

B.E. (Information Science and Engineering)
2022 Regulations, Curriculum & Syllabi
(Candidates admitted during Academic Year 2022-2023)



BANNARI AMMAN INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University - Chennai • Approved by AICTE • Accredited by NAAC with "A+" Grade

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CONTENTS

	Page No.
Vision, Mission and PEOs	3
POs	4
Mapping of PEOs and POs	6
Connectivity Chart	7
Curriculum 2022	8
Syllabi	16
Electives	111

VISION

To promote innovative centric education through excellence in scientific & technical education and research aimed towards improvement of society.

MISSION

- I. Develop human potential with sound knowledge in theory and practice of Information Science & Engineering.
- II. Facilitate the development of Industry Institute collaborations and societal outreach programmes.
- III. Promote research based activities in the emerging areas of technology convergence.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

- I. Competent professional with the knowledge of Information Science and Engineering by designing innovative solutions to real life problems that are technically sound, economically viable and socially acceptable.
- II. Capable of pursuing higher studies, research activities and entrepreneurial skills by adapting to new technologies and constantly upgrade their skills with an attitude towards lifelong learning.
- III. Proficient team leaders, effective communicators and capable of working in multidisciplinary projects and diverse professional activities following ethical values.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

- a. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. **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.
- c. **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.
- d. **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.
- e. **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.
- f. **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.
- g. **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.
- h. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- i. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- j. **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.
- k. **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.
- l. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

- Excel in processing the information using data management with security features.
- Demonstrate and develop applications on data analysis.

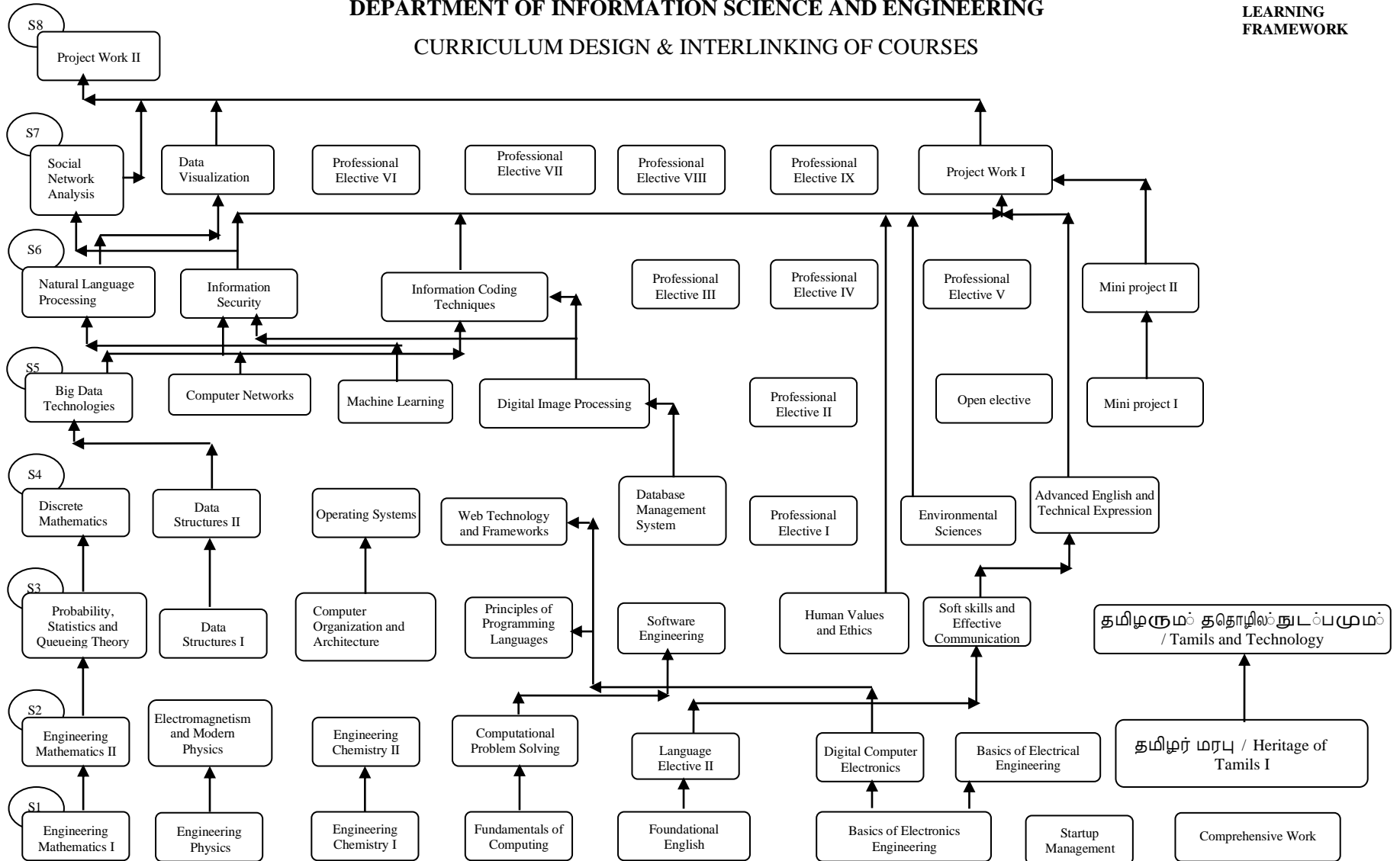
MAPPING OF PEOs AND POs

POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2
PEO 1	X	X	X	X	X	X	X							X
PEO 2	X	X	X	X	X	X					X	X	X	
PEO 3								X	X	X	X		X	X

CONNECTIVITY CHART

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING CURRICULUM DESIGN & INTERLINKING OF COURSES

360° FLEXIBLE
LEARNING
FRAMEWORK



DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING											
Minimum Credits to be Earned: 162											
I SEMESTER											
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category	
							CA	ES	Total		
22MA101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS	
22PH102	ENGINEERING PHYSICS	2	0	2	3	4	50	50	100	BS	
22CH103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS	
22GE001	FUNDAMENTALS OF COMPUTING	3	0	0	3	3	40	60	100	ES	
22HS001	FOUNDATIONAL ENGLISH	1	0	2	2	3	100	0	100	HSS	
22GE004	BASICS OF ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES	
22HS002	STARTUP MANAGEMENT	1	0	2	2	3	100	0	100	EEC	
22IS108	COMPREHENSIVE WORK	0	0	2	1	2	100	0	100	EEC	
Total		14	1	12	21	27	-	-	-	-	
II SEMESTER											
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category	
							CA	ES	Total		
22MA201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS	
22PH202	ELECTROMAGNETISM AND MODERN PHYSICS	2	0	2	3	4	50	50	100	BS	
22CH203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS	
22GE002	COMPUTATIONAL PROBLEM SOLVING	3	0	0	3	3	40	60	100	ES	
22GE003	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES	
22IS206	DIGITAL COMPUTER ELECTRONICS	3	0	2	4	5	50	50	100	ES	
	LANGUAGE ELECTIVE	1	0	2	2	3	100	0	100	HSS	
*22HS003	தமிழர் மரபு / HERITAGE OF TAMILS	1	0	0	1	1	100	0	100	HSS	
Total		17	1	10	23	28	-	-	-	-	

* The lateral entry students have to complete this course during IV semester.

III SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22IS301	PROBABILITY, STATISTICS AND QUEUING THEORY	3	1	0	4	4	40	60	100	ES
22IS302	DATA STRUCTURES I	3	0	2	4	5	50	50	100	PC
22IS303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3	3	40	60	100	PC
22IS304	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	2	4	5	50	50	100	PC
22IS305	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
22HS004	HUMAN VALUES AND ETHICS	2	0	0	2	2	100	0	100	HSS
22HS005	SOFT SKILLS AND EFFECTIVE COMMUNICATION	0	0	2	1	2	100	0	100	EEC
22HS006	தமிழரும் தொழில்நுட்பமும் / TAMILS AND TECHNOLOGY	1	0	0	1	1	100	0	100	HSS
Total		18	1	6	22	25	-	-	-	-
IV SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22IS401	DISCRETE MATHEMATICS	3	1	0	4	4	40	60	100	ES
22IS402	DATA STRUCTURES II	3	0	2	4	5	50	50	100	PC
22IS403	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
22IS404	WEB TECHNOLOGY AND FRAMEWORKS	2	0	2	3	4	50	50	100	PC
22IS405	DATABASE MANAGEMENT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	3	0	0	3	3	40	60	100	PE
22HS007	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
22HS008	ADVANCED ENGLISH AND TECHNICAL EXPRESSION	0	0	2	1	2	100	0	100	EEC
Total		19	2	8	23	29	-	-	-	-

V SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22IS501	BIG DATA TECHNOLOGIES	3	0	0	3	3	40	60	100	PC
22IS502	COMPUTER NETWORKS	3	0	2	4	5	50	50	100	PC
22IS503	MACHINE LEARNING	3	0	2	4	5	50	50	100	PC
22IS504	DIGITAL IMAGE PROCESSING	3	1	0	4	4	40	60	100	PC
	PROFESSIONAL ELECTIVE II	3	0	0	3	3	40	60	100	PE
	OPEN ELECTIVE	3	0	0	3	3	40	60	100	PE
22IS507	MINI PROJECT I	0	0	2	1	2	100	0	100	EEC
Total		18	1	6	22	25	-	-	-	-
VI SEMESTER										
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
22IS601	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PC
22IS602	INFORMATION SECURITY	3	0	0	3	3	40	60	100	PC
22IS603	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
	PROFESSIONAL ELECTIVE III	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE IV	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE V	3	0	0	3	3	40	60	100	PE
22IS607	MINI PROJECT II	0	0	2	1	2	100	0	100	EEC
Total		18	1	2	20	21	-	-	-	-

VII SEMESTER											
Code No.	Course	L	T	P	C	Hours/Week	Maximum Marks			Category	
							CA	ES	Total		
22IS701	SOCIAL NETWORK ANALYSIS	3	0	0	3	3	40	60	100	PC	
22IS702	DATA VISUALIZATION	3	0	2	4	5	50	50	100	PC	
	PROFESSIONAL ELECTIVE VI	3	0	0	3	3	40	60	100	PE	
	PROFESSIONAL ELECTIVE VII	3	0	0	3	3	40	60	100	PE	
	PROFESSIONAL ELECTIVE VIII	3	0	0	3	3	40	60	100	PE	
	PROFESSIONAL ELECTIVE IX	3	0	0	3	3	40	60	100	PE	
22IS707	PROJECT WORK I	0	0	4	2	4	60	40	100	EEC	
Total		18	0	6	21	24	-	-	-	-	
VIII SEMESTER											
Code No.	Course	L	T	P	C	Hours/Week	Maximum Marks			Category	
							CA	ES	Total		
PROJECT	WORK II	0	0	20	10	20	60	40	100	EEC	
Total		0	0	20	10	20	-	-	-	-	

ELECTIVES											
LANGUAGE ELECTIVES											
Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category	
							CA	ES	Total		
22HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS	
22HSH01	HINDI	1	0	2	2	3	100	0	100	HSS	
22HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS	
22HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS	
22HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS	
PROFESSIONAL ELECTIVE											
VERTICAL I - INFORMATION STORAGE AND RETRIEVAL											
22IS001	INFORMATION STORAGE AND MANAGEMENT	3	0	0	3	3	40	60	100	PE	
22IS002	MANAGEMENT INFORMATION SYSTEM	3	0	0	3	3	40	60	100	PE	
22IS003	NOSQL DATABASE	2	0	2	3	3	50	50	100	PE	
22IS004	DATA COMPRESSION	3	0	0	3	3	40	60	100	PE	
22IS005	DECISION SUPPORT SYSTEM	3	0	0	3	3	40	60	100	PE	
22IS006	BUSINESS INTELLIGENCE	3	0	0	3	3	40	60	100	PE	
VERTICAL II - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES											
22IS007	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE	
22IS008	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE	
22IS009	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE	
22IS010	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE	
22IS011	SOFTWARE DEFINED NETWORKS	2	0	2	3	3	50	50	100	PE	
22IS012	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE	
VERTICAL III - CYBER SECURITY AND DATA PRIVACY											
22IS013	CYBER SECURITY	3	0	0	3	3	40	60	100	PE	
22IS014	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE	
22IS015	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE	
22IS016	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE	
22IS017	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	3	50	50	100	PE	

22IS018	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL IV - FULL STACK DEVELOPMENT										
22IS019	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IS020	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IS021	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IS022	APP DEVELOPMENT	2	0	2	3	3	50	50	100	PE
22IS023	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IS024	DEVOPS	3	0	0	3	3	40	60	100	PE
VERTICAL V - DATA SCIENCE										
22IS025	EXPLORATORY DATA ANALYSIS	2	0	2	3	3	50	50	100	PE
22IS026	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IS027	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IS028	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	3	50	50	100	PE
22IS029	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
22IS030	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
VERTICAL VI - MEDIA PROCESSING										
22IS031	MULTIMEDIA DATA COMPRESSION	3	0	0	3	3	40	60	100	PE
22IS032	STREAMING MEDIA TOOLS AND TECHNOLOGIES	2	0	2	3	3	50	50	100	PE
22IS033	METAVVERSE	2	0	2	3	3	50	50	100	PE
22IS034	IMAGE AND VIDEO ANALYTICS	3	0	0	3	3	40	60	100	PE
22IS035	WEARABLE DEVICES APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IS036	3D PRINTING AND DESIGN	3	0	0	3	3	40	60	100	PE
VERTICAL VII – DIVERSIFIED COURSES										
22IS037	OPEN SOURCE SOFTWARE	3	0	0	3	3	40	60	100	PE
22IS038	OPEN STACK ESSENTIALS	3	0	0	3	3	40	60	100	PE
22IS039	BIOINFORMATICS ALGORITHMS	3	0	0	3	3	40	60	100	PE
22IS040	FAULT TOLERANT COMPUTING	3	0	0	3	3	40	60	100	PE
22IS041	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
2IS042	DESIGN THINKING	3	0	0	3	3	40	60	100	PE
HONOURS - DATA SCIENCE										
22ISH01	EXPLORATORY DATA ANALYSIS	2	0	2	3	3	50	50	100	PE

22ISH02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
21ISH03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22ISH04	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	3	50	50	100	PE
22ISH05	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
22ISH06	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
MINORS - DATASCIENCE										
22ISM01	EXPLORATORY DATA ANALYSIS	2	0	2	3	3	50	50	100	PE
22ISM02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22ISM03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22ISM04	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	3	50	50	100	PE
22ISM05	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
22ISM06	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
OPEN ELECTIVES										
22OCE01	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OEC01	BASICS OF ANALOG AND DIGITAL ELECTRONICS	3	0	0	3	3	40	60	100	OE
22OEC02	MICROCONTROLLER PROGRAMMING	3	0	0	3	3	40	60	100	OE
22OEC03	PRINCIPLES OF COMMUNICATION SYSTEMS	3	0	0	3	3	40	60	100	OE
22OEC04	PRINCIPLES OF COMPUTER COMMUNICATION AND NETWORKS	3	0	0	3	3	40	60	100	OE
22OEI01	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	3	40	60	100	OE
22OEI02	SENSOR TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OEI03	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OEI04	OPTOELECTRONICS AND LASER INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OME01	DIGITAL MANUFACTURING	3	0	0	3	3	40	60	100	OE
22OME02	INDUSTRIAL PROCESS ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME03	MAINTENANCE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME04	SAFETY ENGINEERING	3	0	0	3	3	40	60	100	OE
22OBT01	BIOFUELS	3	0	0	3	3	40	60	100	OE
22OFD01	TRADITIONAL FOODS	3	0	0	3	3	40	60	100	OE
22OFD02	FOOD LAWS AND REGULATIONS	3	0	0	3	3	40	60	100	OE

