirectives,components,and services.
CO3: ImplementKafka Ecosystem and its components.
CO4: Develop Standalone Applications using Kafka
CO5: Perform iterative product development using prototyping technique.

VERTICAL IV
MEDIA PROCESSING

22IT953	AUGMENTED AND VIRTUAL REALITY	L	T	P	C
		2	0	2	3

OBJECTIVES:

TheCoursewillenablelearnersto:

- Get exposure on Augmented Reality.
- Introduce Virtual Reality and input and output devices.
- Acquire knowledge on computing architectures and modelling.
- Explore Virtual Reality programming and human factors.
- Learn various applications of Virtual Reality.

UNIT I	AUGMENTED REALITY (AR)	6+6

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices.

List of Exercises:

1.Develop simple AR Application like snapchat.
2.Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization.

UNIT II	INTRODUCTION TO VIRTUAL REALITY (VR) AND INPUT AND OUTPUT DEVICES	6+6

Introduction: The three I's of Virtual Reality - - Early commercial VR technology - The five classic components of a VR system. Input devices: Three-Dimensional position trackers - tracker performance parameters - ultrasonic trackers - optical trackers - Navigation and manipulation interfaces - gesture interfaces. Output devices: graphics displays - large-volume displays - sound displays.

List of Exercises:

1. Study of tools like Unity, Maya/3DS MAX/Blender.
2. Use the primitive objects and apply various projection types by handling camera.

UNIT III	COMPUTING ARCHITECTURES AND MODELING OF A VR SYSTEM	6+6

Computing architectures for VR: The rendering pipeline - The graphics rendering pipeline - The haptics rendering pipeline - PC graphics architecture - PC graphics accelerators - Graphics benchmarks - Distributed VR architectures - Multipipeline synchronization - Colocated rendering pipelines. Modeling: geometric modeling - kinematics modeling - physical and behavior modelling

List of Exercises:

1.Download objects from asset store and apply various lighting and shading effects.

2. Model three dimensional objects using various modelling techniques and apply textures over them

UNIT IV	**VR PROGRAMMING AND HUMAN FACTORS**	**6+6**

Toolkits and scene graphs - WorldToolKit - Model geometry and appearance - The WTK scene graph - Sensors and action functions - WTK networking - Java 3D - Model geometry and appearance - Java 3D scene graph - Sensors and behaviors - Java 3D networking - WTK and Java 3D performance comparison –Human factors in VR: Methodology and terminology - user performance studies - VR health and safety issues - VR and society

List of Exercises:

1.Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.

2. Add audio and text special effects to the developed application

UNIT V	**APPLICATIONS OF VR**	**6+6**

Medical Application of VR - Virtual anatomy-Triage and diagnostic - Surgery - VR in education - VR and the Arts - Entertainment applications of VR - military VR applications - Army use of VR - VR applications in the Navy - Air force use of VR - Applications of VR in Robotics - Robot programming - Robot teleoperation

List of Exercises:

1.Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.

2.Develop VR/AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.

TOTAL =30+30=60 PERIODS

OUTCOMES:

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

- Understand Augmented Reality.
- Explore different input and output devices used in Virtual Reality system.
- Model the VR system.
- To learn about Google Toolkit’s and Scene Graph.
- Apply VR in various fields.

TEXT BOOKS:

1. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison
Wesley, 2016.
2. Grigore C. Burdea, Philippe Coiffet, “Virtual reality technology”, Wiley, Second Edition,
2017.

REFERENCE BOOKS:

1.Sherman, William R & Craig, Alan B, “Understanding Virtual reality”, Elsevier India Private Limited, Noida, 2018.
2.Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR
experiences for mobile”, Packt Publisher, 2018.

SOFTWARE REQUIREMENTS:

Unity, Maya/3DS MAX/Blender.

22IT954	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Tograspthefundamentalknowledgeofimplementing ComputerGraphicsin2D.
- Togetfamiliar with3DGraphics.
- Tolearntheprocessofimplementationof ComputerGraphicsthroughVulkanAPI.
- Togetfamiliaritywithbasic toadvancedrenderingtechnique.
- To become familiar with Animation and Multimedia systems.

UNIT I	2DGRAPHICS PROCESSING	6+6

Video Display devices -Raster Scan System-Graphics Output Primitives-Open GL Point Functions-Open GL Line Functions-Open GL Curve Functions-Implementation Algorithm for Graphics Primitives & Attributes: Line Drawing Algorithm-Parallel Line Algorithm-Circle Generating Algorithm-Ellipse Generating Algorithm-Two-Dimensional Viewing Pipeline-Clipping Algorithm.

List of Exercises:

1. 2D primitives (points, lines,circle,ellipse,rectangle,arc)
2. Apply basic transformations on the cube including Translation, Rotation, Scaling.

UNIT II	3DGRAPHICS PIPELINE	6+6

Three-Dimensional Geometric transformation: Translation- Rotation- Scaling-Composite Three-Dimensional Transformations-Other Three-dimensional Transformations-Three-dimensional viewing pipeline-Projection Transformations-Orthogonal Projections-Oblique Parallel Projections-Perspective Projections-OpenGL Three-dimensional Viewing Function.

List of Exercises:

1. Drawing 3D primitive “Cube” and show the cube from different camera angles and perspectives.
2. Setting up the camera, lights and performing viewing transformations. Demonstrate a Simple projection transformation for a primitive.

UNIT III	VULKAN GRAPHICSAPI	6+6

Overview of Vulkan-Introduction-Instances, Devices and Queues-The Vulkan Instance-Vulkan Physical Devices-Physical Device Memory-Device Queues-Creating a Logical Device-Object Types and Function Conventions- Enhancing Vulkan: Layers – Extensions-Queues and Commands: Device Queue-Creating Command Buffers-Recording Buffer-Recycling Command Buffers -Moving Data: Managing Resource State.

List of Exercises:

1. Install vulkan sdk with c++ in Visual Studio and set up the work environment
2. Understand different types of shaders in Vulkan

UNIT IV	RENDERING	6+6

Lighting and Shading-Light Matter-Light Sources-The Phong Reflection Model-Texture Mapping-Texture Generation-Global Illumination-Ray Tracing- Radiosity-Parallel Rendering-Volume Rendering- Environment map- Bump mapping- isosurfaces and marching Cubes-Rasterization.

List of Exercises:

1. Applying textures on a Cube
2. Apply textures mapping in geometric objects other than Cube.

UNIT V	**ANIMATION**	**6+6**

Design of Animation Sequences-General Computer animation Function-Raster Animations-Computer Animation Languages-Key Frame System- Morphing-Simulating Acceleration-Motion Specification-Direct Motion Specifications-Goal Directed System-Kinematics & Dynamics.

List of Exercises:

1. Create and animate simple 3D scene with different objects and attributes
2. Perform Rendering with Environment and Bump maps or using other rendering techniques.

TOTAL: 30+30 =60 PERIODS

OUTCOMES:

On Successful completion of the course, Students will be able to

CO1: Implement 2D transformations and algorithms for generating primitives and attributes**.**

CO2: Solveproblemsin 3D transformations andviewing**.**

CO3: Implement the processofopen source Vulkan API.

CO4: Implement rendering techniques and use advanced based rendering.

CO5: Understand the multimedia systems and animation.

TEXT BOOKS:

1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, “Computer Graphics with OpenGL”, Pearson Education, Fourth Edition, 2014.
2. Graham Sellers, John Kessenich, “Vulkan Programming Guide”, 1st Edition, Addison Wesley, 2016.
3. Edward Angel, Dave Shreiner,” Interactive Computer Graphics. A Top-Down Approach with WebGL”, 7th Edition, 2015

REFERENCES:

1. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V, 9th Edition, Addison Wesley, 2016.
2. https://vulkan-tutorial.com

22IT955	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the role of digital marketing in overall marketing strategy.
- To understand website designing and optimization methods in digital marketing.
- To learn about Search Engine Marketing Platforms.
- To understand various Social Media Marketing strategies.
- To understand the concepts of Web Analytics and various types of report generation.

UNIT I	INTRODUCTION TO DIGITAL MARKETING	9

Digital marketing - Importance of digital marketing-Difference between traditional and digital marketing- Digital marketing platforms- recent trends and current scenario of the industry - digital marketing as a tool for students, professionals and businesses-Tools.

UNIT II	WEBSITE DESIGNING AND OPTIMIZATION	9

On Page Optimisation (OPO)- HTML and CSS basics- Meta tags usage- Using Javascript - Contextual interlinking - Microformats & schemas - Off-Page Optimization - Linking Strategies - Competitor Analysis-Sculpting-Link baiting - Social Book Marking and Promotions- Directory submissions -Search Engine Optimization (SEO)- Growth of SEO-Ecosystem of a search engine SEO Tools.

UNIT III	SEARCH ENGINE MARKETING	9

SEM platforms- Google Adwords – Ad creation process- Keyword grouping-Bidding techniques – Site targeting & keyword targeting -Ad approval process – Ad extensions-Site, Demographic targeting, CPC-based, CPA-based & CPM-based accounts

UNIT IV	SOCIAL MEDIA MARKETING	9

Social Media Marketing- Email Marketing- Mobile Marketing - Adsense, Blogging and Affiliate Marketing.

UNIT V	WEB ANALYTICS	9

Introduction to Web Analytics- GA Terminology (Dimensions & Metrics)- Introduction to Reports - Audience Reports, Traffic Sources and Content Reports- Campaign Tagging & Reporting - Dashboard- Linking and Using Data from Google Adwords- Case studies on digital marketing strategies.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the role and importance of digital marketing in a rapidly changing business landscape

CO2: Examine website designing and optimization.

CO3: Analyze the various SEM platforms for digital marketing.

CO4: Discuss the marketing strategies used in social media.

CO5: Analyze the web and generate various types of reports for real time application.

TEXT BOOKS:

1. Seema Gupta, Digital Marketing, McGraw Hill, 2nd Edition, 2020.
2. Subhankar Das, Search Engine Optimization and Marketing a Recipe for Success in Digital Marketing, CRC Press, 2021.
3. Chuck Hemann, Ken Burbary, Digital Marketing Analytics, Pearson, Second Edition, 2019

REFERENCES:

1. Dave Chaffey, Fiona Ellis-Chadwick, Digital Marketing: Strategy, Implementation

and Practice 7th Edition, Pearson, 2019.
2. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaign, Wiley, 2016.
3. Rob Stokes, eMarketing The Essential Guide to Marketing in a digital world, Quirk eMarketing.
4. Shivani Karwal, Digital Marketing Handbook: A Guide to Search Engine Optimization, 2015.
5. Jacobson, Howie, McDonald, Joel and McDonald, Kristie, Google AdWords For Dummies, 3rd Edition, O'Reilly, 2011.
6. http://www.gbv.de/dms/zbw/865712123.pdf
7. https://www.redandyellow.co.za/content/uploads/woocommerce_uploads/2017/10/emarketi ng_textbook_download.pdf

22IT956	HUMAN COMPUTER INTERACTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

TheCoursewillenablelearnersto:

- LearnthefundamentalsofHumanComputer Interaction.
- Becomefamiliarwithdifferentdesignsoftware process
- Learnvariousinteractiondesign model
- Beawareof mobiledesign andweb interfacesin HCI
- Learndifferent communicationand guidelinesforinteraction

UNITI	FOUNDATIONSOFHCI	6 + 6

Input–output channels, Human memory, Thinking: reasoning and problem solving, Emotion,Individual differences, Psychology and the design of interactive systems, Text entry devices,Positioning,pointinganddrawing,Displaydevices,Devicesforvirtualrealityand3Dinteraction,Physical controls,sensors and specialdevices, Paper:printingand scanning.

List of Exercises:

1. Design a user interface for Welcome screen.
2. Design a user interface for calculator.

UNITII	DESIGNSOFTWAREPROCESS	6 + 6

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration andprototyping. HCI in software process: Software life cycle– usability engineering – Prototypingin practice – design rationale. Design rules: principles, standards, guidelines, rules. EvaluationTechniques– UniversalDesign.

List of Exercises:

1. Design a user interface with Layouts for printing the numbers in ascending order and descending order.
2. Design a user interface by applying design rules for assigning a grade to students based on the subject marks.

UNITIII	INTERACTIONDESIGNMODELS	6 + 6

GOMS - CMN-GOMS Analysis, Modeling Structure, State Transition Networks - Three-State Model, Glimpse Model, Physical Models,–Shneideman's eight golden rules, Norman's Sever principles, Norman's model of interaction, Nielsen's ten heuristics, Heuristic evaluation, contextual evaluation, Cognitive walk-through.

List of Exercises:

1. Design a user interface for student registration during admission process.
2. Design a user interface for displaying and changing pictures.

UNITIV	MOBILEHCIANDWEBINTERFACEDESIGN	6 + 6

MobileEcosystem:Platforms,Applicationframeworks-TypesofMobileApplications:Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design:Elements of Mobile Design, Tools. - Case Studies. Designing Web Interfaces – Drag Drop,Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - CaseStudies.

List of Exercises:

1. Design a user interface with widgets for end semester exam registrations.
2. Design forms using drag and drop option.

UNITV	COMMUNICATION	6 + 6

Face-to-faceCommunication,Conversation,Text-basedCommunication,Groupworking,Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics,Dialoganalysisanddesign:Groupware,Meetinganddecisionsupportsystems,Sharedapplications and artifacts, Frameworks for groupware Implementing synchronous groupware,Mixed,Augmented andVirtual Reality.

List of Exercises:

1. Design a user interface with Overlays and Inlays for menu-based application.
2. Mini Project.

TOTAL: 30+30=60PERIODS

OUTCOMES:

Attheendofthiscourse,thestudentswillbeableto:

CO1: Enumeratethebasicconcepts ofhuman,computerinteractions

CO2: Inspectsoftwaredesignprocessinhumancomputerinteraction

CO3: Examinevariousmodelsandtheoriesrelated tohumancomputerinteraction

CO4: Buildmeaningful userinterface

CO5: Establishthedifferentlevelsofcommunicationacrosstheapplicationstakeholders.

TEXTBOOKS:

1. ADix,JanetFinlay,GDAbowd,RBeale.,Human-ComputerInteraction,3rdEdition,PearsonPublishers,2008.
2. BrianFling,MobileDesignandDevelopment, FirstEdition,O‘ReillyMediaInc.,20093.BillScottandTheresaNeil,—DesigningWeb Interfaces‖, FirstEdition,O‘Reilly,2009.

REFERENCES:

1. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies forEffective, 2017..
2. Human Computer Interaction, 5th Edition, Pearson Publishers, 2010.Hans-Jorg Bullinger,”Human-ComputerInteraction”,LawrenceErlbaumAssociates,Publishers.

SOFTWARE REQUIREMENTS:

Front End: Java, .NET

Back End **:**MySQL

22IT958	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state of the artvfx techniques
- To become familiar with popular compositing techniques

UNIT I	ANIMATION BASICS	9

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II	CGI, COLOR, LIGHT	9

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT III	SPECIAL EFFECTS	9

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire.

UNIT IV	VISUAL EFFECTS TECHNIQUES	9

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving.

UNIT V	COMPOSITING	9

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: To implement animation in 2D / 3D following the principles and techniques.

CO2: To use CGI, color and light elements in VFX applications.

CO3: To create special effects using any of the state of the art tools.