22OFD03	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	3	0	0	3	3	40	60	100	OE
22OFD04	CEREAL, PULSES AND OIL SEED TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OFT01	FASHION CRAFTSMANSHIP	3	0	0	3	3	40	60	100	OE
22OFT02	INTERIOR DESIGN IN FASHION	3	0	0	3	3	40	60	100	OE
22OFT03	SURFACE ORNAMENTATION	3	0	0	3	3	40	60	100	OE
22OPH01	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH02	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	OE
22OPH03	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH04	BIO-PHOTONICS	3	0	0	3	3	40	60	100	OE
22OPH05	PHYSICS OF SOFT MATTER	3	0	0	3	3	40	60	100	OE
22OCH01	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	OE
22OCH02	POLYMER SCIENCE	3	0	0	3	3	40	60	100	OE
22OCH03	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	OE
22OMA01	GRAPH THEORY AND COMBINATORICS	3	0	0	3	3	40	60	100	OE
22OGE01	PRINCIPLES OF MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OGE02	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	40	60	100	OE
22OGE03	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	40	60	100	OE
22OGE04	NATION BUILDING: LEADERSHIP AND SOCIAL RESPONSIBILITY	3	0	0	3	3	40	60	100	OE
ONE CREDIT COURSES										
22IS0XA	HEALTHCARE ANALYTICS	1	0	0	1	-	100	0	100	EEC
22IS0XB	AWS CLOUD SERVICES AND DATA MANAGEMENT	1	0	0	1	-	100	0	100	EEC

Course Objectives

- To impart mathematical modeling to describe and explore real-world phenomena and data.
- To provide basic understanding on Linear, quadratic, power and polynomial, exponential, and multi variable models
- Summarize and apply the methodologies involved in framing the real world problems related to fundamental principles of polynomial equations

Course Outcomes (COs)

1. Implement the concepts of mathematical modeling based on linear functions in Engineering.
2. Formulate the real-world problems as a quadratic function model
3. Demonstrate the real-world phenomena and data into Power and Polynomial functions
4. Apply the concept of mathematical modeling of exponential functions in Engineering
5. Develop the identification of multivariable functions in the physical dynamical problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3												
2	2	3												
3	2	3												
4	3	3												
5	1	3												

UNIT I**9 Hours****MATHEMATICS MODELING OF LINEAR FUNCTIONS**

The geometry of linear equations - Formation of linear equations: Method of least squares and method of regression - Vector spaces: Basic concepts with examples - Linear combination - Eigen values and vectors

UNIT II**9 Hours****MATHEMATICAL MODELING OF QUADRATIC FUNCTIONS**

General form of a quadratic function - Basic relationships between the equation and graph of a quadratic function - Sum of squares error and the quadratic function of best fit - Quadratic forms: Matrix form - Orthogonality - Canonical form and its nature

UNIT III**9 Hours****MATHEMATICAL MODELING OF POWER AND POLYNOMIAL FUNCTIONS**

Characteristics of the graphs of power and polynomial functions - Fitting of power and polynomial functions using the method of least squares - Local maxima and local minima of

power and polynomial functions - Power series of functions with real variables, Taylors series, radius and interval of convergence - Tests of convergence for series of positive terms - comparison test, ratio test

UNIT IV

9 Hours

MATHEMATICAL MODELING OF EXPONENTIAL FUNCTIONS

Concept of exponential growth - Graphs of exponential functions - Relationship between the growth factor and exponential growth or decline - Exponential equations have a variable as an exponent and take the form $y = ab^x$ through least square approximation - Calculus of exponential functions - Exponential series - Characteristics

UNIT V

9 Hours

MATHEMATICAL MODELING OF MULTIVARIABLE FUNCTIONS

Graphing of functions of two variables - Partial derivatives - Total derivatives - Jacobians - Optimization of multivariable functions with constraints - Optimization of multivariable functions without constraints

Total: 60 Hours

Reference(s)

1. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2016
2. B. S. Grewal, Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB, Khanna, 2014
3. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons 2020
4. Thomas and Finney, Calculus and analytic Geometry, Fourteenth Edition, By Pearson Paperback, 2018

Course Objectives

- Understand the concept and principle of energy possessed by mechanical system
- Exemplify the propagation and exchange of energy
- Identify the properties of materials based on the energy possession

Course Outcomes (COs)

1. Illustrate the concept and principles of energy to understand mechanical systems
2. Exemplify the types of mechanical oscillations based on vibrational energy
3. Infer the concept of propagation of energy as transverse and longitudinal waves
4. Analyze the exchange of energy and work between the systems using thermodynamic principles
5. Apply the concept of energy and entropy to understand the mechanical properties of materials

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1						2						
2	2	1						2						
3	2	1						2	2					
4	2	1						2						
5	2	1						2						

UNIT I**6 Hours****CONSERVATION OF ENERGY**

Concept of energy - types of energy - conservation of energy Mechanical energy: - translation - rotation - vibration - Kinetic and potential energies - conservation - work and energy - laws of motion - minimization of potential energy - equilibrium - dissipative systems - friction

UNIT II**5 Hours****VIBRATIONAL ENERGY**

Periodic Motion - Simple Harmonic Motion - Energy of the SHM - Pendulum types - Damped oscillations - forced oscillations - natural frequency - resonance

UNIT III**6 Hours****PROPAGATION OF ENERGY**

Transfer of energy - material medium - Transverse wave - Longitudinal wave - standing wave - interference - Doppler effect. Sound waves and its types - characteristics - human voice - reflection - refraction - beats

UNIT IV **7 Hours**

EXCHANGE OF ENERGY

Energy in transit - heat - Temperature - measurement - specific heat capacity and water - thermal expansion - Heat transfer processes. Thermodynamics: Thermodynamic systems and processes - Laws of thermodynamics - Entropy - entropy on a microscopic scale - maximization of entropy

UNIT V **6 Hours**

ENERGY IN MATERIALS

Elastic energy - Structure and bonding - Stress - strain - Tension and compression - elastic limit - Elastic Modulus - Stress - strain diagram - ductility - brittleness - rubber elasticity and entropy

1 **5 Hours**

EXPERIMENT 1

Determination of resultant of system of concurrent coplanar forces - Parallelogram law of forces

2 **5 Hours**

EXPERIMENT 2

Determination of moment of inertia - Torsional pendulum

3 **5 Hours**

EXPERIMENT 3

Determination of thickness of a thin wire using interference of light - Air wedge method

4 **4 Hours**

EXPERIMENT 4

Determination of AC frequency using Melde's apparatus

5 **3 Hours**

EXPERIMENT 5

Determination of thermal conductivity of a bad conductor using Lees disc method

6 **4 Hours**

EXPERIMENT 6

Wavelength of ultrasonics in a liquid medium
(ii) velocity of ultrasonic waves in the given liquid
(iii) compressibility of the given liquid using ultrasonic interferometer

7 **4 Hours**

EXPERIMENT 7

Determination of Young's modulus of a given material - Non uniform bending method

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part I: Classical Mechanics and Thermodynamics, Cognella Academic Publishing, 2019.
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

Course Objectives

- Understand the origin of elements from the universe
- Outline the properties of elements in the periodic table
- Analyse the different types of bond formed during chemical reactions and its reaction thermodynamics
- Summarize different states of matter based on atomic arrangement

Course Outcomes (COs)

1. Understand nuclear transmutation reactions that lead to the formation of elements in the universe
2. Illustrate atomic structure of elements in the periodic table and interpret the periodic trends in properties of elements with its anomaly
3. Apply the conditions for the formation of different types of chemical bonds and predict the minimum energy required for a reaction to occur
4. Analyse endothermic and exothermic processes and exchange of energy during chemical reactions
5. Analyse whether the given matter is a solid, liquid, gas, or plasma and interpret the arrangement of atoms

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

UNIT I**5 Hours****ORIGIN OF ELEMENTS**

Hydrogen - Elements and Sun - fusion - hypernova - supernova - dying stars - man-made elements

UNIT II**7 Hours****ATOMIC STRUCTURE AND PERIODICITY**

Atomic Structure - Electronic configuration - Periodic Table - Periodic trends in properties of elements - Anomalous behaviour in periodicity

UNIT III **6 Hours**

CHEMICAL BONDING

Octet rule & its limitations - types of chemical bonds - bond energy - bond cleavage - activation energy of reactions

UNIT IV **6 Hours**

REACTION THERMODYNAMICS

Conservation of energy - Endothermic reactions & exothermic reactions - Exchange of energy involved in chemical reactions

UNIT V **6 Hours**

STATES OF MATTER

Solid - liquid - gas - plasma - quantum dots - arrangement of atoms/ions/molecules in different phases

1 **2 Hours**

EXPERIMENT 1

Lab safety rules and guidelines for students - OSHA Guidelines

2 **3 Hours**

EXPERIMENT 2

Estimation of dissolved oxygen content in water sample(s) by Winkler's method

3 **4 Hours**

EXPERIMENT 3

Determination of Fe(II) in a sample using spectrophotometer

4 **3 Hours**

EXPERIMENT 4

Estimation of chromium content in water sample by volumetric analysis

5 **3 Hours**

EXPERIMENT 5

Estimation of chloride present in the given water sample by argentometric method

6 **3 Hours**

EXPERIMENT 6

Conductometric titration of mixture of acids

7 **4 Hours**

EXPERIMENT 7

Estimation of magnesium ions in given solution by EDTA method

8 **4 Hours**

EXPERIMENT 8

Preparation of salt of fatty acid by saponification process

9

4 Hours

EXPERIMENT 9

Recrystallization of aspirin from water/ethanol

Total: 60 Hours

Reference(s)

1. Peter Atkins, Physical Chemistry, Oxford university press, 2019
2. Rose Marie Gallagher and Author Paul Ingram, Complete Chemistry Cambridge IGCSE, Oxford university press, 2020
3. P L Soni, Text book of inorganic chemistry, Chand publishers, New Delhi, 2017
4. J.D. Lee, Concise inorganic chemistry, Blackman Science Ltd, France, Wiley-India, 5th edition (Reprint), 2016
5. Gareth Price, Thermodynamics of chemical processes, Oxford university press, 2019
6. D Tabor, Gases, liquids and solids and other states of matter, Oxford University press, 2018

Course Objectives

- Understand the fundamental digital logics behind computations of computer systems.
- Develop simple assembly language programs with respect to arithmetic operations.
- Understand the program execution process and basics of software development methodologies.

Course Outcomes (COs)

1. Infer the hidden languages and inner structures of computer hardware and software through codes and combinations.
2. Interpret the organizational and architectural issues of a digital computer with concepts of various data transfer techniques in digital computers and the I/O interfaces.
3. Analyze programming problems and apply assembly instructions to solve simple problems.
4. Infer the fundamentals of operating system and System programs basics.
5. Apply the software development methodologies to various real life scenarios.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1										
2	3	3	3	1										
3	2	2	2	1										
4	2	2	2	1										
5	2	2	2	1										

UNIT I**8 Hours****CODES AND COMBINATIONS**

Communication using Mores and Braille binary codes - Digitizing letters, numbers and objects using binary codes - Performing simple operations: addition through binary codes.

UNIT II**9 Hours****COMPUTATION USING COMPUTER**

Communication to computing devices through various input sources - Computational operation - its flow, functions and control - communication to output devices - Basic communication protocol.

UNIT III**11 Hours****ASSEMBLY LANGUAGE PROGRAMMING**

Little Man Computing (LMC) Model - Instruction Set - Labels - Calculation -Branching - Input- Output - Loops - Simple programs.

UNIT IV **9 Hours**

OPERATING SYSTEM AND APPLICATION GENERATION

BIOS - Device Drivers - Resources - Scheduler - Applications Generation and Creation - Stages of Compilation - Linkers, Loaders and Libraries.

UNIT V **8 Hours**

SOFTWARE DEVELOPMENT

Phases of application life cycle management - Software Development Methodologies - Web Page development.

Total: 45 Hours

Reference(s)

1. Charles Petzold, "Code: The Hidden Language of Computer Hardware and Software", Microsoft Press books, 2009.
2. David D. Riley, Kenya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliasz, "Little Man Computer Programming: For The Perplexed From The Ground Up", The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, "Peter Baer Galvin and Greg Gagne, Operating System Concepts", 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International edition, Seventh edition, 2010

Course Objectives

- Heighten awareness of grammar in oral and written expression
- Improve speaking potential in formal and informal contexts
- Improve reading fluency and increased vocabulary
- Prowess in interpreting complex texts
- Fluency and comprehensibility in self-expression
- Develop abilities as critical readers and writers
- Improve ability to summarize information from longer text, and distinguish between primary and supporting ideas

Course Outcomes (COs)

1. Express themselves in a professional manner using error-free language
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3		2		
2									2	3		2		
3									2	3		2		
4									2	3		2		
5									2	3		2		

UNIT I**15 Hours****SELF-EXPRESSION**

Self-Introduction-Recreating Interview Scenarios (with a focus on verbal communication)- Subject Verb Concord - Tenses - Common Errors in verbal communication Be-verbs Self-Introduction- Recreating interview scenarios-Haptics-Gestures-Proxemics-Facial expressions-Paralinguistic / Vocalic- Body Language- Appearance-Eye Contact-Artefacts Self-Introduction-Powerful openings and closings at the interview-Effective stock phrases - Modified for spontaneity and individuality-Question tags, framing questions including WH-questions- Prepositions-Listening to Ted talks-Listening for specific information.

UNIT II**15 Hours****CREATIVE EXPRESSION**

Descriptive Expression-Picture Description and Blog Writing -Vocabulary-One-word substitution- Adjectives-Similes, Metaphors, Imagery & Idioms -Link words - Inclusive language Narrative Expression- Travelogue and Minutes of Meeting -Verbal Analogy-

Sequence & Time order words - Jumbled paragraph, sentences, Sequencing-Text & Paragraph Completion-Past tense -Using quotation marks.

UNIT III

15 Hours

FORMAL EXPRESSION

Formal Letters and Emails-Writing: E-mails and Letters of apology, Requisition and Explanation, and Letters to newspapers-Speaking: Tendering verbal apologies, and explanations, persuading a listener/ audience-Hierarchy in Business correspondence- Subject of a mail, Header, Body (Salutation) and Footer of a mail- Conjunctive clause Punctuation- Formal Idioms-Phrases-Articles - Definite & Indefinite-Types of sentences-Modal verbs Precision in comprehension, Summary writing, Selective summary-Reading: Active reading-short paragraphs, excerpts, articles and editorials-Skimming and Scanning Reading comprehension & analysis- Tenses, QP/ PQ approach. Identifying the central themes/ crux- Interpreting tone - formal/informal/semi-formal-Note-taking-Listening: Listening for data, for specific information, for opinion-Active and passive Listening-Transcription-Paraphrasing and summarizing information-Agreeing & disagreeing-Note-taking-Writing: Summary writing, selective summary, paraphrasing, note-making, opinion pieces-Finding synonyms in the context Paraphrasing- Sentence Transformation - simple, compound, complex. Sentence Substitution-Sentence completion- Interpreting paragraphs.

Total: 45 Hours

Reference(s)

1. Sasikumar, V, et.al. A Course in Listening & Speaking Foundation Books, 2005.
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010
4. Reynolds, John. Cambridge IGCSEA, First Language English. 2018th ed., Hodder Education, 2018.
5. Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

Course Objectives

- To Understand the concept of energy transmission through mechanical, electrical and electromagnetic form.
- To Analyze the use of PN Junction Diode and BJT for signal conditioning.
- To apply the working principle of PN Junction Diode and BJT for the design of basic Digital Logic.
- To analyze the working and characteristics of Special Purpose Semiconductor Electronic Devices.

Course Outcomes (COs)

1. Understand the need for electrical and electromagnetic signal transmission.
2. Analyze the working principle and characteristics of PN junction diode.
3. Analyze the working principle and characteristics of Bipolar Junction Transistor.
4. Apply the working principle of PN Junction diode and BJT for designing basic Digital Logic functions.
5. Analyze the energy conversion needs and working principle of Special purpose electronic devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1										
2	3	3	3	2										
3	3	3	3	2										
4	3	3	3	2										
5	3	3	3	1										

UNIT I

6 Hours

ENERGY TRANSFER AND SIGNALS

Energy Transmission through Mechanical, Electrical and Electromagnetic means, Signal as Energy Transmission, Complexity in signal transmission (Volume of Information, Distance and Time taken), Limitations of Mechanical Energy Transmission, Electrical and Electromagnetic Signal Transmission, Need for Conversion between Electrical and Mechanical Signals.

UNIT II

8 Hours

SIGNAL CONDITIONING USING DIODE

Need for Vacuum Tubes in the Evolution of Electronics, Overview of Vacuum Tubes, Diode and Triode, Limitations of Vacuum Tubes. Semiconductor Group in Periodic Table, Overview of Semiconductor Materials, Flow of electrical energy through PN Junction Diode, Signal

Clipping, Signal Clamping and Signal Multiplication using PN Junction Diode, Limitations of PN Junction Diode.

UNIT III **6 Hours**

SIGNAL CONDITIONING USING TRANSISTOR

Need for controlling electrical signals, Principle of Bipolar Junction Transistor operation, Signal Switching and Amplification using BJT, Limitations of BJT, Principle of Field Effect Transistor operation.