CO4: To apply popular visual effects techniques using advanced tools.

CO5: To use compositing tools for creating VFX for a variety of applications.

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

REFERENCES:

1. Jon Gress, "Digital Visual Effects and Compositing", New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.

22IT958	GAME DESIGN (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To Understand the Fundamental principles of Game Design and Development.
- To know the importance and application of Game AI.
- To learn the detailed processes of typical Game Engine.
- To Implement simple 2D games using the design and development process learnt.
- To Implement simple 3D games using the design and development process learnt.

UNIT I	GAME DESIGN FUNDAMENTALS	6+6

Role of Game Designer, Structure of Games, major genres, game concepts, game worlds, working with formal elements, dramatic elements and system dynamics, storytelling, game play, core mechanics, game balancing, principles of Level Design, Conceptualization, prototyping, playtesting.

UNIT II	GAME AI	6+6

Game AI, AI model, algorithms for Movement, Path finding, Decision making, Tactical and Strategic AI, Procedural Content Generation, Board Games

UNIT III	GAME ENGINE	6+6

Rendering engine and pipeline, Scene Graph, Level of Detail, sorting, Animation Systems, Collision and Rigid Body dynamics.

UNIT IV	2D GAME DESIGN AND IMPLEMENTATION	6+6

GoDot game engine Designing and Prototyping a simple 2D Game, including character design, storytelling, levels. Implementing the Game in pygame or Godot engine or equivalent.

UNIT V	3D GAME DESIGN AND IMPLEMENTATION	6+6

Designing and Prototyping a simple 3D Game, including character design, storytelling, levels. Implementing the Game in pygame or Godot engine or Blender or equivalent.

TOTAL: 30+30 PERIODS

LIST OF EXERCISES:

(Note: Students can work in small teams of 2 or 3 for the experiments)

1. Install any Game Engine (Ex: Godot engine / equivalent) and understand the features and functions.

2. Install Blender and learn some basic 3D graphics including rendering pipeline, textures, coordinate systems, lighting, simple animation

3. Experiment with creating and importing simple 2D / 3D characters, into the work environment

4. Design and document a simple 2D game, following the principles of game design, including genre, characters, game world, characters, game mechanics, levels.

5. Implement the 2D game using pygame / equivalent tools.

6. Implement any simple path finding algorithm and incorporate the same in the 2D game.

7. Implement any other simple AI techniques, to the game

8. Design and document a simple 3D game, following the principles of game design, including genre, characters, game world, characters, game mechanics, levels.

9. Implement the 3D game using Blender / equivalent tools.

10. Evaluate the design and the implementation of the games.

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Use the Fundamental principles of Game Design and Development in context
CO2: Able to apply AI techniques in Game Design and Development ·
CO3: Thoroughly understand the detailed processes of the Game Engine ·
CO4: Design and Implement simple 2D games using the design and development process learnt.
CO5: Design and Implement simple 3D games using the design and development process learnt.

TEXT BOOKS:

1. Ernest Adams, “Fundamentals of Game Design”, 3rd Edition, Pearson Education, 2015.
2. Ian Millington, “AI for Games”, CRC Press, 3 rd edition, 2019.
3. Jung Hyun Han, “3D Graphics for Game Programming”, Delmar Cengage Learning, 2011.

REFERENCES:

1. Tracy Fullerton: Game Design Workshop, A Play centric Approach to Creating Innovative Games, 4 th Edition, CRC Press, 2018.
2. Jason Gregory, “Game Engine Architecture”, CRC Press, Third Edition, 2018.
3. Ernest Adams and Joris Dormans, “Game Mechanics: Advanced Game Design”, New Riders Press, 2012.
4. Jesse Schell, “The Art of Game Design, A Book of Lenses”, Third Edition, CRC Press, 2019.
5. Sanjay Madhav, “Game Programming in C++: Creating 3D Games”, Addison-Wesley Professional; 1st edition

SOFTWARE REQUIREMENTS:

Blender, Unity, Unreal Engine

22IT959	DESIGN PROGRAMMING	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Provide an idea about Blender interface
- Impart a good understanding of materials and textures.
- Gain clear knowledge on Nurbs and meta shapes.
- Attain insight on Unity Scripts.
- Understand decision making in games.

UNIT I	BLENDER INTERFACE AND NAVIGATION	9+6

3D Modeling-The blender Screen- The user preferences window-preset Interface arrangements- The 3D window-Window Modes-Layers-Moving in 3D space-Blender View menu, Controls, windows-Navigation- Creating and editing Objects

List of Exercises:

1. Create and edit an object using Blender.
2. Navigate an object in 3D using Blender.

UNIT II	MATERIALS AND TEXTURES	9+6

Material settings -Material Buttons, Colors- Textures-Texture Mapping-Unwrapping with Seams-Texture Paint-World Settings-Lighting and Cameras-Rendering and Ray Tracing

List of Exercises:

1. Formulate 3D scene from primitives.
2. Apply Materials and Textures to an 3D object using blender.

UNIT III	NURBS AND META SHAPES	9+6

Introduction to 3D Text-Creating 3D Text in Blender-Converting Text to Mesh Object-Converting text to a curve-Modifiers-Modifiers for generating, deforming, Simulating.

List of Exercises:

1. Converting Text to Mesh Object using blender
2. With Blender, Convert text to a Curve

UNIT IV	UNITY SCRIPTS	9+6

Basic C# scripting- Introducing scripting in unity- Method instead of function - Introducing Classes -Passing values between the classes - Using objects and classes in game script-Understanding component property in scripts - Displaying public variables in inspector panel - Multi-word variable names- Common – built – in variable types - Variable scopes.

List of Exercises:

1. Integration of 3D Assets into Unity.
2. Create Scripts to control the movement of game Assets

UNIT V	DECISION MAKING IN GAMES	9+6

Condition testing using if statement - Usage of for each loop -Usage of while loop - Storing game objects in array -Storing game objects in list- Using dot syntax in unity script - Accessing components own variables and methods - Accessing another game objects and its components.

List of Exercises:

1. Construct a GUI in the Game Engine to interact with the Game Assets
2. Design and animate a game character in Unity

TOTAL: 45+30=75 PERIODS

OUTCOMES:

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

CO1: Learn about Blender interface

CO2: Understand Texture Mapping and Rendering

CO3: Analyse Text to Mesh Object and Curve conversion

CO4: Know the scripting fundamentals

CO5: Understand accessing game objects

TEXT BOOKS:

1. John M.Blain ,"Complete guide to blender graphics",4th edition, Taylor & Francis publications, 2020.
2. Terry Norton, "Learning C# by Developing Games with Unity 3D Beginner's Guide", second edition, Packt Publishing Limited, 2013.

REFERENCES:

1. Lee ZhiEng,"Building a Game With Unity and Blender",1st Edition , Packt Publishing Limited , 2015.
2. Michelle Menard, "Game development with unity", 2nd edition, Cengage Learning PTR, 2015.
3. VahéKaramian," Introduction to Game Programming:Using C# and Unity 3D", Noorcon Inc.2016
4. Michelle Menard, Bryan Wagstaff,"Game development with Unity", Cengage Learning, 2015.

SOFTWARE REQUIREMENTS:

1.Unity

2.Blender

22IT923	COMPUTER GRAPHICS FOR VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
- To learn the basic principles of 3-dimensional computer graphics.
- Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

UNIT I	GRAPHICS SYSTEM AND MODELS	9

Graphics system and models: applications of computer graphics, graphics system, physical and synthetic images, imaging systems, graphics architectures.

UNIT II	GEOMETRIC OBJECTS AND TRANSFORMATIONS	9

Geometric objects and transformations: scalars, points and vectors, three-dimensional primitives, coordinate systems and frames, frames in OpenGL, matrix and vector classes, modelling a colored cube, affine transformations - translation, rotation and scaling, transformations in homogeneous coordinates, concatenation of transformations, transformation matrices in OpenGL, interfaces to 3D applications, quaternion.

Vertices to fragments: basic implementation strategies, four major tasks, clipping - line clipping, polygon clipping, clipping of other primitives, clipping in three dimensions, polygon rasterization, hidden-surface removal, antialiasing, display considerations.

UNIT III	HIERARCHICAL MODELLING	9

Lighting and shading: light and matter, light sources, the Phong reflection model, computation of vectors, polygonal shading, approximation of a sphere by recursive subdivision, specifying lighting parameters, implementing a lighting model, shading of the sphere model, per-fragment lighting, global illumination.

Hierarchical modelling: symbols and instances, hierarchical models, a robot arm, trees and traversal, use of tree data structures, other tree structures, scene graphs,

open scene graph.

UNIT IV	ADVANCED RENDERING	9

Discrete techniques: buffers - digital images - writing into buffers - mapping methods - texture mapping - texture mapping in OpenGL - texture generation - environment maps - reflection map - bump mapping - compositing techniques - sampling and aliasing.

Advanced rendering: going beyond pipeline rendering - ray tracing - building a simple ray tracer - the rendering equation - radiosity - Renderman - parallel rendering - volume rendering - Isosurfaces and marching cubes - mesh simplification - direct volume rendering - image-based rendering, volume rendering – Iso surfaces and marching cubes - mesh simplification - direct volume rendering - image-based rendering

UNIT V	VR MODELLING LANGUAGE	9

Fractals: modelling - Sierpinski Gasket - coastline problem - fractal geometry - fractal dimension - recursively defined curves - Koch curves - c curves - dragons - space filling curves - turtle graphics - grammar based models - Graftals - volumetric examples - k- midpoint subdivision - fractal Brownian motion - fractal mountains - iteration in the complex plane - Mandelbrot set.

Virtual reality modelling language: introduction, exploring and building a world, building object, lighting, sound and complex shapes, animation and user interaction, colors, normals and textures, nodes references. Special applications: stereo display programming, multiport display systems, multi-screen display system, fly mode navigation, walk through navigation, virtual track ball navigation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the basic concepts and theories in computer graphics to understand their application and significance.

CO2: Develop algorithms for scan conversion, geometric transformations, area filling, and clipping, demonstrating an advanced understanding of their implementation and performance.

CO3: Synthesize the fundamentals of animation, virtual reality, and related technologies to propose innovative applications and solutions.

CO4: Design a comprehensive application using the principles of virtual reality, integrating various computer graphics techniques and animation fundamentals.

CO5**:** Assess the effectiveness and efficiency of different algorithms and techniques in computer graphics and justify the choice of specific methods for various applications.

CO6**:** Formulate strategies to enhance virtual reality applications by incorporating emerging technologies and advanced computer graphics methods.

TEXTBOOKS:

1. Rajesh K. Maurya, Computer Graphics with Virtual Reality System, John Wiley & Sons.
2. Edward Angel, “Interactive Computer Graphics: A Top-Down Approach Using OpenGL”, Addison-Wesley.
3. Foley James D, Van Dam, Feiner and Hughes, “Computer Graphics: Principles and Practice”, Pearson Education.
4. Donald Hearn and Pauline Baker, “Computer Graphics C Version”, Pearson Education.

22IT924	CONCEPTS OF VIRTUAL AND AUGMENTED REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- To make students know the basic concept and framework of virtual reality.
- To teach students the principles and multidisciplinary features of virtual reality.
- To teach students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behaviour.
- To teach students the technology for managing large scale VR environment in real time.
- To provide students with an introduction to the VR system framework and development tools.

UNIT I	VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS	9

Virtual reality and virtual environments: the historical development of VR, scientific landmarks computer graphics, real-time computer graphics, virtual environments, requirements for VR, benefits of virtual reality. Hardware technologies for 3D user interfaces: visual displays, auditory displays, haptic displays, choosing output devices for 3D user interfaces.

UNIT II	3D USER INTERFACE INPUT HARDWARE	9

3D user interface input hardware: input device characteristics, desktop input devices, tracking devices, 3d mice, special purpose input devices, direct human input, home - brewed input devices, choosing input devices for 3D interfaces.

Software technologies: database - world space, world coordinate, world environment, objects - geometry, position / orientation, hierarchy, bounding volume, scripts and other attributes, VR environment - VR database, tessellated data, LODs, Cullers and Occluders, lights and cameras, scripts, interaction - simple, feedback, graphical user interface, control panel, 2D controls, hardware controls, room / stage / area descriptions, world authoring and playback, VR toolkits, available software in the market.

UNIT III	3D INTERACTION TECHNIQUES	9

3D interaction techniques: 3D manipulation tasks, manipulation techniques and input devices, interaction techniques for 3D manipulation, design guidelines – 3D travel

tasks, travel techniques, design guidelines - theoretical foundations of wayfinding, user centered wayfinding support, environment centered wayfinding support, evaluating wayfinding aids, design guidelines - system control, classification, graphical menus, voice commands, Gestrual commands, tools, mutimodal system control techniques, design guidelines, case study: mixing system control methods, symbolic input tasks, symbolic input techniques, design guidelines, beyond text and number entry.

UNIT IV	**3D USER INTERFACES DESIGN**	**9**

Designing and developing 3D user interfaces: strategies for designing and developing guidelines and evaluation.

Advances in 3D user interfaces: 3D user interfaces for the real world, AR interfaces as 3D data browsers, 3D augmented reality interfaces, augmented surfaces and tangible interfaces, agents in AR, transitional AR-VR interfaces - the future of 3D user interfaces, questions of 3D UI technology, 3D interaction techniques, 3d UI design and development, 3D UI evaluation and other issues.

UNIT V	**VR APPLICATIONS**	**9**

Virtual reality applications: engineering, architecture, education, medicine, entertainment, science, training.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Evaluate the hardware and software requirements necessary for VR systems.

CO2: Synthesize various intersection techniques to optimize performance in virtual environments.

CO3: Design 3D interfaces that enhance user interaction and experience.

CO4: Develop advanced VR applications with practical i implementation.

CO5: Assess the effectiveness of VR applications through comprehensive testing and user feedback.

CO6: Formulate strategies to integrate emerging technologies into existing VR f frameworks to improve functionality.

TEXTBOOKS:

1. Paul Mealy, Virtual & Augmented Reality for Dummies, John Wiley & Sons.

2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann.
3. Jan Erik Solem, Programming Computer Vision with Python, Shroff Publisher/O’Reilly Publisher

REFERENCES:

1. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA

22IT925	MOBILE VR AND AI IN MODULEY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- To give students hands-on exposure to mobile virtual reality in Moduley.
- To give students experience with basic AI algorithms in virtual reality.
- To provide students with fundamentals of game designs in virtual reality.

UNIT I	INTRODUCTION TO MODULEY	9

Introduction to Moduley, Moduley Editor, Moving a Cube, Lights, Particle Systems, Applying Physics, and Moduley Asset Store, C# Coding Introduction, Variables, Methods, If Blocks, Loops, Hello Mammoth, User Interaction in Moduley, Inputs Introduction Preview, Key Presses, Moving a Player, Jumping, Moving Forward, Cycling Cameras, Prefabs Introduction, What are Prefabs?, Instantiating Objects, Random Angles, Destroying Objects, Explosion Effects, Adding Explosion Effects

UNIT II	MODULEY OPERATION	9

Developing a Path finding Game, How to Set Up a Project, Node, String Map, A* Algorithm Setup, A* Algorithm Loop, Auxiliary Methods, Finishing the Algorithm, Importing 2D Assets, Building a Level, From Console to Visual, Adding Tanks, Identifying Nodes, Moving the Tank, Visually Moving Tank, Smooth Movement, Smooth Rotation, Ordering Tank to Move, Speeding up Player, Spawning Logic, Crate Visuals, Adding Crates to Valid Positions, Collecting Crates, Score Counting, Game Interface, Starting the Game, Game Over Screen, Scoring, Sounds.

UNIT III	VR INTRODUCTION	9

VR Introduction - Moduley, Activating VR, Building a Castle, Camera Changing Position, Lowering Castle Doors, Triggering Events Interface, Blender, Download and Install Blender, Introduction & Customizing Settings, Controlling Blender Camera, Emulate Numpad Camera, Manipulating Objects, Common Tools, Mirroring 1 Side of Object. Case Study: Flappy bird Moduley game, First person shooter game, Kart Moduley game

UNIT IV	MODULEY IN MACHINE LEARNING	9

Introduction to Moduley- ML, Why Machine Learning, different kinds of learnings, Neural Networks (NNs), Training a NN, Optimizer, Convolutional layers, Transfer learning,

Imitation learning in Moduley, Training the kart in kart game via IL, Testing the drive.		
UNIT V	**REINFORCEMENT LEARNING**	**9**
Introduction to Reinforcement Learning in Moduley-ML, Reinforcement Learning, Initial state, training a policy, The PPO algorithm, Evolutional Strategies, Reward, training a kart in the kart game with RL, Tensor board analysis, Testing results		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:

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

CO1: Develop advanced coding solutions for game development using Moduley C# through the application of complex programming concepts and techniques.

CO2: Critically analyze and evaluate the principles of game design to create engaging and innovative game experiences.

CO3: Implement and optimize AI algorithms (A*, IL, and RL) in Moduley-ML to enhance game mechanics and player interactions.

CO4: Design and prototype original games that integrate sophisticated AI behaviors and dynamic game design elements.

CO5: Assess the effectiveness of different AI algorithms in gaming scenarios and justify the choice of algorithms for specific game mechanics.

CO6: Formulate and execute comprehensive testing strategies to ensure the functionality, performance, and user engagement of game projects developed in Moduley C# and Moduley-ML.

TEXTBOOKS:

1. Linowes, J., & Schoen, M. (2016). Cardboard VR Projects for Android. Packt Publishing Ltd.
2. Lanham, M. (2019). Hands-On Deep Learning for Games: Leverage the power of neural networks and reinforcement learning to build intelligent games. Packt Publishing Ltd.
3. Aversa, D., Kyaw, A. S., & Peters, C. (2018). Moduley Artificial Intelligence Programming: Add powerful, believable, and fun AI entities in your game with the power of Moduley 2018! Packt Publishing Ltd.

VERTICAL V

FINTECH and WEB 3.0

22IT912	BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners:

- To understand how blockchain systems (mainly Bitcoin and Ethereum) work
- To securely interact with them
- To design, build, and deploy smart contracts and distributed applications,
- To integrate ideas from blockchain technology into their own projects.

UNIT I	INTRODUCTION	9

What is Blockchain, Types of Block Chain, What is Distributed Ledgers, Consensus Algorithm, Blocks, Transaction, Double spending etc Hashing Techniques, Block Hashing, Distributed Ledgers vs Centralised Controls Ledgers. What is BitCoin, how it works, public ledgers, Miners roles, Pros and Cons.

UNIT II	CONSENSUS ALGORITHMS	9

Consensus Algorithms - Proof of Work, Proof of Stake, practical Byzantine Fault Tolerance (pBFT), Istanbul Byzantine Fault Tolerant, Proof of Burn, Proof of Capacity, Proof of Elapsed Time Understanding between Permissioned vs Permission less Block Chain platforms - Data privacy - Authorization - Multi Partner Setup - Private Channels.

UNIT III	ETHEREUM AND SOLIDITY	9

Solidity Introduction and Installation, Strings, Variables, Struct, Enums, Map, Events, Conversions, Ether Units, Payable, View, Pure Functions, Address, Functions, Function Modifiers, Fall back Function, Math and Crypto Functions, Object Oriented and Error Handling Understanding on EVM, Remix, Gas/Gas-limit, Accounts, Address, Ethereum Value.

UNIT IV	ETHEREUMS DAAPS DEVELOPMENT	9

Installation of NodeJS -- Truffle suite -- Ganache -- Metamask -- Visual Studio Code Edition -- Solidity Compiler -- React Web Application Design and Development of Web3 Apps using Daap Applications using Solidity on Ethereum Platform.

UNIT V	REACT BASED WEB APPLICATION	9

The solution will have React based web application as front end, which will communicate with deployed Smart Contracts via Web3js package. Use Case - Academics, Financial Domain, Life Science Domain.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Apply the basic concepts and technology used for blockchain

CO2 : Illustrate the concepts of Bitcoin and their usage

CO3 : Demonstrate the concepts of Consensus Algorithm

CO4: Implement Ethereum blockchain contract.

CO5 : Implement web3 apps using Solidity on Ethereum Platform

CO6 : Apply smart contract in real world applications

TEXTBOOKS:

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.
2. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, “Blockchain Applications: A Hands On Approach”, VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, “Mastering Bitcoin”, O”Reilly, 2014.
3. Roger Wattenhofer, “The Science of the Blockchain” Create Space Independent Publishing, 2016.
4. Alex Leverington, “Ethereum Programming” Packt Publishing, 2017.

22IT913	INTRODUCTION TO FINTECH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand how finance and technology have evolved and are transforming finance around the world
- Discuss major technological trends, including cryptocurrencies, Blockchain, AI and Big Data

UNIT I	INTRODUCTION	9

FinTech: Introduction– FinTech Evolution: Infrastructure, Collaboration between Financial Institutions and Start-ups –FinTech Typology – Emerging Economics: Opportunities and Challenge – Introduction to Regulation Industry.

UNIT II	PAYMENTS	9

Payments, Crypto currencies and Blockchain – Introduction – Individual Payments – Digital Financial Services – Mobile Money – Regulation of Mobile Money – SFMS – RTGS – NEFT –NDS Systems – Crypto currencies – Legal and Regulatory Implications of Crypto currencies –Blockchain – The Benefits from New Payment Stacks

UNIT III	DIGITAL FINANCE	9

Digital Finance and Alternative Finance -Introduction – Brief History of Financial Innovation – Digitization of Financial Services – FinTech & Funds- Crowd funding– Regards, Charity and Equity – P2P and Marketplace Lending – New Models and New Products – ICO

UNIT IV	FINTECH REGULATIONS	9

FinTech Regulation and RegTech -Introduction – FinTech Regulations Evolution of RegTech – RegTech Ecosystem: Financial Institutions – RegTech Ecosystem Ensuring Compliance from the Start: Suitability and Funds – RegTech Startups: Challenges –RegTech Ecosystem: Regulators Industry –Use Redesigning Better Financial Infrastructure

UNIT V	FUTURE OF FINTECH	9

Data & Tech – Introduction– Data in Financial Services –Application of Data Analytics in Finance – Methods of Data Protection – How AI is Transforming the Future of FinTech –Digital Identity –

Change in mindset: Regulation 1.0 to 2.0 (KYC to KYD) – AI & Governance – New Challenges of AI and Machine Learning – Challenges of Data Regulation.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student will be able to

CO1: Understand the challenges and opportunities in FinTech industry

CO2: Describe how Artificial Intelligence, Big Data, Crypto currencies and Block chain is changing the Financial World.

CO3: Explain the recent developments in digital financial services.

CO4: Analyse the progress of FinTech Regulations.

CO5: Study the future of FinTech Industry

TEXTBOOKS:

1.Susanne Chishti and Janos Barberis, “The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries”, John Wiley, 1st Edition, 2016

2.Theo Lynn, John G. Mooney, Pierangelo Rosati, Mark Cummins, “Disrupting Finance: FinTech and Strategy in the 21st Century”, Palgrave, 1st edition, 2018

References:

1.Abdul Rafay, “FinTech as a Disruptive Technology for Financial Institutions”, IGI Global, January, 2019

22IT914	BITCOIN AND CRYPTOCURRENCY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable learners to:

- To get acquainted with the concept of Block and Blockchain.
- To learn the concepts of consensus and mining in Blockchain.
- To get familiar with the bitcoin currency and its history.
- To understand and apply the concepts of keys, wallets and transactions in the Bitcoin Network
- To acquire the knowledge of Bitcoin network, nodes and their roles.
- To analyze the applications& case studies of Blockchain.

UNIT I	INTRODUCTION TO BLOCKCHAIN	9

Structure of a Block, Block Header, Block Identifiers: Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Blockchain, Merkle Trees and Simplified Payment Verification (SPV).

UNIT II	CONSENSUS AND MINING	9

Decentralized Consensus, Byzantine General's Problem, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Constructing the Block header, Mining the Block, Successfully Mining the Block, Validating a New Block, Assembling and Selecting Chains of Blocks, Block chain Forks

UNIT III	INTRODUCTION TO BITCOIN	9

Bitcoin and the history of Bitcoin, Getting the first bitcoin, finding the current price of bitcoin and sending and receiving bit coin, Bitcoin Transactions.

UNIT IV	CONCEPTS OF BITCOIN	9

Keys and addresses, Wallets and Transactions: Public Key Cryptography and Crypto currency, Private and Public Keys, Bitcoin Addresses, Base58 and Base58Check Encoding, Nondeterministic (Random) Wallets, Deterministic (Seeded) Wallets, HD Wallets (BIP-32/BIP-44), Wallet Best Practices, Using a Bit coin Wallets, Transaction Outputs and Inputs, Transaction Fees, Transaction Scripts and Script Language, Turing Incompleteness, Stateless Verification, Script Construction (Lock + Unlock), Pay-to-Public-Key-Hash (P2PKH), Bitcoin Addresses, Balances, and Other Abstractions

UNIT V	BITCOIN NETWORKS	9

Peer-to-Peer Network Architecture, Node Types and Roles, Incentive based Engineering The Extended Bitcoin Network, Bitcoin Relay Networks, Network Discovery, Full Nodes, Exchanging “Inventory”, Simplified Payment Verification (SPV) Nodes, Bloom Filters, SPV Nodes and Privacy, Encrypted and Authenticated Connections, Transaction Pools

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe the basic concept of Blockchain

CO2: Associate knowledge of consensus and mining in Blockchain

CO3: Summarize the bitcoin crypto currency at an abstract level.

CO4: Apply the concepts of keys, wallets and transactions in the Bitcoin network

CO5: Interpret the knowledge of Bitcoin network, nodes and their roles.

CO6: Illustrate the applications of Blockchain and analyze case studies.

TEXTBOOKS:

1. “Mastering Bitcoin, Programming The Open Blockchain” , 2nd Edition by Andreas M. Antonopoulos, June 2017, Publisher(s): O'Reilly Media, Inc. ISBN: 9781491954386.
2. Blockchain Applications: A Hands-On Approach”, by Arshdeep Bahga, Vijay Madisetti, Paperback – 31 January 2017.
3. “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, July 19, 2016, by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Gold feder, Princeton University Press

REFERENCES:

1. **“**Mastering Blockchain”, by Imran Bashir, Third Edition,Packt Publishing
2. **“**Mastering Ethereum: Building Smart Contracts and Dapps Paperback” byAndreas Antonopoulos, Gavin Wood, Publisher(s): O'Reilly Media
3. “Blockchain revolution: how the technology behind bitcoin is changing money, business and the world $ don tapscott and alex tapscot, portfolio penguin, 856157449

22IT915	BLOCKCHAIN DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners:

1. To understand Ethereum Ecosystem.
2. To understand aspects of different programming languages.
3. To explain how to use the solidity programming language to develop a smart contract for blockchain.
4. To demonstrate deployment of smart contracts using frameworks.
5. To understand principles of Hyperledger fabric.
6. To understand challenges to apply blockchain in emerging areas.

UNIT I	ETHEREUM ECOSYSTEM	9

Ethereum components: miner and mining node, Ethereum virtual machine, Ether, Gas, Transactions, accounts, swarm and whisper, Ethash, end to end transaction in Ethereum, architecture of Ethereum

UNIT II	BLOCKCHAIN PROGRAMMING	9

Types of Blockchain Programming, Solidity, GoLang, Vyper, Java, Simplicity, Rholang, Game Theory and Cryptonomics, Comparative study of different blockchain programming languages Decentralized file system-IPFS

UNIT III	SMART CONTRACT	9

Solidity programming, Smart Contract programming using solidity, mapper function, ERC20 and ERC721 Tokens, comparison between ERC20 & ERC721, ICO, STOMetamask (Ethereum Wallet), setting up development environment, use cases of smart contract, smart Contracts: Opportunities, Risks

UNIT IV	BLOCKCHAIN DEPLOYMENT	9

Ethereum client, Ethereum Network, Introduction to Go Ethereum (Geth), Geth Installation and Geth CLI, Setting up a Private Ethereum Blockchain. Introduction to Truffle, Smart Contract deployment on a Private Blockchain. Introduction to Ganache. Introduction to Dapp, Dapp architecture, Daaps Scalability, testing. Connecting to the Blockchain and Smart Contract,Web3js, Deployment

UNIT V	HYPERLEDGER APPLICATION DEVELOPMENT	9

Installing Hyper ledger Fabric, Hyperledger Fabric Network, Building Your First

Network, Hyperledger Fabric Demo, Hyperledger Fabric Network Configuration, Certificate Authorities, Chaincode Development and Invocation, Deployment and testing of chain code on development network, Hyperledger Fabric Transactions.

Integrating Block chain with cloud, IoT, AI, ERP, End to end block chain integration, Risks and Limitations of Block chain: Privacy & Security. Criminal Use of Payment Blockchains, The “Dark” Side of Block chain

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand Ethereum Components.

CO2: Analyze different blockchain programming languages.

CO3: Implement smart contract in Ethereum using solidity

CO4: Analyze different development frameworks.

CO5: Implement private blockchain network with Hyperledger fabric.

CO6: Illustrate blockchain integration with emerging technologies and security issues.

TEXTBOOKS:

1. Andreas M. Antonopoulos Dr. Gavin Wood, Mastering Ethereum, Building Smart Contract and Dapps, O'reilly.
2. Chandramouli Subramanian, Asha A George, Abhillash K. A and Meena Karthikeyen, Blockchain Technology, Universities press

REFERENCES:

1. Vikram Dhillon,,Devid Metcalf,Max Hooper,Blockchin enabled Applications, A press
2. NarayanPrusty, Packt , Building Blockchain Projects

22IT916	DECENTRALIZED FINANCE (DeFi)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

1. Learn basic concepts of Centralized and Decentralized Finance and compare them.
2. Understand DeFi System and its key categories
3. Explore DeFi components, primitives, incentives, metrics and major business models where they are used
4. Understand DeFi Architecture and Eco System
5. Learn DeFi protocols.
6. Learn real time use cases of DeFi.