UNIT IV **6 Hours**

LOGIC SYNTHESIS USING DIODE AND TRANSISTORS

Overview of Logic Gates, PN Junction and BJT as electronic switches, Digital Logic Synthesis using Diode and Transistor: Diode Logic, Resistor Transistor Logic, Diode Transistor Logic, Transistor Logic.

UNIT V **4 Hours**

DEVICES FOR SPECIAL REQUIREMENTS

Voltage Regulation using Zener Diode, Variable Capacitance using Varactor Diode, Electrical Energy to Light Energy conversion using Light Emitting Diode, Light to Energy to Electrical Energy conversion using Solar Cell.

1 **4 Hours**

EXPERIMENT 1

Design and Implement a simple device to communicate basic information between two different small distance points using wired and wireless methods.

2 **6 Hours**

EXPERIMENT 2

Design and Implement different wave shaping Circuits using PN Junction Diodes.

3 **4 Hours**

EXPERIMENT 3

Design and Implement Voltage Multiplier Circuit using PN Junction Diodes and Capacitors.

4 **4 Hours**

EXPERIMENT 4

Design and Implement a three Stage Circuit to convert 220V 50Hz AC mains supply to 12V DC supply.

5 **4 Hours**

EXPERIMENT 5

Design and Implement a BJT Amplifier Circuit to amplify audio input signal.

6 **4 Hours**

EXPERIMENT 6

Design and Implement Basic Logic Gates using PN Junction Diodes.

EXPERIMENT 7

Design and Implement Basic Logic Gates using BJTs.

Total: 60 Hours

Reference(s)

1. Thomas L. Floyd ,Electronic Devices: Electron Flow Version, Ninth Edition, Prentice Hall, 2012.
2. J Millman, C. Halkias & Satyabrata JIT, Electronic Devices and Circuits, Tata McGraw-Hill, 2007.
3. L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education 2006.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 2003.
5. Adel S. Sedra & Kenneth C. Smith, Micro Electronic Circuits Theory and Applications, Sixth Edition, Oxford University Press, 2013.
6. Behzad Razavi, Microelectronics, Wiley India Pvt. Ltd.; 2nd edition (2018)

Course Objectives

- Promote entrepreneurial spirit and motivate to build startups
- Provide insights on markets and the dynamics of buyer behaviour
- Train to develop prototypes and refine them to a viable market offering
- Support in developing marketing strategies and financial outlay
- Enable to scale up the porotypes to commercial market offering

Course Outcomes (COs)

1. Generate valid and feasible business ideas
2. Create Business Model Canvas and formulate positioning statement
3. Invent prototypes that fulfills an unmet market need
4. Formulate business strategies and create pitch decks
5. Choose appropriate strategies for commercialization

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1							1	2	1		1			
2							2	2	1	1	2			
3							3	3	1	2	2			
4							1	3	1	2	2			
5							2	3	2	2	2			

UNIT I**3 Hours****BUSINESS MODELS AND IDEATION**

Startups: Introduction, Types of Business Modes for Startups. Ideation: Sources of Ideas, Assessing Ideas, Validating Ideas, Tools for validating ideas, Role of Innovation and Design Thinking

UNIT II**3 Hours****UNDERSTANDING CUSTOMERS**

Buyer Decision Process, Buyer Behaviour, Building Buyer Personas, Segmenting, Targeting and Positioning, Value Proposition (Business Model Canvas), Information Sourcing on Markets, Customer Validation

UNIT III**3 Hours****DEVELOPING PROTOTYPES**

Prototyping: Methods-Paper and Digital, Customer Involvement in Prototyping, Product Design Sprints, Refining Prototypes

UNIT IV **3 Hours**

BUSINESS STRATEGIES AND PITCHING

Design of Marketing Strategies and Campaigns, Go-To-Market Strategy, Financial KPIs
Financial Planning and Budgeting, Assessing Funding Alternatives, Pitching, Preparing Pitch
Decks

UNIT V **3 Hours**

COMMERCIALIZATION

Implementation: Prototype to Commercialization, Test Markets, Institutional Support,
Registration Process, IP Laws and Protection, Legal Requirements, Type of Ownership,
Building and Managing Teams, Defining role of investors

1 **1 Hours**

EXPERIMENT 1

Analysis of various business sectors

2 **2 Hours**

EXPERIMENT 2

Developing a Design Thinking Output Chart

3 **1 Hours**

EXPERIMENT 3

Creating Buyer Personas

4 **3 Hours**

EXPERIMENT 4

Undertake Market Study to understand market needs and assess market potential

5 **2 Hours**

EXPERIMENT 5

Preparation of Business Model Canvas

6 **15 Hours**

EXPERIMENT 6

Developing Prototypes

7 **2 Hours**

EXPERIMENT 7

Organizing Product Design Sprints

8 **2 Hours**

EXPERIMENT 8

Preparation of Business Plans

9

2 Hours

EXPERIMENT 9

Preparation of Pitch Decks

Total: 45 Hours

Reference(s)

1. Rashmi Bansal, Connect the Dots, Westland and Tranquebar Press, 2012
2. Pavan Soni, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Penguin Random House India, 2020
3. Ronnie Screwvala, Dream with Your Eyes Open: An Entrepreneurial Journey, Rupa Publications, 2015
4. Stephen Carter, The Seed Tree: Money Management and Wealth Building Lessons for Teens, Seed Tree Group, 2021
5. Kotler Philip, Marketing Management, Pearson Education India, 15th Edition
6. Elizabeth Verkey and Jithin Saji Isaac, Intellectual Property, Eastern Book Company, 2nd Edition, 2021

Course Objectives

- To impart and analyze the concepts of differential equations to describe in real-world phenomena
- To provide basic understanding on differential equation models and vector field models
- Summarize and apply the methodologies involved in framing the real world problems related to fundamental principles of complex functions

Course Outcomes (COs)

1. Interpret the concept of differential equations through mathematical modeling and analyze its applications in engineering
2. Formulate the real world problems as second order linear differential equations and give solutions for the same
3. Demonstrate the real-world phenomena with magnitude and direction in the form of vector functions
4. Apply the concept of vector fields and line integrals through mathematical modeling in engineering
5. Determine complex functions and apply them to formulate problems arising in engineering

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3												
2	2	3												
3	2	3												
4	3	3												
5	3	3												

UNIT I**9 Hours****FIRST ORDER LINEAR DIFFERENTIAL EQUATIONS**

Formation of differential equations- Solutions of first order linear ODE: Leibnitzs and method of separation of variables - Cooling/Heating of an object - A falling object - Modeling of electric circuits: RL and RC circuits - Modeling of population dynamics: Exponential growth and decay - Logistic growth model

UNIT II**9 Hours****SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS**

Methods of solving second order linear ordinary differential equations - Models for linear oscillators: Simple harmonic motion - Mechanical vibrations with and without damping - Electric circuit system: RLC circuits

UNIT III **9 Hours**

VECTOR DIFFERENTIAL CALCULUS

Vector and scalar functions - Fields - Derivative of a vector function and geometrical interpretation - Velocity and acceleration - Gradient and its properties - Tangent and normal vectors - Directional derivative - Divergence of a vector field - Curl of a vector field - Projectile motion

UNIT IV **9 Hours**

VECTOR INTEGRAL CALCULUS

Line integrals of vector point functions - Surface integral of vector point functions - Applications of line and surface integrals - Greens theorem in a plane - Stokes theorem - Gauss divergence theorem

UNIT V **9 Hours**

COMPLEX FUNCTIONS

Basic concepts of Complex numbers Geometrical representation of complex number - Analytic functions and its properties - Construction of Analytic functions: Fluid flow Electric flow - Mapping of complex functions

Total: 60 Hours

Reference(s)

1. Richard E. Williamson, Introduction to Differential Equations and Dynamical Systems, McGraw Hill Companies. Inc, 1997
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B. Thomas, Maurice D. Weir and Joel Hass Thomas Calculus, 13/e, Pearson Publishers, 2013
4. Erwin Kreyszig, Advanced Engineering Mathematics Wiley, 10th editi5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017on ,2015
5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017

**22PH202 ELECTROMAGNETISM AND
MODERN PHYSICS**

2023

Course Objectives

- Understand the principles and mechanisms of electricity and magnetism
- Infer the classification of electromagnetic waves
- Analyze the theory of relativity and energy bands

Course Outcomes (COs)

1. Understand the principles and mechanism of electrostatics and current
2. Illustrate the principles and mechanism of magneto statics
3. Classify electromagnetic waves and infer the characteristics of visible light
4. Outline the importance of theory of relativity and analyze the wave nature of particles
5. Exemplify the electrical properties of semiconductor based on the band theory

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2	1							2					
3	2	1							2					
4	2	1												
5	2	1							2					

UNIT I

6 Hours

ELECTRICITY

Electric monopoles - Electric field - Electric flux - Electric potential - Electrical energy- Capacitor-Conductors and Insulators - Electric dipole and polarization - Electric current - Voltage sources - Resistance

UNIT II

6 Hours

MAGNETISM

Sources of magnetism - Monopoles - Magnetic field and force - magnetic field and current distribution - Magnetic dipole - Magnetic potential energy - Inductor - Electric and magnetic field comparison

UNIT III

6 Hours

ELECTROMAGNETIC WAVES AND LIGHT

Electromagnetism: Basic laws - Electromagnetic energy - radiation. Electromagnetic waves: Origin, nature and spectrum - Visible light. Principle of least time - Geometrical optics-Human eye - Diffraction - Interference - Polarization - LASER

UNIT IV **6 Hours**

MODERN PHYSICS

Special theory of relativity - Simultaneity and time dilation - Length contraction - Relativistic mass variation. Matter waves - De-Broglie hypothesis - Wave nature of particles

UNIT V **6 Hours**

ENERGY BANDS IN SOLIDS

Band theory of solids - Classification of materials - Semiconductors - Direct and indirect semiconductor - Fermi energy - Intrinsic and extrinsic semiconductor - Carrier concentration - Electrical conductivity

1 **5 Hours**

EXPERIMENT 1

Determination of V-I characteristics of a solar cell

2 **5 Hours**

EXPERIMENT 2

Determination of Hall voltage of a given specimen by Hall Effect method

3 **5 Hours**

EXPERIMENT 3

Determination of wavelength of a given laser source - Grating method

4 **4 Hours**

EXPERIMENT 4

Determination of particle size using diode laser

5 **3 Hours**

EXPERIMENT 5

Determination of refractive index of a given solid medium and liquid medium

6 **4 Hours**

EXPERIMENT 6

Determination of energy loss per cycle of a ferromagnetic material using hysteresis curve

7 **4 Hours**

EXPERIMENT 7

Determination of band gap energy of a given semiconducting material

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part II: Electricity and Magnetism, Cognella Academic Publishing, 2019
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019

4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

Course Objectives

- Understand the concept of electrochemistry for determination of electrode potential, pH and applications as energy storage devices
- Outline the chemistry of metal corrosion and analyze the methods of corrosion control
- Understand the role of catalyst in the rate of reaction
- Summarize the variation in properties and reactivity of isotopes.

Course Outcomes (COs)

1. Apply the electrochemical concepts to determine the electrode potential of a metal
2. Analyze the working of batteries for the energy storage devices
3. Understand the mechanism of corrosion and suggest a method to control the corrosion
4. Illustrate reaction mechanisms and assess the role of catalyst in a chemical reaction
5. Analyze various types of nuclear transmutation including decay reactions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1					1							
4	2	1												
5	2	1												

UNIT I**6 Hours****ELECTROCHEMISTRY**

Origin of potential - electromotive force - electrical double layer - transport of charge within the cell - cell description - prediction of cell potentials

UNIT II**6 Hours****ENERGY STORING DEVICES**

Relation between electrical energy and energy content of a cell - reversible and irreversible cell - charging and discharging reactions in a reversible cell - current challenges in energy storage technologies

UNIT III**6 Hours****METAL CORROSION AND ITS PREVENTION**

Oxidation of metals: Electrochemical origin of corrosion - electromigration - electron transfer in the presence and absence of moisture - galvanic series. Strategies for corrosion control: Galvanic anode and impressed current.

UNIT IV **6 Hours**

CATALYSIS

Energy profile diagram for a chemical reaction - activation energy - role of catalyst - homogeneous and heterogeneous catalysis - types

UNIT V **6 Hours**

NUCLEAR REACTIONS

Radioactive and stable isotopes - variation in properties between isotopes - radioactive decay (alpha, beta and gamma) - half-life period - nuclear reactions - radiocarbon dating

1 **4 Hours**

EXPERIMENT 1

Determination of strength of hydrochloric acid in a given solution using pH meter

2 **4 Hours**

EXPERIMENT 2

Application of calomel electrode to determine the redox potential of Fe(II) solution

3 **4 Hours**

EXPERIMENT 3

Construct an electrochemical cell exhibiting valid output and compare its potential with the given standard cell

4 **5 Hours**

EXPERIMENT 4

Determination of corrosion percentage of iron/steel by weight loss method

5 **4 Hours**

EXPERIMENT 5

Determination of percentage of corrosion inhibition in iron/mild steel using a natural inhibitor

6 **4 Hours**

EXPERIMENT 6

Electroplate copper on the given target object and estimate the amount of copper deposited at cathode

7 **5 Hours**

EXPERIMENT 7

Determination of rate constant of acid catalyzed hydrolysis of ester

Total: 60 Hours

Reference(s)

1. Jain and Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2013.
2. P.H. Rieger, Electrochemistry, Second Edition (Reprint), Springer, Netherland, 2012
3. E.McCafferty, Introduction to Corrosion Science, Springer; 2010 Edition, January 2010

4. S. Vairam, Engineering Chemistry, John Wiley & Sons, 2014
5. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th edition, (revised) New Age International Publishers, 2011
6. U. Hanefeld, L. Lefferts, Catalysis: An Integrated Textbook for Students, Wiley- VCH, 2017

22GE002 COMPUTATIONAL PROBLEM SOLVING

3 0 0 3

Course Objectives

- Analyze the algorithm design techniques and development principles in solving the real life problems.
- Illustrate the different ways of organizing and storing the data in computing systems.
- Understand the basic network configuration and setup connections among different device systems.

Course Outcomes (COs)

1. Analyze a problem and formulate algorithms, pseudocodes and flowcharts.
2. Develop algorithmic solutions to simple computational problems and explore algorithmic approaches to problem solving.
3. Design and apply appropriate data structures for solving computing problems.
4. Compare the various storage devices used in a computer system.
5. Analyze the requirements for a given organizational structure and establish the connection between two or more computers to form a network.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2										
2	3	3	3	3										
3	2	2	2	3										
4	2	2	2	2										
5	2	2	2	2										

UNIT I

6 Hours

VISUAL PROCESS MODELING

Scenario decomposition - logical sequencing - drawing flowchart - preparing visual process model.

UNIT II

12 Hours

ALGORITHMIC DESIGN THINKING

Analysis - Verification - Brute force - Divide and conquer - Greedy - Backtracking.

UNIT III

12 Hours

DATA ORGANIZATION

Elementary Data Organization - Abstract Data Types - Fundamentals of Linear and Non Linear Data Structures.

UNIT IV**7 Hours****DATA STORAGE**

Flat File and Relational database- Data Read & Write in Local Storage, Server Storage and Cloud storage - Database Query Methods.

UNIT V**8 Hours****NETWORKING ESSENTIALS**

Networking Components and Services - IP Addressing - Configuring and Managing the Campus Network - Network Security - Firewalls.

Total: 45 Hours**Reference(s)**

1. David D. Riley, Kenya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2011.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.
4. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill, 2015.
5. Behrouz A. Forouzan, "Data Communication and Networking", 5th Edition, Tata McGraw-Hill, 2014.

**22GE003 BASICS OF ELECTRICAL
ENGINEERING**

2 0 2 3

Course Objectives

- To understand the basic concepts of electrical charge and its properties
- To interpret the formation of electric field due to electric charges
- To illustrate the concept of magnetic fields due to revolving electron
- To illustrate the force on moving charges in electric and magnetic field
- To understand the energy transfer in electro mechanical conversion

Course Outcomes (COs)

1. Interpret the behavior of electric charges in different medium using coulombs law.
2. Analyse the electric field due to different charge distributions.
3. Analyse the magnetic field intensity due to long conductor, solenoid, toroid and magnetic dipoles.
4. Analyze the force on conductors due to the moving charges.
5. Interpret the energy conversion concepts in electromagnetic fields.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2								2	2		
2	2	2	2	3							3	2		
3	2	2	1	3							2	2		
4	3	2	1	2							2	2		
5	2	2									2	2		

UNIT I

5 Hours

ELECTRIC CHARGE

Properties of charge, additivity of charges, quantization of charge, conservation of charge, Forces between multiple charges, Electric charge in conductors, Drift of Electrons, Charges in Clouds.