UNIT I	CENTRALIZED AND DECENTRALIZED FINANCE	9

Difference between Centralized and Decentralized Finance, Traditional Financial Institution- Banks: 1. Payment and Clearance systems, 2.Accessibility,3. Centralization and Transparency, Decentralized Finance Vs Traditional Finance

UNIT II	DECENTRALIZED FINANCE (DEFI)	9

The DeFi Ecosystem, Problems that DeFi Solves How Decentralized is DeFi? Defi key Categories:- Stable coins, Stable coin and pegging, Lending and Borrowing, Exchanges, Derivations, Fund Management, Lottery, Payments, Insurance

UNIT III	DEFI PRIMITIVES AND BUSINESS MODELS	9

DeFi Components: Blockchain Cryptocurrency The Smart Contract Platform Oracles Stable coins Decentralized Applications. DeFi Primitives: Transactions Fungible Token: Equity Tokens, Utility Tokens and Governance Tokens NFT: NFT Standard, Multi-token standard Custody Supply Adjustment: Burn-Reduce Supply, Mint-Increase Supply, Bonding Curve-Pricing Supply. Incentives: Staking Rewards, Slashing, Direct Rewards and Keepers, Fees. Swap: Order Book Matching, Automated Market Makers. Collateralized Loans Flash Loans (Uncollateralized Loans).

DeFi Major Business Models: Decentralized Currencies ,Decentralized Payment Services, Decentralized fundraising, Decentralized Contracting

UNIT IV	DEFI ARCHITECTURE AND ECOSYSTEM	9

DeFi Architecture: Consumer Layer: Block chains, Cross-Block chain networks, Oracles, Digital Asset Layer: Crypto currencies, Infrastructure Layer: Wallets and Asset Management, DEXes and Liquidity, Lending and Borrowing, Prediction Markets, Synthetic Assets, Insurance DeFi Eco System and Protocols: On-chain Asset Exchange, Loanable Fund Markets on-chain assets, Stable coins, Portfolio, DeFi Risk and Challenges: Technical Risks, Usability Risks, Centralization Risks, Liquidity Risks, Regulation Risk

UNIT V	DEFI DEEP DIVE	9

Maker DAO: Maker Protocol: Dai Stable coins, Maker Vaults, Maker Protocol Auctions. Maker Actors: Keepers, Price Oracles, Emergency Oracles, DAO Teams, Dai Savings Rate. Dai Usecase Benefits and Examples UniSwap: UniSwap Protocol Overview: How UniSwap Works, Eco System Participants, Smart Contracts

UniSwap Core Concepts: Swaps, Pools, Flash Swaps, Oracles. Compound: Compound Protocol: Supplying Assets, Borrowing Assets,

Interest Rate Model

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the basic concepts of Centralized and Decentralized Finance and Compare them.

CO2: Compare the the DeFi System and its key categories.

CO3: Evaluate the DeFi components, primitives, incentives, metrics and major business models where they are used.

CO4: Interpret the DeFi Architecture and EcoSystem.

CO5: Analyze the DeFi protocols.

CO6: Implement the real time use cases of DeFi.

TEXTBOOKS:

1. How to DeFi,Darren Lau, Daryl Lau, Teh Sze Jin,Kristian Kho, Erina Azmi, TM Lee,Bobby Ong-1st Edition, March 2020
2. DeFi and the Future of Finance-Campbell R. Harvey
3. DeFi Adoption 2020 A Definitive Guide to Entering the Industry

REFERENCES:

1. Blockchain disruption and decentralized finance: The rise of decentralized business models-Yan Chen,Cristiano Bellavitis

2. SoK: Decentralized Finance (DeFi)-Sam M. Werner, Daniel Perez, Lewis Gudgeon,Ariah Klages-Mundt,Dominik Harz∗‡, William J. Knottenbelt,Imperial College London, † Cornell University, Interlay

22IT927	FUNDAMENTALS OF BLOCKCHAIN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- The students should be able to understand a broad overview of the essential concepts of blockchain technology.
- To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.
- Students should be able to learn about different types of blockchain and consensus algorithms.

UNIT I	INTRODUCTION	9

The Double-Spend Problem, Byzantine Generals' Computing Problems, Public- Key Cryptography, Hashing, Distributed Systems, Distributed Consensus.

UNIT II	BITCOIN BLOCKCHAIN	9

Structure, Operations, Features, Consensus Model, Incentive Model.

UNIT III	ETHEREUM BLOCKCHAIN	9

Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.

UNIT IV	TIERS OF BLOCKCHAIN TECHNOLOGY	9

Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains.

UNIT V	TYPES OF CONSENSUS ALGORITHMS	9

Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain Use Case: Supply Chain Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Evaluate the fundamental principles and architecture of distributed systems.

CO2: Analyze the operation and security implications of an immutable distributed ledger and the trust model underpinning blockchain technology.

CO3: Design and construct blockchain platforms by integrating and optimizing their essential components.

CO4: Assess the performance and scalability of various blockchain platforms through detailed case studies and simulations.

CO5: Develop innovative solutions to enhance the functionality and security of blockchain systems.

CO6: Formulate and justify strategies for the deployment and management of blockchain technology in real-world applications.

TEXTBOOKS:

1. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.
2. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
3. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).

REFERENCES:

1. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st edition (2015).
2. Mastering Bitcoin: Programming the Open Blockchain by Andreas Antonopoulos.

22IT928	SMART CONTRACTS AND SOLIDITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- Students should be able to understand the concept of smart contracts related to blockchain.
- Students should be able to understand the smart contract higher-level language Solidity and apply it to create smart contracts.
- Students should be able to learn Truffle IDE for creating and deploying a DApp.

UNIT I	SMART CONTRACTS	9

Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum Higher-Level Languages.

UNIT II	DEVELOPMENT ENVIRONMENT	9

Building A Simple Smart Contract with Solidity, Solc- Compiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.

UNIT III	INTRODUCTION TO SOLIDITY	9

Contracts, Constructors & Functions, Variables, Getters & Setters, Arrays, Memory vs Storage, Mappings in Solidity

Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, **Advanced Solidity** : Abstract Contracts, Inheritance, And Interfaces, Events

UNIT IV	TRUFFLE FRAMEWORK & GANACHE	9

Environment Setup for Truffle & Ganache, Truffle Project Creation, Truffle Compile, Migrate and Create Commands

UNIT V	DECENTRALIZED APP CREATION	9

Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the basic concepts and architectural models of distributed systems to understand their functionality and application.

CO2: Apply the principles of an immutable distributed ledger and trust model to evaluate and design secure blockchain systems.

CO3: Develop a comprehensive understanding of blockchain platforms by illustrating and integrating their essential components.

CO4: Design and implement advanced blockchain solutions that leverage distributed ledger technology for various applications.

CO5: Assess the effectiveness and security of different blockchain platforms through rigorous testing and analysis.

CO6: Innovate and create new applications or improvements to existing blockchain technologies, utilizing in-depth knowledge of their components and operational models.

TEXTBOOKS:

1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
2. Building Blockchain Projects, Narayan Prusty, Packt Publishing.

REFERENCES:

1. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O′Reilly Publisher.

22IT929	BLOCKCHAIN PLATFORMS AND USECASES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- Students should be able to learn different types of blockchain platforms.
- Students should be able to understand different types of Decentralized applications developed using blockchain technology.
- Students should be able to understand several types of blockchain use cases.

UNIT I	PERMISSIONED BLOCKCHAINS	9

Hyperledger Fabric Services, Model and Functions, Hyperledger Composer, Microsoft Azure Blockchain Platform and Services, Other Platforms: IOTA, TRON, Ziliqa, Cosmos, Ripple.

UNIT II	DECENTRALIZED APPLICATION PLATFORMS	9

Augur-Decentralised Prediction Market Platform, Grid+-Energy Ecosystem Platform.

UNIT III	CHALLENGES AND SOLUTIONS RELATED TO BLOCKCHAIN	9

Consensus, Scalability, Privacy and Confidentiality, Escrow, and Multi signature.

UNIT IV	ALTERNATIVE DECENTRALIZED SOLUTIONS	9

Interplanetary File System (IPFS) Working and Uses, Hashgrapgh-Working, Benefits, And Use-Cases.

UNIT V	BLOCKCHAIN USE CASES	9

Financial Services Related Use Cases, Revolutionization of Global Trade, Digital Identity, Auditing Services, Supply Chain Management, Healthcare Related Services, Blockchain and IOT, Blockchain and AI.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the characteristics and functionalities of different blockchain platforms to distinguish their applications and limitations.

CO2: Apply blockchain technology to real-life scenarios by understanding and leveraging its various use cases in diverse industries.

CO3: Assess the shortcomings of blockchain technology and develop innovative solutions to address these challenges.

CO4: Analyze the financial capacities and implications of blockchain technology to evaluate its potential and limitations in financial systems.

CO5: Design and implement secure blockchain solutions, ensuring robust protection against vulnerabilities in various use cases.

CO6: Create and propose advanced blockchain applications that incorporate security, efficiency, and scalability based on comprehensive analysis and evaluation.

TEXTBOOKS:

1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
2. Building Blockchain Projects, Narayan Prusty, Packt Publishing.
3. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (March 17, 2017).

REFERENCES:

1. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher publisher/O'Reilly Publisher Media; 1st edition (2015).

22IT930	BLOCKCHAIN SECURITY AND PERFORMANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- Students should be able to understand the security and performance-related issues of blockchain.
- Students should be able to learn techniques and tools to tackle the security related issues of blockchain.
- Students should be able to learn new approaches required for enhancing blockchain performance.

UNIT I	SECURITY ISSUES	9

Blockchain Related Issues, Higher-Level Language (Solidity) Related Issues, EVM Bytecode Related Issues, Real-Life Attacks on Blockchain Applications/ Smart Contracts, Trusted Execution Environments

UNIT II	SECURITY TOOLS FOR SMART CONTRACTS	9

Working, Advantages, And Disadvantages of Tools- Oyente, Securify, Maian, Manticore, Mythril, SmartCheck, Verx. Secure Key Management, Quantum Resilience Keys.

UNIT III	PERFORMANCE RELATED ISSUES	9

Transaction Speed, Transaction Fees, Network Size, Complexity, Interoperability Problems, Lack of Standardization. Lack of Supportive Regulations Related to Blockchain Applications.

UNIT IV	PERFORMANCE IMPROVEMENTS	9

Off-Chain State Channels, Sidechains, Parallels Chains, Concurrent Smart Contract Transactions, Sharding Technique and Its Benefits, Atomic Swaps Between Smart Contracts.

UNIT V	BLOCKCHAIN APPLICATIONS	9

Decentralized Cryptocurrency, Distributed Cloud Storage, E- Voting, Insurance Claims, Cross-Border Payments, Asset Management, Smart Appliances.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the security and performance aspects of blockchain technology to evaluate its strengths and vulnerabilities.

CO2: Apply advanced security analysis and performance-enhancing techniques to optimize blockchain systems.

CO3: Implement blockchain technology in real-life scenarios to develop innovative solutions for practical problems.

CO4: Evaluate and differentiate between various types of coins and tokens within the blockchain ecosystem to understand their unique functionalities and use cases.

CO5: Analyze the benefits and implications of blockchain technology in the banking sector to identify potential improvements and innovations.

CO6: Design and develop blockchain-based applications that address security and performance issues while providing tangible solutions for real-world problems.

TEXTBOOKS:

1. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O′Reilly Publisher.
2. Richard Hayen, Blockchain & FinTech: A Comprehensive Blueprint to Understanding Blockchain & Financial Technology. - Bitcoin, FinTech, Smart Contracts, Cryptocurrency, Risk Books Publisher.

VERTICAL VI
ARTIFICIAL INTELLIGENCE

22AM921	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- To learn the basic concepts of Soft Computing.
- To understand artificial neural networks.
- To apply fuzzy systems to solve problems.
- To solve problems using Genetic Algorithms.
- To discuss the various Hybrid algorithms and various Swarm Intelligence algorithms.

UNIT I	INTRODUCTION	9

Neural Networks - Application Scope of Neural Networks - Fuzzy Logic - Genetic Algorithm - Hybrid Systems - Soft Computing - Artificial Neural Network - Evolution of Neural Networks - Basic Models of ANN – Weights – Bias – Threshold – Learning Rate – Momentum Factor – Vigilance Parameter- McCulloch–Pitts Neuron - Linear Separability - Hebb Network.

UNIT II	ARTIFICIAL NEURAL NETWORKS	9

Perceptron Networks - Adaptive Linear Neuron - Multiple Adaptive Linear Neurons - Back-Propagation Network - Radial Basis Function Network - Pattern Association – Auto associative and Hetero associative Memory Networks - Bidirectional Associative Memory (BAM) - Hopfield Networks - Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps.

UNIT III	FUZZY SYSTEMS	9

Fuzzy Logic - Classical Sets (Crisp Sets) - Fuzzy Sets – Fuzzy Relation - Features of the Membership Functions - Fuzzification - Methods of Membership Value Assignments - Defuzzification - Lambda-Cuts for Fuzzy Sets (Alpha-Cuts) - Lambda-Cuts for Fuzzy Relations - Defuzzification Methods – Fuzzy Reasoning – Fuzzy Inference Systems.

UNIT IV	GENETIC ALGORITHMS	9

Biological Background - Traditional Optimization and Search Techniques- Genetic Algorithm and Search Space- - Simple GA - General Genetic Algorithm - Operators - Stopping Condition - Constraints - Problem Solving - The Schema Theorem- Classification - Holland Classifier Systems- Genetic Programming - Advantages and Limitations- Applications.

UNIT V	HYBRID SOFT COMPUTING AND SWARM INTELLIGENCE ALGORITHMS	9

Neuro-Fuzzy Hybrid Systems - Genetic Neuro-Hybrid Systems - Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems - Simplified Fuzzy ARTMAP – Swarm Intelligence Algorithms - Ant Colony Optimization – Artificial Bee Colony – Particle Swarm Optimization – Firefly Algorithm.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Elaborate the basic concepts of Soft Computing.
CO2: Discuss Artificial neural networks and its applications.
CO3: Apply Fuzzy logic to solve different applications.
CO4: Solving problems using Genetic algorithms.
CO5: Discuss various algorithms in Soft computing with its applications and limitations.
CO6: Use various algorithms in Soft computing to solve real-world problems.

TEXT BOOKS:

1. S. N. Sivanandam , S. N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2019.
2. Adam Slovik, “Swarm Intelligence Algorithms: Modification and Applications”, Taylor & Francis, First Edition, 2020.

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
2. Kwang H. Lee, First course on Fuzzy Theory and Applications‖, Springer, 2005.
3. N.P. Padhy, S. P. Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
4. S. Rajasekaran, G. A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.
5. NPTEL Courses:
    a. Introduction To Soft Computing - https://onlinecourses.nptel.ac.in/noc23_cs40/preview

22AM922	APPLIED AI and ML	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Understand and apply statistical methods to analyze and interpret data.
- Analyze and cluster genomic data using appropriate algorithms.
- Implement linear regression models to predict outcomes.
- Evaluate and improve model performance in binary classification tasks.
- Implement and train neural networks for various tasks.

UNIT I	FOUNDATION OF DATA SCIENCE	9

Python for Data Science- NumPy & Pandas - Data Cleaning and Preparation- Statistics for Data Science- Types of Data- Levels of Measurement-Descriptive Statistics-Probability theory -Inferential Statistics-Advanced Visualization Techniques.

Case Study: Cardio Good Fitness Data Analysis

Projects:1. Food Hub Analysis

2. FIFO World Cup Analysis
3. Mobile Internet Usage Analysis

UNIT II	MAKING SENSE OF UNSTRUCTURED DATA	9

Introduction to Supervised & Unsupervised Learning- Handling Imbalanced Datasets-K-Means Clustering algorithm, Dimensionality Reduction techniques (PCA, t-SNE)-Visualizing High Dimensional Data-Comparsion of t-SNE with PCA-Combining PCA with t-SNE.