UNIT II

7 Hours

ELECTRIC FIELD

Electric field due to system of charges, Significance of Electric field line. Electric Dipole and its significance, Continuous charge distribution, Field in infinite long uniform straight conductors, field in uniform charged uniform infinite plane sheet, field due to uniform thin spherical sheet.

UNIT III

7 Hours

MAGNETIC FIELDS

Concept of magnetic field, magnetic fields in infinitely long straight wire, straight and toroidal solenoids, Magnetic dipole moment of a revolving electron, Magnetic field intensity due to a

magnetic dipole (bar magnet) along its axis and perpendicular to axis, Induced Electric field due to changing Magnetic Field.

UNIT IV **6 Hours**

FORCE ON CHARGES

Force on a moving charge in uniform magnetic and electric fields, Force on a current carrying conductor in a uniform magnetic field, Force between two parallel current carrying conductors.

UNIT V **5 Hours**

ELECTRO MECHANICAL ENERGY CONVERSION

Energy transfer in electromagnetic fields, Energy storage in magnetic field, Electromagnetic induction, induced emf, Eddy currents. Self and mutual inductance Linear Momentum and Angular Momentum carried by Electromagnetic Fields.

1 **15 Hours**

EXPERIMENT 1

Analyze and design of Electromechanical energy conversion system.

2 **15 Hours**

EXPERIMENT 2

Develop an electrical machine and analyze its performance with supplied input of AC from 0 V to 230 V.

Total: 60 Hours

Reference(s)

1. Mathew N. O. Sadiku, Principles of Electromagnetics, 6th Edition, Oxford University 2020
2. William H. Hayt and John A. Buck, Engineering Electromagnetics, McGraw Hill 2020
3. Kraus and Fleisch, Electromagnetics with Applications, McGraw Hill International Editions, 2017
4. S.P.Ghosh, Lipika Datta, Electromagnetic Field Theory, First Edition, McGraw Hill Education(India) Private Limited 2017

Course Objectives

- Understand the operation of Arithmetic Logic unit in Microprocessors
- Interpret Data retrieval from Memory by Microprocessors
- Analyze the role of Control Unit in Microprocessors
- Analyze Instruction execution in Microprocessors

Course Outcomes (COs)

1. Analyze the Design of Arithmetic and Logic Unit in Microprocessors
2. Analyze the Data Storage and Retrieval from Random Access Memory
3. Analyze the working mechanism of Control Unit in Microprocessors
4. Analyze the execution of Arithmetic and Logical Instructions
5. Analyze the execution of Jump and Memory related Instructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2											
2	2	2	2											
3	2	2	2											
4	2	2												
5	2	2												

UNIT I**9 Hours****BINARY SYSTEM AND DESIGN OF ALU**

Conversion of Decimal, Hexadecimal, Octal and Binary Numbers - Representation of Negative Numbers in Binary - Design of Binary Arithmetic Logic Modules - Magnitude Comparator - Encoder - Decoder - Multiplexer - Demultiplexer - Design of Arithmetic and Logic Unit (ALU)

UNIT II**9 Hours****SYNCHRONOUS CIRCUIT AND DESIGN OF RAM**

Latches and Flip Flops - Clock - Registers - Counters - Shift Registers - Storage and Retrieval of Binary Numbers from Registers - Design of Random Access Memory (RAM) - Encoding and Decoding of Memory address locations

UNIT III**9 Hours****DESIGN OF CONTROL UNIT**

Design of Control Unit - Mechanism of Instruction Read, Data Read, Instruction Decode, Instruction Execute and Data Write

UNIT IV **9 Hours**

BASIC INSTRUCTION EXECUTION

Arithmetic Instructions - Increments, Decrements and Rotate Instructions - Logic Instructions
- Arithmetic and Logic instructions

UNIT V **9 Hours**

ADVANCED INSTRUCTION EXECUTION

Memory Reference instructions - Register Instructions - Jump and Call Instructions - Concept of Flag - Extended Register Instructions - Indirect Instructions - Stack instructions

1 **2 Hours**

EXPERIMENT 1

Design and Simulation of Fundamental Gates using Universal Gates (NAND and NOR)

2 **3 Hours**

EXPERIMENT 2

Design and Simulation of Half Adder, Full Adder, Half Subtractor, Full Subtractor

3 **3 Hours**

EXPERIMENT 3

Design and Simulation of 4-bit Ripple Carry Adder

4 **4 Hours**

EXPERIMENT 4

Design and Simulation of a 4-bit Arithmetic and Logic

5 **4 Hours**

EXPERIMENT 5

Design and Simulation of D Flip Flop and J K Flip Flop

6 **4 Hours**

EXPERIMENT 6

Design and Simulation of 8-bit Register

7 **4 Hours**

EXPERIMENT 7

Design and Simulation of an 8 bit SISO, SIPO, PISO, PIPO Shift Registers

8 **3 Hours**

EXPERIMENT 8

Simulation of Data Read and Data Write from a RAM

9 **3 Hours**

EXPERIMENT 9

Simulation of Control Unit Functionality

Total: 75 Hours

Reference(s)

1. Digital Logic & Computer Design , Morris Mano Pearson Education India, 2019
2. Digital Computer Electronics, Albert Paul Malvino and Jerald A Brown (3rd Edition), McGraw Hill Education India, 2001
3. Digital Design and Computer Architecture, David Money Harris and Sarah L Harris,Elsevier, 2007
4. But How do it Know? The Basic Principles of Computers for Everyone, John C Schott,John C Scott Publishers, 2009
5. Code: The Hidden Language of Computer Hardware and Software (2nd Edition), Petzold Charles, Microsoft Press , 2022
6. Digital Computer Fundamentals (6th Edition), Thomas C Bartee, Tata Mcgraw Hill Education, 2011

Course Objectives

1. Describe the linguistic diversity in India, highlighting Dravidian languages and their features.
2. Summarize the evolution of art, highlighting key transitions from rock art to modern sculptures.
3. Examine the role of sports and games in promoting cultural values and community bonding.
4. Discuss the education and literacy systems during the Sangam Age and their impact.
5. Outline the importance of inscriptions, manuscripts, and the print history of Tamil books in preserving knowledge and culture.

Course Outcomes (COs)

1. Understand the concept of language families in India, with a focus on Dravidian languages.
2. Trace the evolution of art from ancient rock art to modern sculptures in Tamil heritage.
3. Identify and differentiate various forms of folk and martial arts in Tamil heritage.
4. Understand the concepts of Flora and Fauna in Tamil culture and literature.
5. Evaluate the contributions of Tamils to the Indian Freedom Struggle.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT I**3 Hours****LANGUAGE AND LITERATURE**

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

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

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

UNIT III**3 Hours****FOLK AND MARTIAL ARTS**

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

UNIT IV**3 Hours****THINAI CONCEPT OF TAMILS**

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

UNIT V**3 Hours****CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**

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

Total: 15 Hours**Reference(s)**

1. Dr.K.K.Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
2. Dr.S.Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies.
5. Keeladi, Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu.
7. Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
8. R.Balakrishnan, Journey of Civilization Indus to Vaigai, RMRL.

**22IS301 PROBABILITY, STATISTICS AND
QUEUING THEORY**

3 1 0 4

Course Objectives

- The students will be able to understand the basic concepts of probability and the distributions with characteristics and also two-dimensional random variables
- Summarize and apply the methodologies of the statistics and queuing theory
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment

Course Outcomes (COs)

1. Demonstrate and apply the basic probability axioms and concepts in the core areas.
2. Apply the concepts of probability distributions in an appropriate place of computers and Engineering.
3. Implement basic statistical inference techniques for engineering problems.
4. Design an experiment using ANOVA technique and summarize the measurements for statistical quality control.
5. Identify and apply the queuing methodologies to optimize the result of the waiting line.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2	1	2												
3	1	2												
4	1	2												
5	1	2												

UNIT I

9 Hours

PROBABILITY AND RANDOM VARIABLE

Axioms of probability-Conditional probability-Total probability-Bayes theorem-Random variable-Probability mass function-Probability density functions-Properties-Moments - Moment generating functions and their properties.

UNIT II

9 Hours

STANDARD DISTRIBUTIONS

Discrete distributions: Binomial - Poisson - Negative Binomial - Continuous distributions: Uniform - Exponential - Gamma - Normal distributions and their properties.

UNIT III**9 Hours****TESTING OF HYPOTHESIS**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on normal distribution for single mean and difference of means -Small sample tests: t-test for mean -F- test - Chi-square test for Goodness of fit and Independence of attributes.

UNIT IV**9 Hours****DESIGN OF EXPERIMENTS AND CONTROL CHART**

One way and two way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design - Control charts for measurements (X and R charts) - Control charts for attributes (p, c and np charts).

UNIT V**9 Hours****QUEUING THEORY**

Pure Birth and Death Process -Characteristics of Queuing models- Kendall's notation- Single and multi server Markovian queuing models- M/M/1 and M/M/C (Finite and infinite capacity)- Pollaczek-Khinchine formula.

Total: 60 Hours**Reference(s)**

1. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, PHL Publisher, 1996.
2. Kishore S Trivedi, Probability and Statistics with Reliability Queuing and Computer Science Applications, John Wiley and Sons, Second Edition, 2012.
3. Arnold O Allen, Probability Statistics and Queuing Theory with Computer Applications, New Age International, 2003.
4. Jay L Devore, Probability and Statistics for Engineering and The Sciences, Thomson Learning, Seventh Edition, 2002.
5. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists,

Course Objectives

- Implement array and hash data structure for real-world applications.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the performance of various data structures using asymptotic notations

Course Outcomes (COs)

1. Implement the array data structure and its types for searching and sorting operations.
2. Outline the algorithm efficiency with different asymptotic notations for optimizing the code.
3. Implement the linear node-based data structure for real world applications.
4. Evaluate the performance of Hash over arrays and list in memory access.
5. Analyze the tree traversal algorithms for various non-linear data structures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	1
2	2	2	2	2	2						2	2	1	
3	2	3	3	2	2						2	2	2	1
4	3	3	3	3	2						3	3	3	
5	3	2	3	3	3						3	3	2	2

UNIT I**10 Hours****FOUNDATIONAL DATA STRUCTURES**

Algorithms and Data Structures - Data Structures hierarchy -Types of Data- Singular Data and Plural Data - Position indexing : Array - Sets - Ordered Arrays - Searching over Arrays and Ordered Arrays.

UNIT II**7 Hours****ALGORITHM EFFICIENCY**

Algorithm efficiency using Asymptotic Notations - Optimizing code with and without Big O Notation - Optimizing for optimistic scenarios - Trade- offs between Time and Space.

UNIT III**10 Hours****ADT AND NODE BASED DATA STRUCTURES**

ADT : Stacks - Queues - Recursion - Recursive Algorithms for Speed - Node Based Data Structures : Linked list - Need of Linked List - Arrays vs Linked List - Types of Linked List and its operations - Skip Lists.

UNIT IV **8 Hours**

FAST LOOKUP WITH HASH

Hash Table - Hash functions - Internal implementation of Hash - Iteration over Hash - Hash operations - Hash of Hash - Array of Hash - Hash of Array.

UNIT V **10 Hours**

TREES

Tree - Binary Tree - Binary Search Tree - Tree traversal - AVL Tree - Red Black Tree - B Tree - B+ Tree - Heap.

1 **8 Hours**

EXPERIMENT 1

Implement a Python program for the supermarket application using Stack and Queue for basket storage and checkout respectively.

2 **4 Hours**

EXPERIMENT 2

Implement a python program for using a singly linked list. managing a train station and need to keep track of passengers on a particular train

3 **4 Hours**

EXPERIMENT 3

Create a python program that allows users to search for a person's phone number quickly in the phone directory.

4 **2 Hours**

EXPERIMENT 4

Implement a Python program to sort the student grades for the quiz competition.

5 **2 Hours**

EXPERIMENT 5

Implement a digital signature generator and verifier using hash functions and public-key cryptography. Users can sign documents and verify the authenticity of signed documents.

6 **10 Hours**

EXPERIMENT 6

Implement a Python program to give a direction for a Stranger. The landmark will be considered a node and the path between the two landmarks is the link

Total: 75 Hours

Reference(s)

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures & Algorithms in Python, Wiley, 2013.
2. Larry Wall, Tom Christiansen & Randal L. Schwartz, Programming Perl, O'Reilly, 3rd edition, 2000.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2016

4. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
5. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011.
6. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011.

22IS303 COMPUTER ORGANIZATION AND ARCHITECTURE

3 0 0 3

Course Objectives

- Understand the fundamental digital logics behind computations of computer systems.
- Impart knowledge about the operation of the arithmetic unit including the algorithms & implementation addition, subtraction, multiplication & division.
- Acquire knowledge about the modern computer architectures and their instruction execution.

Course Outcomes (COs)

1. Infer the hidden languages and inner structures of computer hardware and software through codes and combinations.
2. Design a processor architecture for implementing various pipeline mechanisms.
3. Outline the memory hierarchy architecture and the influence of Tera MTA in cache performance.
4. Analyze the performance of GPU architecture over CPU architecture and their implementation tools
5. Compare the modern computer architectures and their implementation with the traditional computing systems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2								2		1
2	3	3	2	2								2		2
3	2	2	2									2	2	2
4	2	2	2	2	3							2	1	1
5	2	2	2	2								2		2

UNIT I

9 Hours

UNDERSTANDING PROCESSOR ARCHITECTURE AND INSTRUCTION SETS

Basic Computer Organization and Design - Instruction Set principles - x86 and x64 architecture & instruction sets - 32 bit and 64 bit ARM architecture & instruction sets.

UNIT II

9 Hours

PROCESSOR DESIGN

Designing a Data path for a Simple Processor - DLX Pipeline - Super Pipelining - Super scalar processor - Instruction level parallelism (ILP) - Speculative Execution - Side channel attack (Spectre and Meltdown)

UNIT III **9 Hours**

MEMORY UNIT AND I/O ORGANIZATION

Memory Hierarchy - Cache Architectures - Levels in Cache - Improving Cache Performance - Memory Prefetch - Tera MTA - Connecting I/O Devices to the Processor.

UNIT IV **8 Hours**

EXPLORING GPU ARCHITECTURE

GPU Vs CPU architecture - GPU Architecture Basics - NVIDIA's CUDA Toolkit - CUDA Programming

UNIT V **10 Hours**

MODERN COMPUTER ARCHITECTURE

Domain-Specific Computer Architectures - Sony PlayStation design PS3/PS5, MAC M1 chip, Xbox, Cerebras - Wafer Scale Computing, Accelerators (FPGA, ASIC) - RISC-V Architecture and Instruction Set - Implementing RISC-V in a field-programmable gate array (FPGA).

Total: 45 Hours

Reference(s)

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill, Third Reprint 2015
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The hardware/software interface, Morgan Kaufmann, 4th edition, 2014.
3. Jim Ledin, Modern Computer Architecture and Organization - Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers - Second Edition, 2022.

**22IS304 PRINCIPLES OF PROGRAMMING
LANGUAGES**

3 0 2 4

Course Objectives

- Understand the history and evolution of programming language.
- Gain knowledge about the different data types and control flow statements.
- Impart knowledge about the subprograms, functions, debugging and error handling mechanisms.

Course Outcomes (COs)

1. Outline the programming paradigms and the basic structure of programming language.
2. Assess the implementation of different types of data, variable and types system.
3. Analyze suitable conditional statements and control structures for real world applications.
4. Develop programs using subprograms and explore their types for problem solving.
5. Determine the tools for error handling and event handling in Programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1	1	3						1	2	1	
2	2	3	3	1	3						2	2	1	
3	1	2	3	1	3						2	2	2	
4	1	2	3	1	3						2	2		2
5	1	2	3	1	3						2	2		2

UNIT I

8 Hours

UNDERSTANDING PROGRAMMING PARADIGMS

Natural Vs Artificial language - Common Programming Paradigms - Syntax and semantics - Language Evaluation Criteria - Programming Language Grammar.

UNIT II

10 Hours

VARIABLES AND DATA TYPES

Variable Declarations - Guidelines for Initializing Variables - Power of Variable names - Fundamental Data types - Type Systems - Type Inference and Polymorphism.

UNIT III

10 Hours

STATEMENTS

Expressions and Assignment statements - Organizing straight-line code - Using conditionals - Controlling loops - Unusual control structures - General control issues.

UNIT IV **9 Hours**

SUBPROGRAMS

Fundamentals of Subprograms - Design issues - Parameter passing methods - Overloaded subprograms -Generic subprograms - Implementing subprograms.

UNIT V **8 Hours**

DEBUGGING AND ERROR HANDLING

Debugging - Debugging Strategies - Debugging Tools - Error Messages - Documentation - Test cases - Debugging with print statements - Debugging with comments and questions - Exception handling and Event handling

1 **6 Hours**

EXPERIMENT 1

Online shopping cart: Develop an application to implement online shopping cart and generate bill for the purchased products.

2 **3 Hours**

EXPERIMENT 2

Pocket Bazaar: Develop an application to manage an inventory of products for grocery stores.

3 **3 Hours**

EXPERIMENT 3

Vacation Destination Decision Maker: Create an application program that helps a user decide on their next vacation destination based on their preferences.

4 **3 Hours**

EXPERIMENT 4

Temperature monitor: Develop an application for temperature monitoring system and provide an alert message.

5 **3 Hours**

EXPERIMENT 5

Develop an access control system that simulates the granting access to authorized personnel based on their credentials, such as ID cards and PIN codes.

6 **6 Hours**

EXPERIMENT 6

Math Quiz Generator: Design a math quiz generator that generates questions of various difficulty levels and arithmetic operations.

7 **3 Hours**

EXPERIMENT 7

Develop a program for implementation of subprograms and nested subprograms and investigate the differences between pass-by-value and pass-by-reference parameter passing mechanisms

8 **3 Hours**

EXPERIMENT 8

Build a maze solver application that finds a path from the entrance to the exit of a maze.

Total: 75 Hours

Reference(s)

1. Steve McConnell, Code Complete, Microsoft Press, 2004.
2. Robert. W. Sebesta 10/E , Concepts of Programming Languages , Pearson Education.
3. D. A. Watt, Wiley Dreamtech, Programming Language Design Concepts, 2007.
4. A.B. Tucker, R. E. Noonan, TMH, Programming Languages, 2nd Edition.
5. Thomson, Programming Languages, K. C. Loudon, 2nd Edition, 2003

Course Objectives

- Understand the systematic approach related to the design, development and maintenance of a software system
- Analyze the limitations of manual testing process and provide a succinct summary of those limitations with the help of automated testing tools.
- Understand the Enterprise Architecture (EA) framework that provides the building blocks for successful digital business transformation

Course Outcomes (COs)

1. Apply the software development methodologies to various real life scenarios
2. Apply modern tools and techniques to develop scalable, maintainable, and reliable software systems.
3. Analyze the coding strategies and techniques to write well-structured, efficient, and error-free code
4. Apply specific modern testing tools to ensure the quality and reliability of software products
5. Analyze the elements, structure, and positioning of an Enterprise Architecture framework used for successful digital business transformation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	1	
2	3	3	2	2	3		2		2			2		2
3	2	2	2				2		2			2	1	
4	2	2	2		3		2		2			2		2
5	2	2	2						2				1	

UNIT I

9 Hours

SOFTWARE DEVELOPMENT PROCESS

Phases in Software Development - Traditional Software Development Models - Agile Methodologies - Agile Scaling Frameworks - Lean Software Development - Software Requirements Specification (SRS) - Project Scheduling and Estimation

UNIT II

9 Hours

TOOLS AND TECHNIQUES FOR SOFTWARE DEVELOPMENT

DevOps - Version control with Git - Containerization Using Docker and Kubernetes- Application Performance Monitoring (APM) - Continuous Integration Continuous deployment (CICD) - Clean Room build

UNIT III**9 Hours****CODE QUALITY**

Software Metaphors - Upstream Prerequisites - Key Construction Decisions - Defensive Programming - Code Tuning Strategies and Techniques

UNIT IV**9 Hours****TESTING**

Writing good test cases - Test driven development - Test Automation - Testing using Selenium tool - Continuous Testing - Exploratory Testing - Testing in Agile and DevOps Environments

UNIT V**9 Hours****ENTERPRISE ARCHITECTURE AND MODELING**

Enterprise Architecture (EA) in Digital Transformation - Agility in Digital Business - Measuring EA: Metrics, KPIs and Risks

Total: 45 Hours**Reference(s)**

1. Charles Petzold, Code: The Hidden Language of Computer Hardware and Software, Microsoft Press books, 2009.
2. David D. Riley, Kenya. Hunt, Computational thinking for the modern problem Solver, CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliaz, Little Man Computer Programming: For the Perplexed from the Ground Up, The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill International edition, Seventh edition, 2010

Course Objectives

- Understand the concept of good values and comprehend the importance of value-based living.
- Recognize the culture of peace through education.
- Identify and apply the practices for value development and clarification.

Course Outcomes (COs)

1. Understand the importance of human values and ethics in life.
2. Execute the importance of harmonious living in a diverse society.
3. Analyze the sensitivity to the crying needs of society such as ungodliness, corruption, poverty, and suffering, and play a vital role in eradicating them.
4. Plan intellectually mature, morally upright, ethically correct, and spiritually inspired decisions.
5. Execute a correct balance between professional excellence and social commitment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1								3	2	1				
2								3	2	1				
3								3	2	1				
4								3	2	1				
5								3	2	1				

UNIT I**6 Hours****COURSE INTRODUCTION - NEED, BASIC GUIDELINES AND ANALYSIS**

Importance of Human Values & Ethics in 21st Century - Understanding the theory of basic human values and ethics -Openness to change -Self enhancement -Conservation -Self transcendence - Schwartz Value Survey: Self-Assessment

UNIT II**6 Hours****EMBRACING THE COMMON ETIQUETTE**

Altruism- Integrity-Freedom-Justice-Honesty-Truthfulness-Responsibility-Compassion

UNIT III**6 Hours****CONTINUOUS HAPPINESS AND PROSPERITY**

An overview on basic Human Aspirations- Understanding and living in harmony at various levels of life-Embracing self-love and wellness-Understanding harmony in the family and society

UNIT IV **6 Hours**

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

Reflection on growing global multifold problems: poverty, pollution, hunger, disease, unemployment, caste system, child labour, gender equality, politics and violence. Understanding the challenges in cultural, personal, social, political, and economic environment

UNIT V **6 Hours**

UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS CO-EXISTENCE

Understanding the harmony in the Nature- Holistic perception of harmony at all levels of existence- Practice Exercises and Case Studies will be taken up in Practice Sessions

Total: 30 Hours

Reference(s)

1. Martin, G. The Little Book of Ethics: A Human Values Approach. Australia: G.P. Martin. 2011.
2. Gupta, N. L. Human Values for the 21St Century. India: Anmol Publications Pvt. Limited. 2002.
3. Mishra, A. Happiness Is All We Want. India: Bloomsbury Publishing.2017.
4. Universal Human Values. (n.p.): Booksclinic Publishing. 2023.
5. A Textbook on Professional Ethics and Human Values. India: New Age International (P) Limited.2007.

**22HS005 SOFT SKILLS AND EFFECTIVE
COMMUNICATION**

0 0 2 1

Course Objectives

- Communicate proficiently in formal discussions at the workplace.
- Describe experiences and events, and briefly give reasons and explanations for opinions and plans.
- Interact with a degree of fluency and spontaneity that results in efficacious communication
- Convey agreement and disagreement in a polite but firm manner
- Communicate with coherence and imagination in both written and spoken formats

Course Outcomes (COs)

1. Enhance confidence in expressing thoughts in grammatically proper language and etiquette in waiting for the opportunity to provide input.
2. Effectively communicate in English on formal occasions and proficiency in the use of link words and other discourse markers
3. Provide constructive feedback and file logical complaints.
4. Analyse the understanding of oral and written communication in real-world situations.
5. Apply the improved spelling and punctuation in writing and heightened understanding of tone, pitch and stress in oral formats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT – I - SELF-EXPRESSION

10 Hours

Group discussion/ Peer discussion - Communicating decisions and opinions - Tone, Pitch, Stress - Agreeing, Disagreeing, Suggesting, Speculating - Comparing and Contrasting - Comparatives and Superlatives - Discourse markers – Interjections - Decision making - Synthesis - Higher order thinking Group discussion/Peer discussion - Effective Communication Types of communication - Written vs Spoken - Contractions Intonation Stress Active voice - Question tags - Confidence and body language Guided writing- Outlining Main Points - Group discussion/Peer discussion - Avoiding common errors Reduction of MTI - Common errors - Barriers to communication Accent

UNIT – II - CREATIVE EXPRESSION**10 Hours**

JAM, Debate, Review writing, Social media posts Synonyms - Antonyms Cloze test Phrasal verbs Spotting errors Collocation - Commonly mispronounced

UNIT – III - FORMAL EXPRESSION**10 Hours**

Writing: Giving written feedback, Review writing, and Letter of complaint. Speaking: Giving constructive feedback and offering suggestions, asking for inputs, commenting politely on appropriate phrases - Giving written feedback, Review writing, and Letter of complaint. Critical reasoning - Modal verbs - Polite ways to express negatives

Total: 30 Hours**Reference(s)**

1. Word Power Made Easy by Norman Lewis, W. R. Goyal Pub. & Distributors, 2009.
2. Sasikumar, V, et al., A Course in Listening & Speaking Foundation Books, 2005.
3. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
4. Prasad, Hari Mohan. A Handbook of Spotting Errors, Mcgraw Hill Education, 2010.
5. Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012
6. Business English by Ken Taylor, Orient Blackswan, 2011

Course Objectives

1. Analyse graffiti on potteries as a form of historical and cultural documentation during the Sangam Age.
2. Investigate the building materials and the historical context of Hero stones during the Sangam Age by Analysing the details of stage constructions in Silappathikaram and their cultural significance.
3. Examine ancient knowledge of oceans and its impact on Tamil society.

Course Outcomes (COs)

1. Understand the significance of the weaving industry during the Sangam Age and its cultural importance.
2. Understand the significance of dams, tanks, ponds, and sluices in the agricultural and irrigation practices of the Chola Period.
3. Explore the architectural designs and structural construction methods used in household materials during the Sangam Age.
4. Explore the art of shipbuilding in ancient Tamil culture and its role in maritime trade and transportation.
5. Trace the development of scientific terminology and vocabulary in Tamil language.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT I**3 Hours****WEAVING AND CERAMIC TECHNOLOGY**

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

UNIT II**3 Hours****DESIGN AND CONSTRUCTION TECHNOLOGY**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-

Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III

3 Hours

MANUFACTURING TECHNOLOGY

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

UNIT IV

3 Hours

AGRICULTURE AND IRRIGATION TECHNOLOGY

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoombu 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.

3 Hours

SCIENTIFIC TAMIL & TAMIL COMPUTING

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

Total: 15 Hours

Reference(s)

1. Dr.K.K.Pillay , Social Life of Tamils , A joint publication of TNTB & ESC and RMRL
2. Dr.S.Singaravelu , Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr.S.V.Subatamanian , Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr.M.Valarmathi , The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies
5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ , Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu.
7. Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
8. R.Balakrishnan , Journey of Civilization Indus to Vaigai, RMRL

22IS401 DISCRETE MATHEMATICS**3 1 0 4****Course Objectives**

- Implement the definitions of relevant vocabulary from graph theory and combinatorics and be able to perform related calculations.
- Understand and use the terms Cardinality, finite, countably infinite and uncountably infinite, and determine which of these characteristics is associated with a given set.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Course Outcomes (COs)

1. Understand and apply the concepts of Boolean algebra and characteristics in computers.
2. Apply formalized arguments to classify and assess real-world arguments.
3. Represent the characteristics of predicate logic in computer engineering.
4. Apply different properties of injection, surjection, bijection, composition and inverse functions in software engineering.
5. Interpret the concepts of Permutations, Combinations and Mathematical induction in the phenomena of real world.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												2
2	1	1												
3	1	2											1	
4	2	2												
5	1	2												

UNIT I**9 Hours****BOOLEAN ALGEBRA**

Introduction of Boolean algebra - Truth table - Basic logic gate - Basic postulates of Boolean algebra - Principle of duality- Canonical form - Karnaugh map.

UNIT II**9 Hours****PROPOSITIONAL CALCULUS**

Propositions- Logical connectives-Compound propositions-Conditional and biconditional propositions- Truth tables - Tautologies and Contradictions - Logical and equivalences and implications-DeMorgans Laws-Normal forms-Principal conjunctive and disjunctive normal forms - Rules of inference-Arguments-Validity of arguments.

UNIT III **9 Hours**

PREDICATE CALCULUS

Predicates-Statement Function - Variables-free and bound variables- Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements- Theory of inference- The rules of universal specification and generalization-Validity of arguments.

UNIT IV **9 Hours**

SET THEORY AND FUNCTIONS

Set Operations-properties-Power set-Relations-Graph and matrix of a relation- Partial Ordering- Equivalence relations-Partitions- Functions -Types of Functions- composition of relation and functions- inverse functions.

UNIT V **9 Hours**

COMBINATORICS

Basics of Counting - Counting arguments- Pigeonhole Principle- Permutations and Combinations- Recursion and recurrence relations-Generating Functions- Mathematical Induction- Inclusion - Exclusion

Total: 60 Hours

Reference(s)

1. Trembly J P and Manohar R, Discrete Mathematical Structures with Applications to computer Science, Tata McGraw Hill Publications Co. Ltd., New Delhi 30th Re-print 2007.
2. Alan Doerr and Kenneth Levasseur, Applied Discrete Structures for Computer Science, Galgotia Publications Pvt. Ltd. Delhi. 2010.
3. Ralph P Girmaldi and Ramana B.V. Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education Asia, Delhi, 2007.
4. Kolman Busby Ross, Discrete Mathematical Structures , Prentice-Hall India, New Delhi, Fifth Edition, 2007.
5. Rosen K.H Discrete Mathematics and its Applications, Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.

22IS402 DATA STRUCTURES II**3 0 2 4****Course Objectives**

- Understand and use the various major modern data structures like Trie, Rope, Segment tree and Octree.
- Apply the graph data structure and tree traversal algorithms for solving real time problems.
- Analyze the performance of algorithm design techniques with different data structures.

Course Outcomes (COs)

1. Implement the Trie data structure and its basic search operations.
2. Outline the traversal algorithm and its types with graph data structure.
3. Implement Minimum Spanning tree algorithms and analyze their performance.
4. Design and implement different problems using the backtracking and branch and bound techniques and analyze the time complexities of them.
5. Implement modern data structures like Segment tree, Quadtree and Octree for real world applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	1	
2	1	2	2	2	2						2	2	1	
3	2	3	3	2	2						2	2	1	
4	3	3	3	3	2						3	3	1	
5	3	2	3	3	3						3	3	1	

UNIT I**9 Hours****TRIE DATA STRUCTURES**

Trie Structure-Types-Prefix-Based Search-Space Efficiency-Time Complexity-Compact Tries-Applications-Suffix Array and Suffix Tree-Rope.

UNIT II**9 Hours****GRAPH**

Graph representation-Breadth-first traversal-Depth-first traversal-Shortest Path Algorithms: Unweighted Shortest Paths-Dijkstras Algorithm-Travelling Salesman Problem-Analysis of shortest path algorithms.

UNIT III**9 Hours****GRAPH MST**

Minimum Spanning Tree: Prims Algorithm-Kruskals Algorithm-Disjoint-Set Union (Union-Find)-A* algorithm-Flood filling algorithm-Analysis of MST algorithms.

UNIT IV **9 Hours**

ALGORITHM DESIGN TECHNIQUES

NP Complete problems- Backtracking: N-Queens Problem and Subset-Sum problem - Branch and bound: Knapsack problem-Approximation algorithms for NP hard problems: Traveling salesman-P, NP, NP-Complete and NP-Hard Problems.

UNIT V **9 Hours**

MODERN DATA STRUCTURES

Segment Tree-Interval Tree-Fenwick Tree-K-D Tree-Quadtree and Octree-Circular Buffer (Ring Buffer)-Marshaling/Unmarshaling-JSON-benefits-Schema-limitations-Protobuf.

1 **4 Hours**

EXPERIMENT 1

Implement a Trie data structure and perform prefix based search.

2 **4 Hours**

EXPERIMENT 2

For a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

3 **4 Hours**

EXPERIMENT 3

Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.