Case Study: Genomic Data Clustering

Project: Fantasy Sports Clustering Analysis

UNIT III	REGRESSION AND PREDICTION	9

Introduction to Linear Regression-OLS Method-Cost function and Optimization-Gradient Descent Algorithm-Multiple Linear Regression-Elastic Net, Model Evaluation Techniques in solving Real World Regression Problems.

Case Studies: 1. Hospital LOS Prediction

2.Big Mart Sales Prediction

Project: Super Kart Sales Prediction

UNIT IV	CLASSIFICATION AND HYPOTHESIS TESTING	9

Concepts of Classification algorithms- Model Performance- Application of Binary Classification-Multi class classification-Multi label classification-Challenges in solving real world classification problems.

Case Studies: 1.HR Employee Attrition Prediction

2. KC Roasters Coffee Quality Prediction

Projects: 1. Travel Package Purchase Prediction

2. Potential Customers Prediction

UNIT V	DEEP LEARNING	9

Implementation of Neural Networks-Data Quality & Quantity-Data Augmentation- Hyper parameter tuning-Computational Challenges -Transformer Networks-Transfer learning -solving real world Neural Network based Problems.

Case Study: 1. Audio MNLST Digit Recognition,

2.Street View Housing Number Digit Recognition

Project: Food Image Classification

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Apply statistical techniques to interpret data and make data-driven decisions.

CO2: Utilize dimensionality reduction techniques such as PCA and t-SNE to simplify complex datasets.

CO3: Apply regression techniques to real-world problems.

CO4: Perform hypothesis testing to validate assumptions and make inferences from data.

CO5: Apply deep learning techniques to solve practical problems.

CO6: Implement the concepts of AI and ML to solve various applications.

TEXT BOOKS:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson, 2019.
2. Ethem Alpaydin, Introduction to Machine Learning, Adaptive Computation and Machine Learning Series, Third Edition, MIT Press, 2014.
3. Deep Learning: A Practitioner's Approach, Josh Patterson, Adam Gibson, O'Reilly Media, 2017.
4. Deep Learning, Ian Goodfellow, Yoshua Bengio Aaron Courville, MIT Press, 2017.
5. Neural Networks and Deep Learning, Michael Nielsen, Determination Press, 2015.

REFERENCES:

1. Anuradha Srinivasaraghavan, Vincy Joseph, Machine Learning, First Edition, Wiley, 2019.
2. Peter Harrington, "Machine Learning in Action", Manning Publications, 2012.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
4. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
5. Christoph Molnar, "Interpretable Machine Learning - A Guide for Making Black Box Models Explainable", Creative Commons License, 2020.
6. Deep Learning with TensorFlow: Explore neural networks with Python, Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy, Packt Publisher, 2017.
7. Deep Learning with Keras, Antonio Gulli, SujitPal , Packt Publishers, 2017.
8. Deep Learning with Python", Francois Chollet, Manning Publications, 2017
9. https://olympus.mygreatlearning.com/courses

22AM903	SOCIAL NETWORK ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To outline the components of the social network.
- To elaborate the modeling and visualization of the social network.
- To classify descriptive and inferential methods.
- To discuss about the evolution of the social network.
- To illustrate the applications in real time systems.

UNIT I	INTRODUCTION	9

Basics of Social Network Analysis: Introduction- The Social network and Representation -Types of Networks-Network parts and Level of Analysis-Networks as Social Structure and Institution- Theoretical Assumptions-Causality in Social Network Studies- A Brief History of Social Network Analysis-Mathematical Foundations: Graphs-Paths and components-Adjacency matrices-Ways and modes-Matrix products-Sources of network data-Types of nodes and types of ties- Data Collection: Network questions-Question formats-Interviewee burden-Data collection and reliability-Archival data collection-Data from electronic sources.

UNIT II	MODELING AND VISUALIZATION	9

Data Management: Data import-Cleaning network data- Data transformation-Normalization-Cognitive social structure data-Matching attributes and networks-Converting attributes to matrices-Data export,- Multivariate Techniques Used in Network Analysis: Multidimensional scaling-Correspondence analysis-Hierarchical clustering,- Visualization: Layout-Embedding node attributes-Node filtering-Ego networks-Embedding tie characteristics-Visualizing network change-Exporting visualizations-Closing comments.

UNIT III	DESCRIPTIVE AND INFERENTIAL METHODS	9

Descriptive Methods in Social Network Analysis: Graph and Matrix-Social Network Representation – Density – Centrality, Centralization and Prestige- Cliques – Multidimensional Scaling(MDS) and Dendogram – Structural Equivalence -Two mode Networks and Bipartite Matrix-Inferential Methods in Social Network Analysis: Permutation and QAP (Quadratic Assignment Procedure) Correlation-P* or Exponential Random Graph Model(ERGM).

UNIT IV	EVOLUTION	9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V	APPLICATIONS	9

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Outline the internal components and terminology of the social network.

CO2: Illustrate the fundamental exploratory multivariate techniques and visualizing network data.

CO3: Discuss most common descriptive and inferential statistical tools available.

CO4: Discuss about the evolution of the social network.
CO5: Illustrate the real time applications of social network analysis.
CO6: Apply the methods in Social Network Analysis to solve real world problems.

TEXT BOOKS:

1. Song Yang , Franziska B. Keller, "Social Network Analysis Methods and Examples", SAGE Publications Inc. 2017.
2. Stephen P Borgatti, Martin G. Everett, Jeffrey C. Johnson, "Analyzing Social Networks", Second Edition, 2017.

REFERENCES:

1. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2014 .
2. Przemyslaw Kazienko, Nitesh Chawla, "Applications of Social Media and Social Network Analysis", Springer,2015.
3. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2012.
4. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2011.
5. Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2012.

22CS937	REINFORCEMENT AND ENSEMBLE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Outline the concepts of Reinforcement Learning
- Solve problems using Monte Carlo Decision Process and Dynamic Programming.
- Implement problems using temporal difference learning.
- Apply functional approximation in reinforcement learning.

UNIT I	INTRODUCITON	9

Introduction - Elements of RL, History of RL- Limitation and Scope - Examples – Multi-arm Bandits – k-armed Bandit Problem – Action-Value Methods – Incremental Implementation – Nonstationary Problem – Optimistic Initial Values – Upper Confidence Bound Action Selection – Gradient Bandit Algorithms – Contextual Bandits.

UNIT II	TABULAR SOLUTION METHODS	9

Finite Markov Decision Processes – Dynamic Programming – Monte Caro Methods – Temporal Difference Learning.

UNIT III	FUNCTION APPROXIMATION METHODS	9

On-Policy Prediction with Approximation: Value-function Approximation – The Prediction Objective – Stochastic-gradient and Semi-gradient Methods - Linear Methods – Feature Construction for Linear Methods - Eligibility Traces: The λ-return – TD(λ).

UNIT IV	CORE ENSEMBLE METHODS	9

Boosting - Boosting procedure – AdaBoost Algorithm – Examples and Issues - Bagging - Algorithm – Examples and Issues – Random tree Ensembles -Combination Methods - Averaging – Voting – Combining by learning – Other Combination methods – Relevantmethods.

UNIT V	ADVANCED ENSEMBLE METHODS	9

Ensemble Pruning - Categories – Ordering based – Clustering based – Optimization based Clustering Ensembles - Categories – Similarity based – Graph based – Relabeling based – Transformation based.

TOTAL: 45 PERIODS

22AM925	COMPUTATIONAL NEUROSCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand what nervous systems do and determine how they function.
- To explore the computational principles governing various aspects of vision, sensory-motor control, learning, and memory.
- To analyze neural models.
- To learn to extract information through neural encoding and decoding.
- To investigate models of synaptic plasticity and learning in the brain.

UNIT I	NEURAL ENCODING	9

Firing Rates and Spike Statistics: Introduction- Spike Trains and Firing Rates - What Makes a Neuron Fire? Spike-Train Statistics – The Neural Code

Reverse Correlation and Visual Receptive Fields – Estimating Firing Rates Introduction to the Early Visual System Reverse-Correlation Methods: Simple Cells Static Non linearities: Complex Cells - Receptive Fields in the Retina and LGN Constructing Visual Receptive Fields

UNIT II	NEURAL DECODING AND INFORMATION THEORY	9

Discrimination - Population Decoding - Spike-Train Decoding

Information Theory: Entropy and Mutual Information – Information and Entropy Maximization – Entropy and Information for Spike Trains

UNIT III	MODEL NEURONS	9

Phase Plane Analysis – I - Phase Plane Analysis – II - Analyzing HHE – Bifurcations - Other Point Models – Levels of Neuron Modeling-Conductance-Based Models – The Cable Equation- Multi-compartment models

UNIT IV	NETWORK MODELS	9

Firing Rate Models – Feedforward Networks – Recurrent Networks – Excitatory-Inhibitory Networks – Stochastic Networks

UNIT V	PLASTICITY	9

Synaptic Transmission and Synaptic Strength - Ways of Modification of Synaptic Strength - Types of Plasticity - Short Term Plasticity - Long Term Plasticity – Computational Implications

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Elaborate the fundamentals of neural encoding.
CO2: Apply neural encoding techniques.
CO3: Use Information Theory to decode neural signals.
CO4: Analyze and model the dynamics of neurons.
CO5: Design and analyze neural networks.
CO6: Implement the concepts of synaptic plasticity.

TEXT BOOKS:

1. Dayan, Peter, and L. F. Abbott, Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems. Cambridge, MA: MIT Press, 2005. ISBN: 9780262041997.
2. Paul Miller, An Introductory Course in Computational Neuroscience, MIT Press, 2018.

REFERENCES:

1. Signal and Systems, Alan V. Oppenheim, Alan S. Willsky, Syed Hamid Nawab Prentice Hall, 1997.

2. Methods in Neuronal Modeling, Second Edition From Ions to Networks , Edited by Christof Koch and Idan Segev, MIT Press
3. Ionic Channels of Excitable Membranes, Second Edition, Bertil Hille, Sinauer Associates Inc.,1992
4. NPTEL: Computational Neuroscience - Course (nptel.ac.in)

22AM924	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Knowledge Engineering.
- To discuss reasoning under uncertainty.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT I	INTRODUCTION	9

Knowledge, Representation and Reasoning - Need for Logic – First order logic – Syntax – Semantics – Pragmatics- Implicit and Explicit Belief - Expressing Knowledge - Resolution – Propositional case - Horn Logic – Horn clauses - Procedural Control of Reasoning.

UNIT II	REASONING UNDER UNCERTAINTY	9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering – Evidence-based reasoning task: Intelligent Analysis.

UNIT III	ONTOLOGIES – DESIGN AND DEVELOPMENT	9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.
Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV	REASONIING WITH ONTOLOGIES AND RULES	9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge - Rules in Production Systems - Object-Oriented Representation - Structured Descriptions.

UNIT V	LEARNING AND RULE LEARNING	9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Inductive concept learning from Examples – Learning with an Incomplete Representation Language – Formal definition of Generalization.
Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Elaborate the basics of Knowledge Representation and Knowledge Engineering.
CO2: Develop reasoning under uncertainty.
CO3: Design and develop ontologies.
CO4: Implement ontology-based reasoning systems.
CO5: Understand learning and rule learning.
CO6: Integrating knowledge representation and reasoning in intelligent systems.

TEXT BOOKS:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.

2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016.

REFERENCES:

1. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
2. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
3. King, Knowledge Management and Organizational Learning , Springer, 2009.
4. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

22AM006	FOUNDATIONS OF DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To outline the basics of deep neural networks.
- To discuss advanced deep learning models.
- To discuss CNN and RNN architectures of deep neural networks.
- To elaborate autoencoders in neural networks.
- To discuss the deep generative models.

UNIT I	DEEP NETWORKS	9

Challenges motivating deep learning - Deep feedforward networks - Learning XOR - Gradient based learning - Hidden Units – Architecture Design – Back Propagation – Regularization – Parameter Norm Penalties – Constrained Optimization – Under-Constrained Problems – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter Tying and Sharing – Bagging and Other Ensemble methods – Dropout – Adversarial Training.

UNIT II	OPTIMIZATION FOR TRAINING DEEP MODELS	9

Pure optimization – Challenges – Basic Algorithms – Parameter initialization Strategies – Algorithms with Adaptive Learning Rates – Approximate Second-Order methods – Optimization Strategies and Meta Algorithms.

UNIT III	CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS	9

Convolution Operation – motivation – Pooling – Infinitely Strong prior – Variants – Structured Output – Data Types – Efficient Convolutional Algorithms – Random or Unsupervised features – Neuroscientific Basis - Deep Learning – Sequence Modelling - Computational Graphs - RNN - Bidirectional RNN – Encoder-Decoder - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks -- Long Term Dependencies; Leaky Units – Strategies for multiple time scales – LSTM and Gated RNNs – Optimization for Long Term Dependencies.

UNIT IV	AUTOENCODERS	9

Autoencoders: Undercomplete autoencoders - Regularized autoencoders – Power, Layer Size and Depth - Stochastic encoders and decoders – Denoising Autoencoders - Learning with autoencoders – contractive Autoencoders – Applications of autoencoders.

UNIT V	DEEP GENERATIVE MODELS	9

Boltzmann Machine – Restricted Boltzmann Machine – Deep Belief Networks – Deep Boltzmann Machines - Boltzmann Machines for Real-Valued Data – Convolutional Boltzmann Machines - Boltzmann Machine for Structured or Sequential Outputs – Directed Generative Nets – Evaluating Generative Models.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Outline the basics of deep neural networks.
CO2: Develop advanced deep learning models.
CO3: Implement CNN and RNN architectures of deep neural networks.
CO4: Interpret autoencoders in neural networks.
CO5: Apply deep generative models to solve real world problems.
CO6: Build deep learning models and evaluate them.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning", MIT Press, 2016.

REFERENCES:

1. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.
2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. Francois Chollet, ``Deep Learning with Python", Manning Publications Co, 2018.
4. Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
5. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.

NPTEL:

6. Deep Learning - https://onlinecourses.nptel.ac.in/noc24_ee04/preview
7. Deep Learning - IIT Ropar - https://onlinecourses.nptel.ac.in/noc24_cs59/preview

22AM702	COMPUTER VISION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection.
- To become familiar with feature based alignment and motion estimation.
- To develop skills on 3D reconstruction.
- To understand image based rendering and recognition.

UNIT I	INTRODUCTION TO IMAGE FORMATION AND PROCESSING	9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II	FEATURE DETECTION, MATCHING AND SEGMENTATION	9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III	FEATURE-BASED ALIGNMENT & MOTION ESTIMATION	9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV	3D RECONSTRUCTION	9

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos

UNIT V	IMAGE-BASED RENDERING AND RECOGNITION	9

View interpolation Layered depth images - Light fields and Lumi graphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Analyze and apply basic image processing techniques in practical applications.
CO2: Compare the concepts related to feature detection, matching and detection.
CO3: Implement feature-based alignment and motion estimation in real-world applications.
CO4: Create and Apply 3D Reconstruction techniques in diverse applications.
CO5: Perform image-based rendering and recognition.

CO6: Implement efficient solutions to image processing and computer vision problems.