4 **6 Hours**

EXPERIMENT 4

Implement the Flood fill algorithm for replacing the color from the source row to source column in 2D array.

5 **4 Hours**

EXPERIMENT 5

Implement N Queens problem using Backtracking.

6 **4 Hours**

EXPERIMENT 6

Construct a segment tree for computing sum of the elements in a given range.

7 **4 Hours**

EXPERIMENT 7

Implement a Quad tree for locating a node in the given quad.

Total: 75 Hours

Reference(s)

1. Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley publications, 2013.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2016.
3. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures-A Pseudocode Approach with C, Thomson 2011.
4. Aho, J.E. Hopcroft and J.D. Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.
5. Reema Thareja, Data Structures Using C, Second Edition, Oxford University Press, 2011

22IS403 OPERATING SYSTEMS

3 1 0 4

Course Objectives

- Establish a solid foundation in the introductory concepts of operating systems and gain insights into the structures, services, and roles of operating systems in computing environments.
- To apply process scheduling algorithms in a multi-programming environment and implement the various deadlock strategies effectively to prevent each other from accessing the computer resources
- To gain knowledge on the operations of memory management and File management.

Course Outcomes (COs)

1. Analyze the basic structure and architectural components of the operating system and interpret how application programs interact with the operating system through APIs.
2. Apply the various scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. Analyze memory allocation and deallocation mechanisms involved in memory management for a specific system.
4. Apply the various file handling strategies to manage files on a secondary storage structure and in a distributed environment.
5. Analyze the virtualization technologies and their types to simulate hardware functionality and create a virtual computer system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2		
2	3	3	2	2	3		2		2			2	2	2
3	2	2	2				2		2			2	1	
4	2	2	2		3		2		2			2	1	1
5	2	2	2						2					1

UNIT I

8 Hours

INTRODUCTION TO OPERATING SYSTEMS

Basic Operating System Concepts-Operating System Structure and Components-Operating System Services and Interfaces-Role of the Kernel and User Space-System calls and System Programs-Open Source and Closed source operating systems.

UNIT II

12 Hours

PROCESS MANAGEMENT

Processes and Threads-Process Scheduling and CPU Scheduling Algorithms-Process Synchronization and Concurrency Control-Deadlocks and Handling Strategies-Inter-Process Communication (IPC)-Multi-Core and Multi-Processor Management

UNIT III **9 Hours**

MEMORY MANAGEMENT

Memory Hierarchy-Address Spaces and Memory Allocation-Paging and Segmentation-Page Replacement Algorithms-NUMA (Non-Uniform Memory Access)-Memory Compression-Memory Tiering.

UNIT IV **8 Hours**

FILE SYSTEM DESIGN AND AND IMPROVEMENTS

File System Structures-Storage Technologies-SSD and Flash Storage Optimization-Copy-on-Write (CoW) File Systems-File System Journaling-Distributed File Systems and Cloud Storage-File System Monitoring and Analytics

UNIT V **8 Hours**

VIRTUALIZATION AND RECENT DEVELOPMENTS

Virtualization Principles and Types (Hardware, Software, Network, Storage)-Hypervisors and Virtual Machine Monitors-Microkernels and Exokernels-Security and Integrity in Virtualized Environments-Security in Operating Systems-Operating Systems for Quantum Computers-Cross-Platform Compatibility.

Total: 60 Hours

Reference(s)

1. 1.Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2. 2.Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. Ltd, 2014
3. 3.William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4. 4.Harvey M. DeitelM, Operating Systems, Pearson Education Pvt. Ltd, 2007.
5. 5.Distributed file system for cloud: A Clear and Concise Reference Kindle Edition by Gerardus Blokdyk
6. 6.<https://www.redhat.com/en/topics/virtualization>

22IS404 WEB TECHNOLOGY AND FRAMEWORKS

2 0 2 3

Course Objectives

- Understand the Web Application Architectures and trace the evolution of the web and introduce concepts like Web 3.0 and Decentralized Web.
- Familiar with the different Web development Frameworks and Full stack development.
- Explore the emerging web technologies and implement best practices for making web applications accessible to all users

Course Outcomes (COs)

1. Analyze the architecture of various web applications and develop simple use cases for the real time web applications
2. Implement web applications using client-side scripting language and server-side scripting languages.
3. Integrate the web applications with databases using Web frameworks.
4. Develop a complete, functional web application that incorporates both front-end and back-end components.
5. Implement the emerging web technologies in web application development projects.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2		
2	2	2	2	2	2						2	2		1
3	2	3	3	2	2						2	2		1
4	3	3	3	3	2						3	3		2
5	3	2	3	3	3						3	3		3

UNIT I

5 Hours

INTRODUCTION TO WEB APPLICATION

Evolution of the web-Understanding Web Application Architectures:Server Side Rendered Applications-Single Page Application SPA-Mobile Application Development-Comparison of Monolithic and Microservice architectures-Serverless computing-HTTP Protocol and Methods-Web Browsers and Rendering Engines-Use cases of various web applications, including Flipkart, BIT Discourse, BIP, Wiki and Moodle.

UNIT II

7 Hours

SCRIPTING LANGUAGES

Client-side Scripting vs Server-Side Scripting-Client-side Scripting: Execution Location-Languages: JavaScript Fundamentals-Document Object Model DOM. Server-Side Scripting: Execution Location-Languages-PHP Programming fundamentals

UNIT III **6 Hours**

WEB DEVELOPMENT FRAMEWORKS

Introduction to Web Development Frameworks -MVC Architecture - Building APIs with a Framework - RESTful APIs and API Design - Building a RESTful API - Database Integration with ORM/ODM -Building a Basic Front-End Application.

UNIT IV **6 Hours**

FULL STACK DEVELOPMENT

Full-Stack Development - Combining Front-End and Back-End Technologies - Building a Full-Stack Web Application- 12 factor application model - Deployment and Hosting Options - Continuous Integration and Continuous Deployment CI/CD - Performance Optimization and Scalability.

UNIT V **6 Hours**

EMERGING WEB TECHNOLOGIES

Emerging Web Technologies-Progressive Web Apps PWAs-WebAssembly and WebRTC-Web Security Best Practices-Open Web Application Security Project OWASP-Web Accessibility and Inclusive Design-Web Performance Optimization.

1 **3 Hours**

EXPERIMENT 1

Create a simple HTML page and use the browsers developer tools to inspect and manipulate elements.

2 **3 Hours**

EXPERIMENT 2

Write JavaScript to validate the following fields of the Registration page.

- a)First Name (Name should contains alphabets and the length should not be less than 6 characters).
- b>Password (Password should not be less than 6 characters length).
- c)E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
- d)Mobile Number (Phone number should contain 10 digits only).
- e)Last Name and Address (should not be Empty).

3 **3 Hours**

EXPERIMENT 3

Develop a multi-page website using HTML and CSS and apply responsive design techniques to make the site mobile-friendly.

4 **3 Hours**

EXPERIMENT 4

Develop a QR code generator using PHP and connect to a database to store and retrieve data

5 **3 Hours**

EXPERIMENT 5

Developing a Simple Web Application using a server-side framework (e.g., Flask, Django, or Ruby on Rails) and apply security measures to protect against common web vulnerabilities

6 **4 Hours**

EXPERIMENT 6

Create a single-page application (SPA) using the front-end framework (e.g., React, Angular, or Vue.js) and implement routing and state management.

7 **3 Hours**

EXPERIMENT 7

Develop a RESTful API using a back-end framework (e.g., Node.js or Express), perform the CRUD operations and Test the API using tools like Postman

8 **4 Hours**

EXPERIMENT 8

Create a full-stack web application to implement user authentication and authorization connected to a database to store and retrieve data for the application

9 **4 Hours**

EXPERIMENT 9

Deploy a web application in a hosting platform (e.g., Heroku, AWS, or Azure) and set up a continuous integration and continuous deployment (CI/CD) pipeline to monitor the deployed application for performance and errors.

Total: 60 Hours

Reference(s)

1. P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education,2009.
2. James Gillies and Robert Cailliau, How the Web Was Born: The Story of the World Wide Web, 2000
3. D Crockford , The Good Parts, O Reilly , 2009
4. Mark Masse , REST API Design Book,O Reilly,2011
5. Matti Luukkainen and Jarkko Moilanen , Fullstack Open: Deep Dive Into Modern Web Development
6. Michal Zalewski , The Tangled Web: A Guide to Securing Modern Web Applications 2011

22IS405 DATABASE MANAGEMENT SYSTEM**3 0 2 4****Course Objectives**

- Analyze the data models, conceptualize and Design a database system using E-R diagrams.
- Gain knowledge on the design principles of relational and modern database systems like SQL, NoSQL and NewSQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

Course Outcomes (COs)

1. Analyze the data models and the types of data used in databases.
2. Implement SQL queries for creating databases and performing the relational operations.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes.
5. Analyze the performance of NoSQL and NewSQL databases related to design.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2		
2	2	2	2	2	2						2	2	2	
3	2	3	3	2	2						2	2		
4	3	3	3	3	2						3	3		
5	3	2	2	3	3						3	3		

UNIT I**8 Hours****INTRODUCTION TO DATABASES AND DBMS**

Understanding Data and Information - Database vs DBMS - Modern Databases - DBMS Architecture and Components - Data Models - Relational Model - Codd's 12 Rules - Object-Relational Mapping (ORM).

UNIT II**10 Hours****STRUCTURED QUERY LANGUAGE (SQL)**

SQL Basic Commands - Constraints - Database Objects - SQL Functions - Subqueries- Correlated Subqueries- Nested subqueries - Recursive queries - Common Table Expressions (CTEs) - Triggers and Stored procedures.

UNIT III **9 Hours**

DATABASE DESIGN AND NORMALIZATION

Database Design fundamentals - Entity-Relationship Diagrams (ERD) - ERD to tables - Functional Dependencies and Normal Forms: 1NF, 2 NF, 3 NF, BCNF, 4 NF, 5NF and 6 NF - Domain-Key Normal Form (DKNF) - Nested Normal Form (NNF) - Denormalization and Trade-offs - Emerging trends in Database Design - Dealing with real-world complexities in Database Design- CASE Tools for Database Design.

UNIT IV **9 Hours**

QUERY OPTIMIZATION AND TRANSACTION MANAGEMENT

Query Optimization and Execution Plans -Optimization Visualization Tool - DB Sharding - Vitess - Vitess vs MySQL- Table partitioning - Transaction Management and ACID Properties - Concurrency Control: Lock based protocols -Deadlock handling - Multi version concurrency control (MVCC) - Transaction isolation.

UNIT V **9 Hours**

NOSQL AND NEWSQL DATABASES

NoSQL Vs NewSQL- NoSQLDatabases: MongoDB and Cassandra - NewSQL databases: Redis and NuoDB -Selection of NoSQL or NewSQL over RDBMS - CAP Theorem and BASE Properties - HeidiSQL - In-Memory Databases and Caching - Database Security and Encryption - Database Performance Tuning

1 **4 Hours**

EXPERIMENT 1

Create a simple relational database with tables and write SQL queries for basic CRUD operations (Create, Read, Update, Delete).

2 **3 Hours**

EXPERIMENT 2

Create multiple tables and perform Database Querying - Simple queries, Nested queries, Sub queries, Joins and views.

3 **3 Hours**

EXPERIMENT 3

Create a database with multiple tables. Add constraints (e.g., primary key, foreign key, check constraints) to database tables. Create indexes for performance optimization. Implement triggers to automate actions based on data changes.

4 **3 Hours**

EXPERIMENT 4

Design an ERD for a simple database schema. Normalize the schema to eliminate redundancy and improve data integrity.

5 **3 Hours**

EXPERIMENT 5

Implement the normalized schema in the RDBMS and populate it with sample data.

6

3 Hours

EXPERIMENT 6

Install and set up a NoSQL database (e.g., MongoDB). Write queries to insert, update, and query data in MongoDB.

7

4 Hours

EXPERIMENT 7

Set up a distributed database cluster using open-source tools (e.g: Apache Cassandra). Store and retrieve data in a distributed environment.

8

4 Hours

EXPERIMENT 8

Implement in-memory caching using technologies (Redis) and measure the performance improvements achieved through caching.

9

3 Hours

EXPERIMENT 9

Implement access control and user authentication in an RDBMS. Encrypt sensitive data at rest and in transit

Total: 75 Hours

Reference(s)

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, McGraw -Hill, Sixth Edition, 2018
2. Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems, Pearson Education, Seventh Edition, 2016
3. Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management, Thompson Learning Course Technology, Ninth edition, 2011
4. Guy Harrison , Next Generation Databases: NoSQLand Big Data, Apress.

22HS007 ENVIRONMENTAL SCIENCE**2000****Course Objectives**

- Understand the interdisciplinary and holistic nature of the environment
- Identify the significance of natural resources and environment on the quality of life and stimulate the quest for sustainable development
- Assess the socio-economic, political and ethical issues in environmental science

Course Outcomes (COs)

1. Show the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources
2. Demonstrate the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation
3. Assess the existing environmental challenges related to pollution and its management
4. Select suitable strategies for sustainable management of components of environmental science
5. Compare the impacts of population and human activities on environment

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1												
3	2	2					1							
4	1													
5	2													

UNIT I**6 Hours****NATURAL RESOURCES**

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer - pesticide problems (eutrophication, blue baby syndrome, biomagnification). Energy resources - renewable (solar, wind, and hydro).

UNIT II**6 Hours****ECOSYSTEMS AND BIODIVERSITY**

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features: desert ecosystem. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III **6 Hours**

ENVIRONMENTAL POLLUTION

Pollution: Definition - causes - effects - control measures of air pollution - Water pollution - Sewage water treatment by activated sludge and trickling filter process - Noise pollution - Thermal pollution. Disaster management - causes - effects - control measures of floods - Earthquake

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development - Definition - Unsustainable to sustainable development - solid waste management - causes - effects - 5R Principles - landfills, incineration, composting. Water conservation - rain water harvesting - watershed management. Climate change - Global warming - acid rain - Ozone layer depletion. E-waste

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

Human population: Population growth - characteristics - variation among nations - population explosion - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

Total: 30 Hours

Reference(s)

1. Anubha Kaushik, C.P. Kaushik, Environmental Science and Engineering, 4th Multi Colour Edition, New Age International Publishers, New Delhi, 2014
2. Raven, P. H. Hassenzahl, D.M. & Berg, L.R. 2012. Environment, 8th edition. John Wiley & Sons
3. T. G. Jr. Miller, S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi, 2014
4. Pepper, I. L, Gerba, C. P. & Brusseau, M. L. 2011, Environmental and Pollution Science, Academic Press
5. A. K. De, Environmental Chemistry, 7th Edition, New age international publishers, New Delhi, 2014

22HS008 ADVANCED ENGLISH AND TECHNICAL EXPRESSION

0021

Course Objectives

- To enable students to achieve proficiency in academic writing
- Effectively use the language to persuade others
- Appreciate the nuances of the language and engage an audience
- Use advanced tools of language to improve communicative competence
- Prepare for professional demands at the workplace
- Give concrete expression to the plans and goals

Course Outcomes (COs)

1. Understand the clarity in articulating the objectives and aims and improved proficiency in using the English language
2. Communicate effectively and with good interpersonal skills; speak in public, engage the audience, and lead a group discussion
3. Critically evaluate the ethics of persuasive appeals and confidence to influence opinion
4. Analyse a specific piece of information; take in what is read, and use good writing techniques with proper grammar and syntax in all formal situations
5. Create awareness and empathy to emotional signals in communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT – 1 - CREATIVE EXPRESSION

15 Hours

Proposals & Grant applications, Argumentative essays & editorials, Sales Pitches, Campaigning, Commercials/advertisements, effectively answering the famous interview question: 'Why should we hire you?' Sentence and paragraph formation - Rhetorical questions - Emphasis & effective repetition - Empathetic expression, knowing the audience, capturing attention - Creating Memes, Comic Strips, Stand-up comedy, Caption writing, and Limericks, Vocabulary and slang words for comedy - Similes & Metaphors - Homophones, homonyms, alliteration, wordplay

UNIT 2 - FORMAL EXPRESSION

15 Hours

Writing: Action plans, Cover letters, Mind-Mapping, Paragraph writing Logical reasoning - SVA - Advanced level - Style: Clarity, Concision, Coherence, Evocativeness, Efficacious

Vocabulary - Conditional Clause - Be verbs- Tenses- advanced - Opening and closing sentences - Action plans, Anecdotal references, order of communication/ narration, complete communication- Wh-questions - Effective beginning and closing - Rhetorical questions - Appraising target audience - Pronunciation, Enunciation, Tone, Pace and Volume. - Writing: SOPs, Research Objectives, Thesis Statement, Indexing, Scholarly Articles, Academic Writing, Executive Summary, Survey Questionnaires, Citations and Bibliography - Reading: Quantitative & qualitative analysis, Analysis and paraphrasing of reference materials Speaking: Commentate live events, give instructions to operate machines/ conduct experiments Listening: Informational listening, Reflective listening, - Discriminative listening - Connective words - Prefixes and Suffixes - Quoting and paraphrasing Proofreading - Directed writing and writing formats - Note taking - Active verbs

Total: 30 Hours

Reference(s)

1. Sangeeta Sharma et.al. Communication Skills for Engineers and Scientists, PHI Learning Pvt.Ltd, 2011
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book forIntermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, TataMcGraw Hill & Co. Ltd., 2001
4. Personality Development, Harold R. Wallace &L. Ann Masters, Cengage Learning, New Delhi
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd.1990, Delhi
6. English Grammar, Composition and Usage by N.K.Agrawal&F.T.Wood, Macmillan India Ltd.,New Delhi

22IS501 BIG DATA TECHNOLOGIES**3 0 0 3****Course Objectives**

- Understand the basic ideas of Big Data
- Analyze the HDFS mechanism for handling Big Data
- Analyze Hadoop related tools for data integration

Course Outcomes (COs)

1. Demonstrate the concepts and applications of big data
2. Create and Manage data using NoSQL databases.
3. Develop the basic idea of the Hadoop and HDFS
4. Implement programs using Map reduce concepts
5. Design machine learning techniques to resolve the issue by Hadoop related tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1		2	2									
2	2	2		2	3									
3	2	2		2	2									
4	2	2	2	2	3									
5	2	2	3	2	2									

UNIT I**10 Hours****UNDERSTANDING BIG DATA**

Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing- unstructured data - industry examples of big data.