TEXT BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Person Education, Second Edition, 2015

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

22AM002	FOUNDATIONS OF NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of natural language processing
- To discuss word level analysis.
- To discuss the different language models.
- To understand the significance of syntactic and semantic analysis.
- To learn discourse algorithms and various lexical resources.

UNIT I	INTRODUCTION	9

Natural Language Processing - Ambiguities in NLP - Regular Expressions – Words – Corpora - Text Normalization, Minimum Edit Distance.

UNIT II	WORD LEVEL ANALYSIS	9

Morphological Analysis – Morphological Parsing - Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based - HMM - Transformation-based tagging.

UNIT III	LANGUAGE MODELS	9

Markov Chains – Hidden Markov Model – Forward Algorithm – Decoding: Viterbi Algorithm – Training HMMs – Maximum Entropy Models – Maximum Entropy Markov Models.

UNIT IV	SYNTACTIC AND SEMANTIC ANALYSIS	10

Context-Free Grammars - Grammar rules - Treebanks - Normal Forms for grammar – Finite-state – CFG - Dependency Grammar – Parsing with CFG – Search – Ambiguity - Syntax-Driven Semantic analysis – Semantic Augmentations - Semantic attachments – Unification based approaches to Semantic Analysis – Semantic Attachments – Integrating Semantic Analysis to Early Parser – WordNet.

UNIT V	APPLICATIONS OF NLP	8

Information Extraction - Question Answering and Summarization – Dialogue and Conversational Agent - Machine Translation.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Elaborate the fundamentals of natural language processing.
CO2: Perform word level analysis in NLP.
CO3: Illustrate different ML models for NLP.
CO4: Analyze the syntax and semantics using various methods.
CO5: Analyze text at the word level.
CO6: Apply NLP to solve real-world problems.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, Second Edition, 2019.

REFERENCES:

1. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, First Edition, O’Reilly Media, 2009.
2. Breck Baldwin, “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015.
3. Richard M Reese, “Natural Language Processing with Java”, O’Reilly Media, 2015.

4. Nitin Indurkhya and Fred J. Damerau, “Handbook of Natural Language Processing”, Second Edition, Chapman and Hall/CRC Press, 2010.
5. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

VERTICAL VII

QUANTUM COMPUTING

COURSECODE	LINEAR ALGEBRA	L	T	P	C
22MA202		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- introduce the concepts of matrices and determinants.
- impart the knowledge of vectors and linear combinations.
- elaborate the concept and application in the vector space.
- implement the concept in linear transformations
- implement the concept of linear combinations in image processing and Machine learning.

UNIT I MATRICES AND DETERMINANTS 9

Introduction to Matrices and Determinants – Solution of Linear Equations – Cramer's rule – Inverse of a Matrix.

UNIT II VECTORS AND LINEAR COMBINATIONS 9

Vectors and linear combinations – Rank of a matrix – Gaussian elimination – LU Decomposition– Solving Systems of Linear Equations using LU Decomposition method.

UNIT III VECTOR SPACE 9

Vector space – Dimension – Basis – Orthogonality – Projections – Gram-Schmidt orthogonalization and QR decomposition.

UNIT IV LINEAR TRANSFORMATIONS 9

Linear transformations – Eigen values and Eigen vectors – Positive definite matrices – Hermitian and unitary matrices.

UNIT V APPLICATIONS OF MATRICES 9

Singular value decomposition and Principal component analysis–Introduction to their applications in Image Processing and Machine Learning.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After the successful completion of the course, the student will be able to:

CO1: solve the system of linear equations using Cramer's rule.

CO2: solve the system of equations using LU Decomposition method.

CO3: compute QR decomposition for a given matrix.

CO4: represent the linear transformations in matrix and to find Eigenvalues and Eigenvectors.

CO5: apply the concept of linear combinations in image processing and Machine learning.

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, New Delhi 2014.
2. A. H. Friedberg, A. J. Insel and L. Spence, "Linear Algebra", Prentice Hall of India,4th Edition New Delhi, 2004.

REFERENCE BOOKS:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning, 7th Edition.
2. Michael. D. Greenberg, "Advanced Engineering Mathematics", Pearson, 2nd Edition.
3. Gilbert Strang, "Introduction to linear algebra", Wellesley-Cambridge Press, 5th Edition.
4. P. N. Wartikar& J.N. Wartikar, "Applied Mathematics", Volume I & II, Pune VidyarthiGrihaPrakashan, 7th Edition, 1994.
5. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Pearson Education International, 3rd Edition.

22IT919	QUANTUM INFORMATION THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners to:

- Understand the foundational principles of quantum mechanics as they pertain to information theory.
- Explore the theoretical framework of quantum computation and quantum communication.
- Analyze and implement quantum algorithms and protocols.
- Investigate quantum error correction and quantum cryptography techniques.
- Develop a comprehensive understanding of quantum entanglement and its applications in quantum information processing.

UNIT I	INTRODUCTION TO QUANTUM MECHANICS	9

Basic principles of quantum mechanics - Quantum states and qubits - Quantum superposition and entanglement - Quantum measurement theory - Introduction to quantum gates and circuits

UNIT II	QUANTUM COMPUTATION	9

Quantum algorithms (Deutsch, Grover, Shor) - Quantum Fourier Transform - Quantum search algorithms - Quantum complexity theory - Quantum programming languages and tools

UNIT III	INTRODUCTION TO QUANTUM INFORMATION THEORY	9

Quantum entropy and information - Von Neumann entropy - Quantum mutual information - Quantum channels and noise models - Holevo's theorem and capacity

UNIT IV	QUANTUM ERROR CORRECTION	9

Principles of quantum error correction - Quantum error correcting codes (Shor code, CSS codes, stabilizer codes) - Fault-tolerant quantum computation - Decoherence and noise in quantum systems - Practical implementations of error correction

UNIT V	QUANTUM CRYPTOGRAPHY	9

Basics of quantum cryptography - Quantum key distribution (QKD) protocols (BB84, E91) - Security proofs for QKD - Quantum teleportation - Advanced quantum cryptographic protocols

TOTAL: 45 Periods

COURSE OUTCOMES:

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

CO1: Apply quantum state representation to solve basic problems.

CO2: Analyze the computational complexity of quantum algorithms.

CO3: Compute and interpret quantum entropy and information metrics.
CO4: Analyze quantum channels and their capacities.
CO5: Design and implement quantum error correcting codes.
CO6: Implement and analyze the security of quantum cryptographic protocols.

TEXTBOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, “Quantum Computation and Quantum Information”, Cambridge University Press, 10th Edition, December 2010.
2. Mark M. Wilde, “Quantum Information Theory”, Cambridge University Press, May 2013.

REFERENCES:

1. David J. Griffiths, Darrell F. Schroeter, “Introduction to Quantum Mechanics”, Cambridge University Press, 3rd Edition, August 2018
2. Richard P. Feynman and Albert R. Hibbs, "Quantum Mechanics and Path Integrals”, Dover Publications Inc, 2010.

22IT932	QUANTUM COMPUTING FOUNDATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Understand the fundamentals of quantum mechanics
- Familiarize the concepts of Linear Algebra
- Perform Quantum computation
- Apply Quantum Algorithms for real time applications
- Comprehend the challenges in Quantum Technology

UNIT I	OVERVIEW OF QUANTUM COMPUTING	9

Basic quantum mechanics, Classical vs Quantum systems, Quantum supremacy, Quantum computer architectures, Quantum applications, Introduction to Quantum theory: Complex Numbers, Linear Algebra – vector and matrix operations

UNIT II	QUANTUM STATES AND QUANTUM GATES	9

Dirac notation, Bloch sphere, Hilbert space, Quantum superposition, Single qubit gates, multiple qubit gates, Quantum entanglement, Bell state

UNIT III	QUANTUM SOFTWARE DEVELOPMENT	9

Quantum assembly language, Quantum programming languages, Quantum simulator, Design and evaluation of quantum algorithms, Complexities in real quantum system execution

UNIT IV	Quantum Algorithms	9

Shor's Factorization algorithm, Grover's unstructured search algorithm, Simon's algorithm, Quantum error correcting code

UNIT V	CHALLENGES IN QUANTUM TECHNOLOGY	9

Quantum measurement, Cloning theorem, Scalability in real quantum systems, Quantum Applications: Healthcare, transportation, finance, security, Quantum warfare, cryptography

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO 1: Understand quantum mechanics concepts [Understanding]

CO 2: Apply linear algebra operations [Applying]

CO 3: Interpret quantum computer systems [Understanding]

CO 4: Analyze quantum application software [Creating]

CO 5: Summarize the role of quantum technology in secure computing [Understanding]

CO 6: Design and evaluate quantum programs for simple known algorithms [Creating]

TEXTBOOKS:

1. Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.
2. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press,Cambridge, 2020
3. David McMahon-Quantum Computing Explained-Wiley-Interscience ,IEEE Computer Society (2008)

REFERENCES:

1. Quantum Computation and Quantum Information, M. A. Nielsen &I.Chuang, Cambridge University Press (2013).
2. Quantum Computing, A Gentle Introduction, Eleanor G. Rieffel and Wolfgang H. Polak MIT press (2014)

MINOR DEGREE SPECILIAZATION IN FULL STACK ENGINEERING

(OFFERED TO OTHER DEPARTMENTS)

22IT943	FRONT END ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable learners:

- To understand web semantics and framework
- To interpret the functionality of Angular frameworks
- To develop a scalable and responsive web application
- To integrate database and perform CRUD operations

UNIT I	ADVANCED WEB TECHNOLOGY	9

An Introduction to HTML5 – Tags, Link, Images, Forms, Label, Sections, Media, Structure, CSS3 – inline, internal, Box Model, Targeting Elements, Flex Model, Responsive and Fluid Layout, Media Queries-- An introduction to JavaScript (ES6) – 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 – Scope and Function Context - Closures - JavaScript Design Pattern.

UNIT II	JAVASCRIPT MVW FRAMEWORK	9

TypeScript – Static Typing, User Defined Data Types, Lambda Expression and Functional Programming, String, Number, Boolean, Union, Tuple, Object Oriented Programming – Inheritance, Interface, Access Modifiers, Let vs Var, Arrays, Generics, Duck Typing, Any/Unknown, TS Config.

UNIT III	INTRODUCTION TO -ng	9

Introduction to Single Page Application (SPA) and Angular Architecture, SPA's Components and Templates, Interpolation and 2 way data binding, Modules, Forms (Template/Reactive), Promise and Observable, CLI Features, i18n, Workspace Structure

UNIT IV	TESTING ANGULAR APPLICATIONS	9

Service Definition and Injection, Routes and Navigation, Data Integrity enablement, Flux/Redux, Security, Pipes and Directives, Behavior Subject, Logging and Exceptions handling, Performance Engineering, Unit Testing using Jasmine and Karma, Responsive Web design using Bootstrap and MD

UNIT V	MEAN STACK	9

NodeJS Introduction and Installation, YARN Integration, Imports and Modules, ExpressJS, JWT/OAUTH2.0 based security, Routes and Middleware, DB Integration – Config – Reactive DB Operations – CRUD, Exception Handling, Transaction Management, Logging and Audit, Deployment

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Design a web page using text formatting, graphics, audio, and video.
CO2: Create a simple application using Typescript
CO3: Develop a web application using Angular Framework
CO4: Implement responsive web applications.
CO5: Build a web application integrating Databases
CO6: Able to develop data driven back end API using NodeJS as the core platforms.

TEXTBOOKS

1. John & Michael Kocer ”Angular 11 by Example 2021”, Kindle Edition, 2020
2. Lars Gyrup Brink Nielsen, “Accelerating Angular Development with Ivy”, Paperback Edition, 2021

REFERENCES:

1. Doguhan Uluca, “Angular 6 for Enterprise-Ready Web Applications: Deliver production-ready and cloud-scale Angular web apps”, 1st Edition, Kindle Edition, 2018
2. Adam Freeman, “Pro AngularJS (Expert's Voice in Web Development) Paperback”,2014
3. Nate Murray, Felipe Coury, Ari Lerner, Carlos Taborda, “ng-book: The Complete Guide to Angular”, 2018.

22IT944	SERVER-SIDE PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of JEE concepts and usage of build tools like Maven.
- To acquire knowledge on core technologies like IOC, DI and AOP.
- To develop and deploy application in frameworks like Spring, Spring MVC and Building RESTServices with spring MVC
- To understand Logging process, ORM framework and build secure applications using JWT andOAUTH

UNIT I INTRODUCTION TO JAKARTA ENTERPRISE EDITION (FORMERLY CALLED AS JAVA EE) 9

Java EE 8 Platform Overview - Distributed Multi-tiered Applications- Web and Business Components-Java EE Containers – services & types - Java EE Application Assembly and Deployment – Packaging Applications, Java EE modules - Getting Started with Web applications Model View Controller (MVC)

Architecture and Packaging – Web application deployment descriptor (web.xml file) - Web Application Archive (*.WAR file), Java Archive (*.JAR), Enterprise Application archive (*.EAR). Build Tools: Maven, Configuration, Archetype, Local Maven Repository and Mvn Repository, Dependency Plugins.

UNIT II CORE TECHNOLOGIES AND FRAMEWORKS 9

Introduction to Spring Core, Spring Architecture, Bean Container, Inversion of Control, IOC Container, Bean Definition, Bean Scope, Bean Life Cycle, Dependency Injection-Constructor Injection and property Injection, Auto-wiring, Aspect Object Programming (AOP), Spring MVC, Building a REST services with spring, using http calls (GET, POST, PUT, etc) with annotations: Controller, Rest Controller, Get Mapping, Post Mapping, Put Mapping and Delete Mapping, Error handling for REST, Logging with Log4J. Case Study: Performing CURD operation using spring MVC and RESTFUL

services. Introduction to Tools

UNIT III DATA PERSISTENCE 9

Object/Relation Mapping using Simple JDBC Integration with native SQL commands, JNDI(Java Naming and Directory Interface), JNDI Data source Configuration, Application Deployment in Tomcat with JNDI.

UNIT IV HIBERNATE 9

Introduction, Integrating and configuring Hibernate, understanding connection pool, ORM Architecture, Spring Data, JPA vs Hibernate, JPA annotations, Entity Manager, Entity Relationships – Many To One Relation, One To Many Relation, One To One Relation and Many To Many Relation. Building a sample application using JPA.

UNIT V WEB SECURITY FRAMEWORK 9

JSON Web Token (JWT), JWT structure and configuration. OAUTH2, Architecture, Authentication grant, Obtaining Access Token, Accessing a protected resource, OAuth Registry, Extensibility. Case Study: Develop a Spring based application with JWT-OAUTH2.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students will be able to:

CO1: Analyze the concepts of JEE and create tools using Maven.

CO2: Implement core technologies in real-world applications.

CO3: Develop real-world applications utilizing frameworks such as Spring and Spring MVC.

CO4: Integrate logging processes and Spring Security into real-world applications.

CO5: Evaluate the effectiveness of different frameworks in real-world scenarios.

CO6: Design secure and efficient applications using advanced JEE concepts and tools.

Use Cases:

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop

3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management - eMall

TEXTBOOKS:

1. Kogent Learning Solutions Inc.,"Java Server Programming Java EE7 (J2EE 1.7): BlackBook", Dream Tech Press, 2014.
2. Jim Keogh, “J2EE: The Complete Reference”, McGraw Hill, 2002
3. Geoffroy Warin, “Mastering Spring MVC 4”, Packt Publishing, 2015

REFERENCES:

1. Christian Bauer, Gavin King, and Gary Gregory, “Java Persistence with Hibernate”, SecondEdition, Manning publication, 2015
2. Joseph B.Ottinger, Jeff LinWood, Dave Minter, “ Beginning Hibernate: for Hibernate 5”, 4th Edition, Apress, 2016
3. Laurentiu Spilca, “Spring Security in Action, Manning Publication, 2020

E-RESOURCES:

1. https://www.baeldung.com/rest-with-spring-series
2. https://www.coursera.org/courses?query=spring%20framework
3. https://www.gangboard.com/spring-and-hibernate-courses

22IT945	MICROSERVICE ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners:

- To understand the Microservice Architecture.
- To understand the Microservice Design and pattern.
- To understand the JEE Framework.
- To understand the Microservice Implementation.
- To understand the usage of Docker with Microservices.

UNIT I INTRODUCTION TO MICROSERVICE 9

Introduction to Microservice and how it differs from Distributing Computing, Understand the current Monolithic Architecture Design and its advantage and pit falls, Places of Usage, Feature Set, Pros and Cons.

Introduction, Qualities of Microservice Architecture, Place of Usage, Points to be taken care, Core JEE and Microservice Patterns, Pros and Cons. Controller, Error Handler, Validation, Rest API Client.

UNIT II MICROSERVICES DESIGN 9

Messaging - Introduction to Messaging based Integration, Places of Usage, Pub Sub Model, P2P Integration, Request and Reply Model, Exception Handling and Dead Letter Channel, Transaction Support.

Design Patterns-Decompose by business capability, Decompose by subdomain, Database per Service, Shared database, Saga, API Composition, CQRS, Domain event, Event sourcing, Strangler Application, Anti-corruption layer, Consumer-driven contract test, Consumer-side contract test, Multiple service instances per host, Service instance per host, Service instance per VM, Service instance per Container, Serverless deployment, Service deployment platform.

UNIT III JEE FRAMEWORK 9

Maven Build framework - Why Maven and Features, Goal, Profile, Life Cycle, Parent-Child, Plugins. Introduction to Spring Framework, Spring Core - IOC, DI, Life Cycle, Autowire, Parent/Child. Spring Boot - MVC, REST Controller, Global Error Handling, HTTP Response Code, URI Patterns and HTTP Verbs. Spring AOP, Spring Configuration, Spring JPA - Entity Mapping, Association Mapping, Inheritance Mapping, JPA/Hibernate,@Query, Join Query, Pagination, CRUD Operation.

UNIT IV MICROSERVICE IMPLEMENTATION 9

Eureka Service Registry Configuration and Setup.

Spring Cloud Ribbon - Client-Side LB. Spring Cloud Config - Centralized Versioned Configuration. Spring Feign Client - Declarative REST Client. Spring Boot - Spring Configuration (Eureka, Port, JPA cfgs). Spring RestController, Feign Rest Client, Spring Hystrix Fault Tolerant, Fall Back Implementation, Hystrix Configuration, Hystrix Dashboard. Spring Cloud Bus - Dynamic Configuration Changes.

UNIT V MICROSERVICE SECURITY AND INTEGRATIONS 9

Integration with Spring MS Components, RabMQ Exchanges/Queue. API Gateway Pattern, Spring Cloud Gateway, Caching Options, Redirection, Security, Integrating with Service Registry. Sleuth, Zipkin and Spring Admin.Docker Containers - Image, Containers, Linking, Volume, Networks, Logs, K8, Apache Kafka - Producers, Consumers, Queries, Streaming, Case Study - Project Execution using Microservice.

TOTAL: 45 PERIODS

USE CASES:

1. Star Small and Medium Banking and Finance
2. Inventory Management for a EMart Grocery Shop
3. Society Financial Management
4. Cop Friendly App - ESeva
5. Property Management - eMall

COURSE OUTCOMES:

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

CO1: Apply the principles of Microservices to understand their necessity and architectural design.

CO2: Design applications integrating Microservice pattern.

CO3: Analyze and comprehend Spring Boot to apply its functionalities effectively.

CO4: Apply knowledge of Eureka to configure Spring Cloud.

CO5: Design Applications using Docker Microservices.

TEXTBOOKS:

1. Microservices: Flexible Software Architecture by Eberhard Wolff, 2016.
2. Microservice Patterns and Best Practices: Explore patterns like CQRS and event sourcing to create scalable, maintainable, and testable Microservices by Vinicius Feitosa Pacheco, 2018
3. Microservices with Spring Boot and Spring Cloud: Build resilient and scalable microservices using Spring Cloud, Istio, and Kubernetes, 2nd Edition by Magnus Larsson, 2021.

REFERENCES:

1. Building Microservices: Designing Fine-Grained Systems by Sam Newman, Second Edition, 2021.
2. Hands-On Microservices with Spring Boot and Spring Cloud: Build and deploy Java microservices using Spring Cloud, Istio, and Kubernetes, by Magnus Larsson, 2019
3. Essentials of Microservices Architecture: Paradigms, Applications, and Techniques, 1st Edition, Kindle Edition by Chellammal Surianarayanan, Gopinath Ganapathy, Raj Pethuru .

22IT946	DEVOPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the concepts of DevOps and the issues it resolves
- Learn the DevOps tools set
- Learn to Develop automation using Maven
- Understand Continuous Delivery and Continuous Deployment
- Understand Docker Containerization

UNIT I INTRODUCTION 9

What Is DevOps, Architecture, Life Cycle, Workflow and Principles, Tools, CI, CD and CD Pipelines Linux Introduction, Basic Commands, Scripting

UNIT II TOOLS SET 9

Maven Build Management, Goals, Profiles, Plugins, LifeCycles, Configuration, Parent/Child - SCM Tools - GitHub, Init, CheckIn, Merge, Pull, Push, Local and Remote Repo, Pull Request, Tagging Strategy – Unit Testing – Unit Testing scropts - Artifact Repository - Release Management aligned Repos, Private and Public Repos Monitoring - Tools like nagios to assist in monitoring and managing the deployed instances

UNIT III TESTING AUTOMATION 9

Maven with Unit / Integration / Performance Testing - Report Generation and Configuration

UNIT IV DEPLOYMENT AND MONITORING – DOCKER 9

Docker Introduction, Images, Containers, Docker Hub, Links, Volume, Network, Interactive Sessions - K8 - Single and Cluster Mode, Secrets,

Persistence Volume and Claim, Replica Factor, Services, Pods, Deployments, logs, Kubernetes

UNIT V DEPLOYMENT AND MONITORING – JENKINS 9

SonarQube integration with Project and Jenkins

Jenkins - Setup and Configuration, Jobs - Continuous Integration, Continuous Delivery and Continuous Deployment Configuration

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the concept of DevOps Architecture.

CO2: Apply the DevOps Tools in real time applications.

CO3: Build Maven with Unit, Integration and Performance Testing

CO4: Deploy and monitor using Docker

CO5: Deploy and monitor using Jenkins

CO6: Integrate DevOps workflows by leveraging continuous integration and continuous deployment (CI/CD) pipelines to enhance efficiency, collaboration, and quality in software development and operations.

REFERENCES:

1. Jennifer Davis and Ryn Daniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, 1st Edition, O'Reilly Publications.
2. Gene Kim, Patrick Debois et al., The DevOPS Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, IT Revolution Press; Illustrated edition, 2016.

MINOR DEGREE SPECILIAZATION IN ENTREPRENEURSHIP AND INNOVATION

(OFFERED TO OTHER DEPARTMENTS)

22IT948	FOUNDATIONS OF ENTREPRENERUSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners:

- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
- To empower the learners to run a Technology driven business efficiently and effectively

UNIT I	INTRODUCTION TO ENTREPRENEURSHIP	9

Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur- Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.

UNIT II	BUSINESS OWNERSHIP & ENVRIONMENT	9

Types of Business Ownership – Business Environmental Factors – Political-Economic-Sociological- Technological-Environmental-Legal aspects – Human Resources Mobilisation-Basics of Managing Finance- Essentials of Marketing Management - Production and Operations Planning – Systems Management and Administration

UNIT III	FUNDAMENTALS OF TECHNOPRENEURSHIP	9

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts-Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

UNIT IV	APPLICATIONS OF TECHNOPRENEURSHIP	9

Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching – Managing

Technology based Product / Service entrepreneurship –– Success Stories of Technopreneurs - Case Studies

UNIT V	EMERGING TRENDS IN ENTREPRENERUSHIP	9

Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing- Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneurship - NGO Entrepreneurship – Recent Entrepreneurial Developments - Local – National – Global perspectives.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Learn the basics of Entrepreneurship

CO2: Understand the business ownership patterns and environment

CO3: Understand the Job opportunities in Industries relating to Technopreneurship

CO4: Learn about applications of technopreneurship and successful technopreneurs

CO5: Acquaint with the recent and emerging trends in entrepreneurship

TEXTBOOKS:

1. S.S.Khanka, “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 2021.
2. Donal F Kuratko Entrepreneurship (11th Edition) Theory, Process, Practice by Published 2019 by Cengage Learning,

REFERENCES:

1. Daniel Mankani. 2003. Technopreneurship: The successful Entrepreneur in the new Economy. Prentice Hall
2. Edward Elgar. 2007. Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe. Edi: Jan Ulijn, Dominique Drillon, and Frank Lasch. Wiley Pub.
3. Lang, J. 2002, The High Tech Entrepreneur's Handbook, Ft.com.
4. David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
5. JumpStart: A Technoprenuership Fable, Dennis Posadas, (Singapore: Pearson Prentice Hall, 2009
6. Basics of Technoprenuership: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP

E-RESOURCES:

1. HarperBusiness,https://fanny.staff.uns.ac.id/files/2013/12/Technopreneur-Based- Education-Revolution.pdf

22IT949	TEAM BUILDING AND LEADERSHIP MANAGEMENT FOR BUSINESS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners:

- To develop and strengthen the Leadership qualities and motivation of learners.
- To impart the Leadership skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of Team Building in managing Technology oriented businesses.
- To empower the learners to build robust teams for running and leading a business efficiently and effectively

UNIT I	INTRODUCTION TO MANAGING TEAMS	9

Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) -Multicultural Teams.

UNIT II	MANAGING AND DEVELOPING EFFECTIVE TEAMS	9

Team-based Organisations- Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III	INTRODUCTION TO LEADERSHIP	9

Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.

UNIT IV	LEADERSHIP IN ORGANISATIONS	9

Leadership Styles – LMX Theory- Leadership Theory and Normative Decision Model - Situational Leadership Model - Contingency Model and Path Goal Theory – Transactional and Transformational Leadership - Charismatic Leadership - Role of

Ethics and Values in Organisational Leadership.

UNIT V	LEADERSHIP EFFECTIVENESS	9

Leadership Behaviour - Assessment of Leadership Behaviours - Destructive Leadership - Motivation and Leadership - Managerial Incompetence and Derailment Conflict Management - Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Evaluate strategies for managing teams effectively in business environments.

CO2: Formulate approaches to developing and nurturing effective business teams.

CO3: Analyze leadership principles essential for successful business operations.

CO4: Assess the significance of leadership in driving business growth and development.

CO5: Synthesize emerging trends in leadership to enhance entrepreneurial effectiveness.

TEXTBOOKS:

1. Hughes, R.L., Ginnett, R.C., & Curphy, G.J., Leadership: Enhancing the lessons of experience ,9th Ed, McGraw Hill Education, Chennai, India. (2019).
2. Katzenback, J.R., Smith, D.K., The Wisdom of Teams: Creating the High Performance Organisations, Harvard Business Review Press, (2015).
3. Haldar, U.K., Leadership and Team Building, Oxford University Press, (2010).
4. Daft, R.L., The Leadership Experience, Cengage, (2015).
5. Daniel Levi, Group Dynamics for Teams, 4th Ed, (2014), Sage Publications.
6. Dyer, W. G., Dyer, W. G., Jr., & Dyer, J. H..Team building: Proven strategies for improving team performance, 5th Ed, Jossey-Bass, (2013).

22IT950	CREATIVITY AND INNOVATION IN ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners:

- To develop the creativity skills among the learners
- To impart the knowledge of creative intelligence essential for entrepreneurs
- To know the applications of innovation in entrepreneurship.
- To develop innovative business models for business.

UNIT I	CREATIVITY	9

Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities- Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment- Creative Technology- - Creative Personality and Motivation.

UNIT II	CREATIVE INTELLIGENCE	9

Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training--Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity– Creative Tools and Techniques - Blocks to creativity-fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment.

UNIT III	INNOVATION	9

Innovation: Definition- Levels of Innovation- Incremental Vs Radical Innovation-Product Innovation and Process- Technological, Organizational Innovation – Indicators- Characteristics of Innovation in Different Sectors. Theories in Innovation and Creativity- Design Thinking and Innovation- Innovation as Collective Change-Innovation as a system.

UNIT IV	INNOVATION AND ENTREPRENEURSHIP	9

Innovation and Entrepreneurship: Entrepreneurial Mindset , Motivations and Behaviours- Opportunity Analysis and Decision Making- Industry Understanding - Entrepreneurial Opportunities- Entrepreneurial Strategies – Technology Pull/Market Push – Product -Market fit.

UNIT V	INNOVATIVE BUSINESS MODELS	9

Innovative Business Models: Customer Discovery-Customer Segments-Prospect

Theory and Developing Value Propositions- Developing Business Models: Elements of Business Models – Innovative Business Models: Elements, Designing Innovative Business Models- Responsible Innovation and Creativity.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Evaluate the fundamentals of creativity in fostering entrepreneurship.

CO2: Analyze the significance of creative intelligence for driving business growth.

CO3: Assess the impact of industrial innovation on business advancements.

CO4: Apply innovative strategies in the development of successful ventures.

CO5: Design and implement innovative business models for efficient and effective business management.

TEXTBOOK:

1. Khanka SS, Creativity and Innovation in Entrepreneurship, Sultan Chand & Sons, 1st Edition, 2021

REFERENCES:

1. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata Mc Graw Hill, 2004.
2. Paul Trott, Innovation Management and New Product Development, 4e, Pearson, 2018.
3. Vinnie Jauhari, Sudanshu Bhushan, Innovation Management, Oxford Higher Education, 2014.
4. Innovation Management, C.S.G. Krishnamacharyulu, R. Lalitha, Himalaya Publishing House, 2010.
5. A. Dale Timpe, Creativity, Jaico Publishing House, 2003.
6. Brian Clegg, Paul Birch, Creativity, Kogan Page, 2009.
7. Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.

22IT951	PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable the learners:

- To provide basic knowledge of concepts, principles, tools and techniques of marketing for entrepreneurs
- To provide an exposure to the students pertaining to the nature and Scope of marketing, which they are expected to possess when they enter the industry as practitioners.
- To give them an understanding of fundamental premise underlying market driven strategies and the basic philosophies and tools of marketing management for business owners.

UNIT I	INTRODUCTION TO MARKETING MANAGEMENT	9

Introduction - Market and Marketing – Concepts- Functions of Marketing - Importance of Marketing - Marketing Orientations - Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix - The Additional 3Ps - Developing an Effective Marketing Mix.