UNIT II**7 Hours****BASICS OF HADOOP**

Data format - analyzing data with Hadoop-scaling out-Hadoop streaming- Hadoop pipes- design of Hadoop distributed file system (HDFS)- HDFS concepts--compression-serialization.

UNIT II**8 Hours****MAP REDUCE APPLICATIONS**

MapReduce workflows - unit tests with MR Unit -test data and local tests - anatomy of MapReduce job run - classic Map-reduce - YARN- failures in classic Map-reduce and YARN -

job scheduling -shuffle and sort - task execution - MapReduce types -input formats -output formats

UNIT IV

10 Hours

NOSQL DATA MANAGEMENT

Introduction to NoSQL- aggregate data models- aggregates -key-value and document data models -relationships- graph databases-schema less databases-materialized views-distribution models -sharding -version - Map reduce- partitioning and combining -composing map-reduce calculations

UNIT V

10 Hours

HADOOP RELATED TOOLS

Hbase- data model and implementations- Hbase clients - Hbase examples -praxis. Cassandra-cassandra data model- cassandra examples- cassandra clients -Hadoop integration. Hive - data types and file formats -HiveQL data definition- HiveQL data manipulation -HiveQL queries.

FOR FURTHER READING

Cloud and big data - mobile business intelligence - Crowd sourcing analytics - inter and Trans firewall analytics

Total: 45 Hours

Reference(s)

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5. Alan Gates, "Programming Pig", O'Reilley, 2011.

22IS502 COMPUTER NETWORKS**3 0 2 4****Course Objectives**

- To understand the division of network functionality into layers and to familiarize the functions and protocols of each layer of TCP/IP protocol suite.
- To understand the components required to build different types of network and to learn concepts related to network addressing.
- To understand the flow of information from one node to another node in the network and to learn the application layer utilities.

Course Outcomes (COs)

1. Compare OSI model with TCP/IP protocol suite and design a network based on four different topologies.
2. Design and analyze error and flow control algorithms for communication between adjacent nodes in a network.
3. Identify and apply the suitable routing algorithms for the given network.
4. Develop a client/server application using TCP/UDP and design algorithms for end-end communication.
5. Analyze the capabilities of application layer utilities and replicate the same for new applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	3										2	
2	1	2	3	1	1								2	
3	3	2	2										2	
4	1	3	2										2	
5	3	2											2	

UNIT I**9 Hours****DATA COMMUNICATIONS**

Introduction: Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, OSI Model - Physical Layer: Introduction to Physical Layer - Transmission Media: Guided Media, Unguided Media.

UNIT II**9 Hours****DATA LINK LAYER**

Introduction to Data Link Layer: Link Layer Addressing - Error Detection and Correction: Block Coding, Cyclic Codes, Checksum, Forward Error Correction - Data Link Control: DLC services,

Data-Link Layer Protocols, HDLC, Point-to-Point Protocol - Media Access Control: Random Access and Controlled Access.

UNIT III **9 Hours**
NETWORK LAYER

Network Layer Services - Packet Switching - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMPv4 - Routing Algorithms- Unicast Routing Protocols - Next Generation IP: IPv6 Addressing, IPv6 Protocol.

UNIT IV **9 Hours**
TRANSPORT LAYER

Introduction to Transport Layer: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol, Selective Repeat Protocol, Bidirectional Protocols: Piggybacking - User Datagram Protocol - Transmission Control Protocol - Congestion Control.

UNIT V **9 Hours**
APPLICATION LAYER

Client Server Programming - WWW - HTTP - FTP - DNS - SNMP-DHCP

LABORATORY EXPERIMENTS

EXPERIMENT 1 **5 Hours**

Experiment on configuring network topology using packet tracer.

EXPERIMENT 2 **5 Hours**

Experiment on error correction code like CRC and Checksum.

EXPERIMENT 3 **5 Hours**

Experiment on configuring router and switch.

EXPERIMENT 4 **5 Hours**

Experiment on ARP and RARP in live network.

EXPERIMENT 5 **5 Hours**

Experiment on routing algorithms like Distance Vector and Link State Routing.

EXPERIMENT 6 **5 Hours**

Experiment on chat programming using TCP and UDP sockets.

Total: 75 Hours

Reference(s)

1. Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2017.
2. Andrew S Tanenbaum and David J Wetherall, Computer Networks, Fifth Edition, Pearson Education, 2011.
3. William Stallings, Data and Computer Communications, Tenth Edition, Prentice Hall, 2013.
4. Larry L Peterson and Bruce S Davie, Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2011.
5. James F Kurose and Keith W Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Sixth Edition, Addison-Wesley, 2013.

22IS503 MACHINE LEARNING**3 0 2 4****Course Objectives**

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor algorithms in machine learning.
- Perform statistical analysis of machine learning techniques.

Course Outcomes (COs)

1. Understand the need for Machine learning and apply concept learning to find maximally consistent hypothesis.
2. Apply supervised learning algorithms to solve classification and regression problems.
3. Analyze unsupervised and reinforcement learning algorithms with real time applications.
4. Analyze the representation and algorithms involved in Neural Networks.
5. Apply the advanced machine learning algorithms to design predictive models.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	2										
2	1	2	2	2	1	1								
3	1		2	1	1	1							2	
4	1	2	2	2										
5	1	2	2	2									2	

UNIT I**9 Hours****INTRODUCTION**

Need for Machine Learning- Machine Learning Process - Types of Machine Learning - Concept Learning: Find - S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias

UNIT II**9 Hours****SUPERVISED LEARNING**

Classification Algorithms: Support Vector Machines - Logistic Regression - K-Nearest Neighbors - Naive Bayes Classifier - Decision Trees - Random Forests - Regression Algorithms: Simple Linear Regression - Multiple Linear Regression

UNIT III **9 Hours**

UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING

Clustering algorithm: k-means clustering - Fuzzy c-means clustering - Hierarchical clustering - Gaussian (EM) clustering - Density-based clustering - Reinforcement Learning: Examples - Challenges - Q - Learning Algorithm

UNIT IV **9 Hours**

NEURAL NETWORKS

Neural Network Basics: Multilayer Perceptron - Feed Forward Neural Networks - Back Propagation - Hyperparameter Tuning. Convolutional Neural Networks: Image Classification. Recurrent Neural Networks: Long Short - Term Memory

UNIT V **9 Hours**

ADVANCED MODELS

Generative Models - Autoencoders - Recommendation System: Collaborative Filtering Recommendation System - Content Based Recommendation System - Hybrid Recommendation System.

LABORATORY EXPERIMENTS

EXPERIMENT 1 **5 Hours**

Consider a set of training data examples and implement algorithms to find the most specific hypothesis and set of all hypotheses that are consistent with the training examples.

EXPERIMENT 2 **5 Hours**

Apply suitable classification algorithm to classify the iris data set.

EXPERIMENT 3 **5 Hours**

Apply EM algorithm and k-Means algorithm to cluster a set of data. Compare the results of these two algorithms and comment on the quality of clustering.

EXPERIMENT 4 **5 Hours**

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

EXPERIMENT 5 **5 Hours**

Apply CNN to build computational models consisting of several processing elements to receive inputs and deliver outputs based on activation functions. learning to get the desired output.

EXPERIMENT 6

5 Hours

Build a Simple and Content-Based Book Recommendation System.

Total: 75 Hours

Reference(s)

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, 2nd edition, Springer Series in Statistics.
3. Ethem Alpaydin, Introduction to Machine Learning, Second edition, MIT press.

22IS504 DIGITAL IMAGE PROCESSING**3 1 0 4****Course Objective**

- To impart fundamental steps of digital image processing based on image representations, operations and transform function.
- To inculcate the knowledge about enhancement, restoration, compression by applying appropriate techniques to obtain the desired image quality.
- To apply the related to image segmentation and recognition techniques to real world problems.

Course Outcomes (COs)

1. Interpret the image types and representations involved in digital image processing system.
2. Implement the arithmetic, logical, geometrical operations and transforms techniques to process an image.
3. Analyze the techniques suitable for image enhancement and image restoration in spatial and frequency domain.
4. Apply image compression and segmentation techniques to perform image processing.
5. Apply an image representation and recognition techniques to solve real world problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2								1			
2	3	2	2								1			
3	3	2	3								1			
4	3	2	3								1			
5	3	2	3								1			

UNIT I**9 Hours****DIGITAL IMAGE FUNDAMENTALS**

Nature of digital image processing - digital image representation - types of images - digital image processing operations - fundamental steps in image processing - image processing applications - digital imaging system - physical aspects of image acquisition - sampling and quantization – relationship between pixels - image storage and file formats.

UNIT II**9 Hours****IMAGE PROCESSING OPERATIONS AND TRANSFORMS**

Arithmetic operations - logical operations - geometrical operations - image interpolation techniques - convolution and correlation operations - data structures and image processing

applications development – Transforms: - Fourier transform - discrete cosine and sine transform
- Walsh transform - Hadamard transform - Haar transform – Wavelet transform

UNIT III **8 Hours**

IMAGE ENHANCEMENT AND RESTORATION

Need for image enhancement - Point operations - Spatial filtering concepts - Frequency domain filtering - Image restoration model: Categories of image degradations - Image restoration in noise - Image restoration techniques.

UNIT IV **10 Hours**

IMAGE COMPRESSION AND SEGMENTATION

Compression: Model – Types of redundancy – Lossless compression and lossy compression algorithms - Segmentation: Classification – Detection of Discontinuities – Edge detection - Corner detection – Principles of Thresholding – Region based segmentation – Dynamic segmentation. Morphology- Dilation, Erosion, Opening and Closing.

UNIT V **9 Hours**

IMAGE REPRESENTATION AND RECOGNITION

Boundary representation – Boundary Descriptions – Regional Descriptors – Feature Selection Techniques – Recognition: Pattern and Pattern classes – Template matching

Total: 60 Hours

Reference(s)

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. 4ed, PHI/Pearson Education, 2018.
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, Digital Image Processing, McGraw Hill Education, 2nd edition, 2020.
3. S. Sridhar, Digital Image Processing, Oxford University Press; Second edition ,2016.

22IS601 NATURAL LANGUAGE PROCESSING**3 0 0 3****Course Objectives**

- Provide basic mathematical models and methods used in NLP applications to formulate computational solutions.
- Understand the syntax and semantics of natural languages. How they work and how machine can convert from one natural language to another.
- Acquire the knowledge on designing procedures for natural language resource annotation and the use of related tools for text analysis and hands-on experience of using such tools.

Course Outcomes

1. Understand the fundamental mathematical models and algorithms in the field of NLP.
2. Apply the mathematical models and algorithms in the applications of software.
3. Implement a rule-based system to tackle morphology/syntax of a language.
4. Analyze the design and implementation issues in various NLP applications such as information retrieval and information extraction.
5. Apply the principles of language resource annotation and its use in machine learning applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	1										
2	3	2	2	2	2							1		
3	3	2	2	2	2							1		
4	3	2	2	2	2									
5	3	2	2	1	2							1		

UNIT I**9 Hours****INTRODUCTION**

Introduction - Mathematical Foundations - Elementary Probability Theory - Essential Information Theory – Linguistic Essentials- Parts of Speech and Morphology- Phrase Structure- Semantics and Pragmatics - Regular Expressions, Text Normalization, Edit Distance - N-gram Language Models

UNIT II**9 Hours****SENTIMENT CLASSIFICATION AND LOGISTIC REGRESSION**

Naive Bayes Classification and Sentiment - Logistic Regression- Vector Semantics -Neural Nets and Neural Language Models - Sequence Labeling for Parts of Speech- Deep Learning- Architectures for Sequence Processing

UNIT III

9 Hours

SYNTACTIC PARSING

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar- Ambiguity – Cocke Kasami Younger (CKY) algorithm - Partial Parsing - Statistical Parsing- Dependency Parsing- Dependency Formalisms-Treebanks- Transition-Based Dependency Parsing- Graph-Based Dependency Parsing.

UNIT IV

9 Hours

COMPUTATIONAL SEMANTICS AND SEMANTIC PARSING

Computational Desiderata for Representations- Model-Theoretic Semantics- First-Order Logic- Event and State Representations- Logics -Relation Extraction- Relation Extraction Algorithms- Word Senses- Relations between Senses- WordNet: A Database of Lexical Relations- Disambiguation- Alternate WSD algorithms and Tasks -Semantic Role Labeling

UNIT V

9 Hours

DISCOURSE COHERENCE AND COREFERENCE RESOLUTION

Lexicons for Sentiment, Affect, and Connotation, Discourse Coherence -Coherence Relations- Discourse Structure Parsing- Centering and Entity-Based Coherence- Representation learning models for local coherence- Co reference Resolution- Co reference Tasks and Datasets- Architectures for Co reference Algorithms- A neural mention-ranking algorithm

Total: 45 Hours

Reference(s)

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schuetze, MIT Press, 2018
3. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media; 1 edition, 2009
4. Breck Baldwin, —Language processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
5. Richard M Reese, —Natural Language Processing with Javal, O'Reilly Media, 2015.
6. Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
7. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

22IS602 INFORMATION SECURITY**3 0 0 3****Course Objectives**

- Understand information security's importance in our data-driven digital world.
- Acquire the knowledge of key concepts of information security and how they work.
- Develop a Security mindset learn how to critically analyze situations of computer and network usage from a security perspective, identifying the salient issues, technologies, policies, laws, standards, and practices.

Course Outcomes (COs)

1. Examines the business drivers behind the information security analysis design process.
2. Illustrate the major components, scope, and target audience for each of the levels of security policy
3. Apply the suitable security technologies to segregate the organizations systems from the insecure Internet.
4. Identify the underlying foundations of modern cryptosystems and analyze the traditional symmetric encryption systems with more modern asymmetric encryption systems.
5. Interpret the several key laws, policies, standards and practices that shape the field of information security.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1		1									
2	2	1	1		2									
3	2	2	3	1	3									
4	1	2	3		3									
5	2	1	3	2										

UNIT I**9 Hours****INTRODUCTION TO INFORMATION SECURITY**

The History of Information Security-Key Information Security Concepts-The Security Systems Development Life Cycle- Security Professionals and the Organization- Need for Security.

UNIT II**9 Hours****INFORMATION SECURITY POLICY, STANDARDS AND PRACTICES**

Information Security Planning and Governance - Information Security Policy, Standards, and Practices – The Information Security Blueprint -Security Education, Training, and Awareness Program – Continuity Strategies.

UNIT III

9 Hours

SECURITY TECHNOLOGIES

Introduction-Access Control, Identification, Authentication, Authorization and Accountability- Firewalls Virtual Private Networks (VPNs)- Intrusion Detection and Prevention Systems - Scanning and Analysis Tools- Biometric Access Controls.