UNIT II	MARKETING ENVIRONMENT	9

Introduction - Environmental Scanning - Analysing the Organisation's Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.

UNIT III	PRODUCT AND PRICING MANAGEMENT	9

Product- Meaning, Classification, Levels of Products – Product Life Cycle (PLC) - Product Strategies - Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding Pricing - Factors Affecting Price Decisions - Cost Based Pricing - Value Based and Competition Based Pricing - Pricing Strategies - National and Global Pricing.

UNIT IV	PROMOTION AND DISTRIBTUION MANAGEMENT	9

Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) - Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing -

Segmentation, Targeting and Positioning (STP)- Logistics Management- Introduction to Retailing and Wholesaling.

UNIT V	CONTEMPORARY ISSUES IN MARKETING MANAGEMENT	9

Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business Market - Buying Roles in Industrial Marketing - Factors that Influence Business - Services Marketing
- E-Marketing or Online Marketing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Evaluate the marketing management process to enhance strategic decision-making.

CO2: Analyze the marketing environment and its impact on business operations.

CO3: Develop effective product and pricing strategies to maximize market potential.

CO4: Design comprehensive promotion and distribution plans for optimal marketing management.

CO5: Assess contemporary marketing scenarios and propose innovative solutions to address marketing challenges.

TEXTBOOK:

1. Marketing Management, Sherlekar S.A, Himalaya Publishing House, 2016.

REFERENCES:

1. Marketing Management, Philip Kortler and Kevin Lane Keller, PHI 15th Ed, 2015.
2. Marketing Management- An Indian perspective, Vijay Prakash Anand, Biztantra, 2nd edition, 2016.
3. Marketing Management Global Perspective, Indian Context, V.S.Ramaswamy & S.Namakumari, Macmillan Publishers India, 5th edition, 2015.
4. Marketing Management, S.H.H. Kazmi, 2013, Excel Books India.
5. Marketing Management- text and Cases, Dr. C.B.Gupta & Dr. N.Rajan Nair, 17th edition, 2016.

LIST OF OPEN ELECTIVES
(OFFERED TO OTHER DEPARTMENTS)

22IT001	WEB DEVELOPMENT FRAMEWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable learners:

- To understand web semantics and related tools and framework
- To get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

UNIT I	ADVANCED JAVASCRIPT	9

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring

UNIT II	INTRODUCTION TO REACTJS	9

Class-Inheritance, Methods, Extended Class-Map, filter and Reduce Functions, Functions - Arrow Functions, Lambda Expressions , REST - Introduction, Why JSX, Hello World Apps, Project Structure

UNIT III	REACT COMPONENTS AND HOOKS	9

Class vs Functional Components, React Class Based Components – component DidMount, WillUpdate, shouldupate, didcatchetc - State - UseState, UseRef, USeEffect,UseHistory Usage and Props(difference, when to use what, mutable or immutabilty,direction of flow), PropTypes, Auxillary Components, Controlled and Uncontrolled Components,Component Interaction (Parent to Child and Child to Parent), Iteration & Conditional Response

UNIT IV	REACT LIBRARY - I	9

Event Bubbleup - Component Wrapper – Integration of CSS Modules-Forms Validations (YUP, Formik, Standard), Events Handling, Data Binding

UNIT V	REACT LIBRARY - II	9

Custom Hooks, HTTP - Fetch, Axios, Services, Behaviour Subjects - StateLess, StateFulll and Container Components, Error Handling - Build, Env, CORS, Unit Testing w React Testing Library - Introduction to react-native - Introduction to StoryBook

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Design and Customize web pages by integrating advanced text formatting, graphics, audio, and video elements.

CO2: Implement and Evaluate RESTful APIs and PropTypes in dynamic web applications.

CO3: Create sophisticated web applications using the latest React framework, demonstrating advanced development skills.

CO4: Integrate and Assess various React features, including functions, components, and services, to optimize application performance.

CO5: Develop and Enhance applications by utilizing ReactJS hooks for state management and side effects.

CO6: Critically Analyze and Optimize web applications built with React to ensure high performance, scalability, and maintainability.

TEXTBOOKS:

1. David Flanagan, Javascript The Definitive Guide, Paperback, 7th Edition, 2020.
2. David Choi ,Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020
3. Mehul Mohan, Advanced Web Development with React Paperback – 1 January 2020

E-RESOURCES:

1. Parental Website - https://reactjs.org/
2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by KirupaChinnathambi
5. "React Up & Running" by StoyanStefanov
6. https://www.edureka.co/reactjs-redux-certification-training
7. CodePen,
8. CodeSandbox (Preferred)
9. Stackblitz

22IT002	REST APPLICATION DEVELOPMENT USING SPRING BOOT AND JPA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable learners:

- To provide comprehensive knowledge of RESTful APIs and the HTTP methods used in the Spring Boot framework.
- To cover advanced querying techniques using JPA, including LIKE queries, and to manage CRUD operations using JPQL.
- To explore various relational mappings in JPA, such as one-to-one and one-to-many associations, and their practical implementations.
- To implement and manage Spring AOP applications using annotation-based configurations for method interception and post-execution operations.
- To build production-grade Spring Boot applications with integrated security using JWT, detailed API documentation with SwaggerUI and OpenUI, and effective logging practices.

UNIT I	INTRODUCTION TO REST API	9

RESTful APIs – overview about data exchange between client and server - separating concerns between handling HTTP requests and executing business logic - retrieving server resources via HTTP requests - injection of property values - self-contained application - serialization and deserialization – JSON properties - managing data access.

UNIT II	ADVANCED DATA MANAGEMENT WITH JAVA AND MYSQL	9

Build production-grade applications – MYSQL - mapping Java classes to relational database - repository interface - data access operations – retrieving data from the database –mapping of request body to entity - retrieve an entity - capture data from API requests - building complex queries using keywords.

UNIT III	ADVANCED JPA QUERIES AND ANNOTATIONS	9

Pagination & Sorting using JPA, @Transient Annotation, Queries using JPA, Starts and Ends with query using JPA, JPQL with @Query Annotation, custom JPQL

queries.

UNIT IV	JPA ASSOCIATIONS AND MAPPING	9

JPA Mapping of One-to-One Associations - fetching entities using queries – Loading optimization technique - Two-way One-to-One Relationship Mapping with JPA - single entity instance associated with multiple instances - Adding Data with One-to-One and One-to-Many Associations using JPA.

UNIT V	SPRING BOOT ESSENTIALS: API SECURITY, LOGGING, AOP, AND BUILD MANAGEMENT	9

SwaggerUI with Spring Boot, OpenUI with Spring Boot, Logging with Spring Boot, Changing Log Level, Logging Request and Response- Managing Spring Boot Logging Configuration - Aspect-Oriented Programming (AOP) Concepts - Method Parameter Handling - Post- Execution Operations - Returning Data Handling - Comprehensive Advice Handling. API security using JWT, Gradle for build management, Sonar Lint for coding standards and guidelines.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Create simple applications using RESTful APIs and effectively manage HTTP methods within the Spring Boot framework.

CO2: Apply database connectivity with JPA, utilizing advanced queries to interact with the database.

CO3: Build applications using Spring Boot and perform CRUD operations efficiently using JPQL

CO4: Demonstrate the implementation of various relational mappings in JPA, including one- to-one and one-to-many associations

CO5: Develop real-time applications that integrate user interfaces and utilize Spring AOP for method interception and advice handling.

TEXTBOOKS:

1. Raja CSP Raman, Ludovic Dewailly, “Building RESTful Web Services with Spring 5”, Packt Publishing, 2018.
2. Leonard Richardson, Sam Ruby “RESTful Web Services” O'Reilly Media,

2008.

3. Ludovic Dewailly, “Building a RESTful Web Service with Spring: A hands-on guide to building an enterprise-grade, scalable RESTful web service using the Spring Framework”, Packt Publishing, 2015
4. Raja CSP Raman, Ludovic Dewailly, “Building RESTful Web Services with Spring 5 - Second
5. Edition: Leverage the power of Spring 5.0, Java SE 9, and Spring Boot 2.0”, Packt Publishing, 2018

REFERENCES:

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.
3. Greg L. Turnquist, “Learning Spring Boot 2.0”, Packt Publishing, 2021
4. Sourabh Sharma, “Modern API Development with Spring and Spring Boot”, Packt Publishing, 2021

22IT003	MANAGING CLOUD AND CONTAINERIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The Course will enable learners:

1. To understand the basics of cloud computing, the evolution of AWS from existing technologies, and the services provided by AWS.
2. To learn about AWS security services and Identity and Access Management (IAM), including IAM users, groups, roles, and policies.
3. To acquire skills in using Amazon S3 for cloud storage and AWS EC2 for compute services, including managing instances, storage classes, and lifecycle management.
4. To understand networking fundamentals and implement virtual private clouds (VPCs), load balancing with different types of load balancers, and auto scaling to optimize resources and enhance security.
5. To learn DevOps concepts and benefits, use Docker for containerization, and integrate AWS container services and CI/CD pipelines for automated system updates and lifecycle management.

UNIT I	INTRODUCTION TO AWS	9

Introduction to AWS (Cloud basics) - Introduction to Cloud Computing, Services provided by AWS, Future of AWS, AWS Account Creation, Identity & Access Management - AWS Security Services Introduction, Introduction & Function of IAM, IAM users, groups, roles, MFA, Types of policies in IAM.

UNIT II	AMAZON S3	9

Amazon S3 - Cloud storage, Types, Benefits, Bucket permission & Object permission, Static website hosting, Object versioning, Storage Classes, Life Cycle management.

UNIT III	AWS ELASTIC COMPUTE CLOUD	9

AWS Elastic Compute Cloud - AWS EC2 Introduction, EC2 Instances creation, EC2 Instance protection, EBS, Snapshots, MyAMI, EIP.

UNIT IV	VIRTUAL PRIVATE CLOUD	9

Virtual Private Cloud - Networking Fundamentals, VPC and its Components, Create VPC components, Public, Private Subnets, Elastic Load Balancers - Introduction, Benefits, Types of load balancers, Classic Load Balancer, Application Load Balancer, Network & Gateway Load Balancer, AWS Autoscaling - Types of Scaling Policies, how autoscaling works, Launch Configuration, Autoscaling Group. AWS Cloud Front - Introduction and Benefits of CloudFront, working with distributions, working with policies, Adding, removing, or replacing content.

UNIT V	DEVOPS AND AWS CONTAINER SERVICES	9

Introduction to DevOps & Docker - What is Development, Operations, DevOps, DevOps benefits, Docker introduction, Docker Architecture, Images and containers, Docker Run Static sites. Docker & AWS Container Services - Docker Images creations, Images from Docker Files, Usage of Docker Networks, Usage of Docker Composes, What is AWS ECR and How it works?, What is AWS ECS and How it works?, What is AWS Fargate and How it works?, What is AWS EKS and How it works? AWS CI & CD Pipeline - Introduction to pipeline, Test Driven Development, Continuous Integration, Continuous Delivery, Continuous Deployment, Rolling Deployments.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of the basic global infrastructure of the AWS Cloud, including regions, availability zones, and edge locations.

CO2: Identify and recommend appropriate AWS Cloud services for various use cases, optimizing solutions based on the specific needs of applications and workloads.

CO3: Interpret the components and architecture of Docker containers and understand their role in supporting compute container implementations within AWS.

CO4: Examine common infrastructure servers, implement strategies for high availability, and leverage AWS scaling options to ensure reliable and scalable applications.

CO5: Understand the significance of automation, cultural practices, and metrics in DevOps, and apply these principles to create efficient and effective DevOps workflows using AWS tools and services.
TEXTBOOKS:
1. Mark Wilkins, “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud”, 2019.
2. Sean P. Kane, Karl Matthias, “Docker: Up & Running: Shipping Reliable Containers in Production”, O’Reilly Media Inc, 2015.
3. Jennifer Davis and Ryn Daniels, “Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale”, 2016, O’Reilly Media Inc.
4. Sunil Gulabani, “Amazon Web Services Bootcamp: Develop a Scalable, Reliable, and Highly Available Cloud Environment with AWS”,Packt Publishing, 2018
5. Amit Shah and AurobindoSarkar,“Learning AWS”, Packt Publishing, 2017
REFERENCES:
1. Ardian, “Using Docker: Developing and Deploying Software with Containers”, O’Reilly Media Inc, 2015.
2. Sean Keery, Clive Harber, Marcus Young, “Implementing Cloud Design Patterns for AWS”, Second Edition, Packt Publishing, 2019
3. Michael Charge “Docker Easy: The Complete Guide on Docker World for Beginners”, 2020
4. NikitSwaraj, “AWS Automation Cookbook” Packt Publishing Limited, 2017

22IT004	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
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COURSE OBJECTIVES:

The Course will enable learners:

- To introduce the basics and necessity of software testing.
- To provide various testing techniques along with concepts of software bugs and its impact.
- To develop and validate a test plan.
- To build a testing team required.
- To understand the need for and challenges in test automation and to develop testing scripts.

UNIT I	TESTING PRINCIPLES AND AXIOMS	9

Testing as a Process – Testing Axioms –Software Testing Principles – Origins and Cost of Defects – Defect Classes and Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention Strategies.

UNIT II	BLACK BOX, WHITE BOX TESTING AND TEST ADEQUACY	9

Test Case Design Strategies – Black Box Approach – Boundary Value Analysis – Equivalence Class Partitioning – State-Based Testing – User Documentation Testing – White Box Approach – Static Testing vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Cyclomatic Complexity – Test Adequacy Criteria.

UNIT III	LEVELS OF TESTING	9

Unit Test – Planning – Designing the Unit Test Process – Running the Unit Tests and Recording Results – Integration Test Planning – Scenario Testing – Defect Bash Elimination System Testing – Acceptance Testing – Performance Testing – Regression Testing – Internationalization Testing – Ad-Hoc Testing – Alpha, Beta Tests

UNIT IV	TEST MANAGEMENT	9

Organization Structures For Testing Teams – Testing Services – Test Planning Attachments – Locating Test Items – Test Management – Reporting Test Results – The Role of Three Groups in Test Planning and Policy Development – Introducing the Test Specialist – Skills Needed by a Test Specialist – Building a Testing Group.

UNIT V	TEST AUTOMATION	9

Software Test Automation – Skill Needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Test Metrics and Measurements – Project, Progress and Productivity Metrics – Maintenance of Documents During Testing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Obtain an insight to software testing.

CO2: Apply both black box testing and white box testing.

CO3: Understand and apply multiple levels of testing.

CO4: Understand the role of a tester as an individual and as a team member.

CO5: Apply software testing for large projects using automated testing tools.

CO6: Maintain documentation on testing.

TEXTBOOKS

1. Paul C. Jorgensen, “Software Testing: A Craftsman’s Approach”, Fourth Edition, CRC Press, 2013.
2. Dorothy Graham, Mark Fewster, “Experiences of Test Automation: Case Studies of Software Test Automation”, Pearson Education, 2012.

REFERENCES:

1. Glenford J. Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”, Third Edition, John Wiley & Sons, 2012.
2. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2009. .
3. Boris Beizer, “Software Testing Techniques”, Dream Tech Press, 2009.
4. Mauro Pezze, Michal Young, “Software Testing and Analysis Process Principles and Techniques”, Wiley India, 2008.
5. Ali Mili, Fairouz Chier, “Software Testing: Concepts and Operations”, Wiley, 2015.