UNIT IV

9 Hours

CRYPTOGRAPHY

Foundations of Cryptology-Cipher Methods-Cryptographic Algorithms-Cryptographic Tools- Protocols for Secure Communications-Attacks on Cryptosystems.

UNIT V

9 Hours

LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY

Law and Ethics in Information Security - General Computer Crime Laws - International Laws and Legal Bodies - Agreement on Trade-Related Aspects of Intellectual Property Rights - Digital Millennium Copyright Act (DMCA) - Ethics and Information Security-Codes of Ethics and Professional Organizations.

Total: 45 Hours

Reference(s)

1. Michael E Whitman, Herbert J Mattord , Principles of Information Security ,Sixth Edition, Cengage Learning,2017.
2. Mark Stamp, Information Security : Principles and Practices, Wiley ,Second edition,2011
3. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India/Pearson Education, New Delhi, 2007.
4. Charles B.fleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson Education, 2014.
5. Dieter Gollmann, Computer Security, John Wiley & Sons Ltd., 2011.
6. SunitBelapure and Nina Godbole , Cyber Security, Wiley, 2011.

22IS603 INFORMATION CODING TECHNIQUES 3 1 0 4**Course Objectives**

- Acquire a complete understanding of error–control coding.
- Understand encoding and decoding of digital data streams.
- Interpret methods for the generation of these codes and their decoding techniques.
- Understand compression and decompression techniques.

Course Outcomes (COs)

1. Interpret the basics of Information entropy.
2. Discover the data and voice coding techniques.
3. Assess the fundamental coding methods for error control.
4. Evaluate the text and image compression techniques.
5. Identify the audio and video coding techniques.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1											
2	1		2											
3		2	1											
4	1	2	2											
5		3	2											

UNIT I**9 Hours****INFORMATION ENTROPY FUNDAMENTALS**

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding – Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II**9 Hours****DATA AND VOICE CODING**

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III**9 Hours****ERROR CONTROL CODING**

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

UNIT IV

9 Hours

COMPRESSION TECHNIQUES

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V

9 Hours

AUDIO AND VIDEO CODING

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

Total: 60 Hours

Reference(s)

1. Simon Haykin, Communication Systems, John Wiley and Sons, 4th Edition, 2014
2. Fred Halsall, Multimedia Communications, Applications Networks Protocols and Standards, Pearson Education, 2012
3. Mark Nelson, Data Compression Book, BPB Publication, 2010
4. Rafael C.Gonzalez and Richard E.Woods, Digital image processing, PHI, 2013

22IS701 SOCIAL NETWORK ANALYSIS**3 0 0 3****Course Objectives**

- Comprehend the latest techniques and technologies in web development for the Social Web.
- Create a model to bring together different types of data, making it easier to understand in web development.
- Use tools and algorithms to efficiently find and extract information from social networks.
- Study how people behave in social networks and explore issues related to trust.
- Apply visualization techniques to make it easier to see and understand information in social networks.

Course Outcomes (COs)

1. Apply knowledge for current web development in the era of Social Web
2. Develop a model for integrating data for knowledge representation
3. Apply the tools and an algorithm for mining in social networks
4. Examine the human behavior and trust disputes of social networks
5. Apply visualization technique in Social networks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2										
2	3	2			2									
3	2	3			2	2								
4		2	2			2								
5		2	2			3								

UNIT I**9 Hours****INTRODUCTION TO SOCIAL NETWORK ANALYSIS**

Introduction to Web: Limitations of current Web- Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities, Web-based networks.

UNIT II**8 Hours****MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION**

Ontology languages for the Semantic Web: RDF and OWL - Modelling and aggregating social network data: State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations.

UNIT III

9 Hours

EXTRACTION AND MINING COMMUNITITES IN WEB SOCIAL NETWORKS

Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks: Definition of Community - Evaluating Communities - Methods for Community Detection- Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities - Decentralized Online Social Networks: Introduction- Challenges for DOSNs- General purpose DOSNs.

UNIT IV

10 Hours

PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES

Understanding and Predicting Human Behavior for Social Communities - User Data Management- Inference and Distribution - Enabling New Human Experiences: Reality Mining - Context Awareness - Privacy in Online Social Networks: Trust in Online Environment - Trust Models Based on Subjective Logic - Trust Network Analysis - Trust Transitivity Analysis - Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons

UNIT V

9 Hours

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Graph Theory- Centrality- Clustering - Node-Edge Diagrams, Matrix representation, Visualizing Online Social Networks - Visualizing Social Networks with Matrix-Based Representations: Matrix and Node- Link Diagrams - Hybrid Representations - Applications of social network analysis: Covert Networks - Community Welfare - Collaboration Networks.

Total: 45 Hours

Reference(s)

1. Borko Furht, -Handbook of Social Network Technologies and Applications, Springer, 1st edition, 2010. Peter Mika,-Social Networks and the Semantic Web, Springer, 1st edition 2007.
2. Guandong Xu , Yanchun Zhang and Lin Li,Web Mining and Social Networking Techniques and applications, Springer, 1st edition, 2011.
3. Dion Goh and Schubert Foo, Social information retrieval systems: Emerging technologies and applications for searching the Web effectively, IGI Global snippet, 2008.
4. Max Chevalier, Christine Julien and Chantal Soul-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling, IGI Global snippet, 2009

22IS702 DATA VISUALIZATION**3 0 2 4****Course Objectives**

- Understand the methodologies used to view large data sets
- Analyze the various process used in data visualization
- Explore the fundamentals settings of Interactive data visualization

Course Outcomes (COs)

1. Understand the representation of complex and voluminous data
2. Design and use various methodologies present in data visualization
3. Analyze the various process and tools used in data visualization
4. Implement the principle of visual perception for various data analysis tasks
5. Apply the interactive data visualization to make inferences.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		2									2
2	2	2	2		3									3
3	2	3	2		2									3
4	1		1											3
5	2	2	2	1	3									3

UNIT I**9 Hours****INTRODUCTION TO DATA VISUALIZATION**

Context of data visualization – Definition, Methodology, Visualization design objectives.
Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools- Image Visualization

9 Hours**UNIT II****DATA VISUALIZATION METHODS**

Mapping – Locations on a Map- Time series - Connections and correlations – Indicator-Area Chart-Pivot table- Scatter charts, Scatter maps - Tree maps, Space filling and non-space filling methods-Hierarchies and Recursion - Networks and Graphs -Matrix representation for graphs- Info graphics- EDA using Python

UNIT III**9 Hours****DATA VISUALIZATION PROCESS**

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders - Advanced Web Techniques. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT IV

9 Hours

PRINCIPLES FOR FIGURE DESIGNS

The Principle of Proportional ink – Handling Overlapping points - Common pitfalls of Color use – Redundant coding – Multipanel figures-Title, Captions and Tables- Balance the Data and Context – Use Larger Axis labels

UNIT V

9 Hours

INTERACTIVE DATA VISUALIZATION

Technology Fundamentals- Setting up D3- Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting.

FOR FURTHER READING

Security Data Visualization – Attacking and Defending Visualization, Data Visualization for Web.

EXPERIMENT 1

3 Hours

DATA PREPROCESSING AND CLEANING METHODS ON STUDENT DATASETS

Create an Employee Table with training data set which includes attributes like name, id, salary, experience, gender, phone number. Preprocess the given data by checking the constraints on each attribute

EXPERIMENT 2

3 Hours

Import a dataset in any one of the data visualization tools and provide graphical representation in following formats: Bar Chart, Pie Chart, Area Chart, Scatter Chart and Scatter plot.

EXPERIMENT 3

3 Hours

Wise Owl Travel Agents					
Country	Resort Name	No of Days	Travel Method	Price	Holiday ID
Australia	Great Barrier Reef	32	Plane	£750	I990AUS
Australia	Perth	28	Plane	£985	AUS112J
Chile	Santiago	21	Plane	£1,259	CH286H
England	London	3	Train	£69	I456UK
England	Bognor	1	Coach	£12	BG726H
France	Lyon	14	Plane	£399	A7995FR
France	Paris - Euro Disney	5	Train	£269	TH789FR
France	Paris - Euro Disney	3	Train	£125	TH788FR

Create a pivot table from this data, then use the filters within to view the average prices of holidays that have a Travel Method of Plane and a Resort Name that begins with the letter S. Confirm that there are 3 holidays in total, by using the drill-down feature.

EXPERIMENT 4

3 Hours

Pick a single data series and create an appropriate data visualization technique for it using Processing. A single series contains one set of values for a single variable. An example might be data representing your height for every year of your life, petrol cost over the last 10 years, or the relative popularity of the top 10 learning websites.

EXPERIMENT 5

3 Hours

Take multiple data series and make visualization in Processing that allows someone to easily compare them visually.

EXPERIMENT 6

3 Hours

Use the batch yields dataset and construct a monitoring chart using the 300 yield values. Use a subgroup of size 5. Report the target value, lower control limit and upper control limit

EXPERIMENT 7

3 Hours

Using the Website traffic data set

1. Create a chart that shows the variability in website traffic for each day of the week.
2. Use the same data set to describe any time-based trends that are apparent.

EXPERIMENT 8

3 Hours

Load the room temperature dataset into any one of the tools like R, Python or MATLAB, or whichever software tool you prefer to plot with.

1. Plot the 4 trajectories, FrontLeft, FrontRight, BackLeft and BackRight on the same plot.
2. Comment on any features you observe in your plot.

EXPERIMENT 9

3 Hours

Load the six-point board thickness dataset, available from datasets website.

1. Plot a boxplot of the first 100 rows of data to match the figure in these notes
2. Explain why the thick center line in the box plot is not symmetrical with the outer edges of the box.

EXPERIMENT 10

3 Hours

Create an information dashboard on COVID cases in a particular location. Map the raw data into meaningful information

Total: 75 Hours

Reference(s)

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008
2. Claus O. Wilke, "Fundamentals of Data Visualization -A Primer on Making Informative and Compelling Figures", O'Reilly, April 2019
3. Scott Murray, "Interactive data visualization for the web", O'Reilly Media, Inc., Second Edition, 2017.
4. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013
5. Storytelling with Data: "A Data Visualization Guide for Business Professionals", Wiley, 2015

22IS707 PROJECT WORK I**0 0 4 2****Course Objectives**

- Work in teams to propose, formulate, and solve a challenging open-ended design problem of significant scope, depth, and breadth.
- Understand and incorporate engineering standards and multiple realistic constraints, within realistic design time, budget, and performance objectives.
- Develop a prototype of the proposed design and demonstrate the prototype in accordance with the specifications.
- Effectively communicate information relating to all aspects of the design process in written, oral, and graphical form.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present the oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	3	1	3	3	3	3	3		2	3	3
2	2	2	3	3	1	3	3	3	3	3	-	2	3	3
3	2	2	3	3	3	3	3	3	3	3	3	2	3	3
4	2	2	3	3	3	3	3	3	3	3	3	2	3	3
5	2	2			2			3	3	3		2	3	3

22IS801 PROJECT WORK II**0 0 20 10****Course Objectives**

- Work in teams to propose, formulate, and solve a challenging open-ended design problem of significant scope, depth, and breadth.
- Understand and incorporate engineering standards and multiple realistic constraints, within realistic design time, budget, and performance objectives.
- Develop a prototype of the proposed design and demonstrate the prototype in accordance with the specifications.
- Effectively communicate information relating to all aspects of the design process in written, oral, and graphical form.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present the oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	3	1	3	3	3	3	3		2	3	3
2	2	2	3	3	1	3	3	3	3	3		2	3	3
3	2	2	3	3	3	3	3	3	3	3	2	2	3	3
4	2	2	3	3	3	3	3	3	3	3	2	2	3	3
5	2	2			2			3	3	3		2	3	3

22HS201 COMMUNICATIVE ENGLISH II**1 0 2 2****Course Objectives**

- Command over the English language for day-to-day transactions.
- Improve listening and reading skills
- Increase ability to comprehend complex content
- Enhance confidence in expressing with clarity and elegance
- Enthusiastic and reflective use of the language through sufficient and focused practice
- Articulate fluently and confidently in challenging situations

Course Outcomes (COs)

1. Engage with the English language in functional contexts
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									1					
2									2					
3									3					
4										1				
5										2				

UNIT I**15 Hours****SELF-EXPRESSION**

Personal Goals and Values - Being a Team Player-Expressing strengths and Weaknesses- Abstract nouns -Adjectives-Active Listening Skills-Note Making-Pronunciation and Accent Personal goals and values - Reading for Gist and Details-Professional Ethics-Reported Speech-Conjunctions Reading skills - phonemics, word/phrase recognition, sight words Personal Goals and Values-Conditional clauses- Hypothetical questions and Answers-Sentence Structure-Simple Present Tense-Perfect tense

UNIT II

15 Hours

CREATIVE EXPRESSION

Instructive and Expository Expression - Creating brochures, catalogues, and manuals for products/ services, Giving directions, Process writing, Sequencing experiments, Concept Explanation-Reported Speech-Voice Sentence Equivalence-Proofreading

UNIT III

15 Hours

FORMAL EXPRESSION

Notices and Announcements-Writing: Creating notices and circulars for events, announcing college tours and lost and Found-Varied Vocabulary - Gender Sensitive Vocabulary, Non-discriminatory Vocabulary, Concise Vocabulary-Paragraph writing - Effective titles, topics and supporting sentences, calling in registrations and queries. Effective communication-Understanding purpose, reach and target audience, achieving complete communication Punctuation - Capitalization, Numeration, Use of proper nouns and Articles-Spelling-Reading: Analyzing and interpreting notices and Circulars-Understanding the gist of short real-world notices, and messages. Culling out keywords Information words vs Supporting words-Interpreting Abbreviations, Acronyms and Short-forms-Listening: Analyzing and interpreting announcements Decoding - Screening for salient points-Note making-Raising queries for clarification-Speaking: Announcements-Giving complete information-Pronunciation and Enunciation Pace, Intonation, and Pitch-Conducting Events-Speaking: Master of ceremonies, Short speeches - welcome speech, the vote of thanks/ valedictory speech, award-acceptance speech Writing: Invitations, Preparation of script/draft after interviewing someone. Adjectives-Pronunciation/ Punctuation Precision and Concision-Politeness markers

Total: 45 Hours

Reference(s)

1. Sasikumar, V, et.al. A Course in Listening & Speaking FoundationBooks, 2005.
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010.
4. Reynolds, John. Cambridge First Language English. 2018th ed., Hodder Education, 2018.
5. Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

22HSH01 HINDI**1 0 2 2****Course Objectives**

- To help students acquire the basics of Hindi
- To teach them how to converse in Hindi on simple day- to -day situations
- To help students understand a simple technical text in Hindi

Course Outcomes (COs)

1. Construct simple sentences and use vocabulary required for day- to -day conversation.
2. Distinguish and understand the basic sounds of Hindi language.
3. Apply appropriate grammar to write and speak in Hindi language
4. Comprehend the conversation and give correct meaning
5. Take up Hindi examinations conducted by Dakshin Bharat Hindi Prachar Sabha

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I**9 Hours****VOWELS AND CONSONANTS**

Hindi Alphabet: Introduction (Self introduction) - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu & Visarg -Table of Alphabet -Vocabulary.

UNIT II**9 Hours****NOUNS**

Nouns: Genders -Masculine & Feminine -Reading Exercises

UNIT III**9 Hours****PRONOUNS AND TENSES**

Pronouns and Tenses - Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

UNIT IV

9 Hours

CLASSIFIED VOCABULARY

Classified Vocabulary: Parts of body -Relatives Spices Eatables -Fruit & Vegetables -Clothes - Directions -Seasons Professions.

UNIT V

9 Hours

CONVERSATIONS

Speaking - Telling the times -Saying the Numbers from 1 to 50 Speaking practice for various occasions.

Total: 45 Hours

Reference(s)

1. B.R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi, 2009.
2. Hindi Prachar Vahini - 1
3. Videos, Stories, Rhymes and Songs.

22HSG01 GERMAN**1 0 2 2****Course Objectives**

- To help students appear for the A1 level Examination
- To teach them how to converse fluently in German in day-to-day scenarios

Course Outcomes (COs)

1. Listen and identify individual sounds of German
2. Use basic sounds and words while speaking
3. Read and understand short passages on familiar topics
4. Use basic sentence structures while writing
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I**9 Hours****INTRODUCTION**

Introduction to the German language - Alphabets-Numbers Greetings -Days and Seasons-Working with Dictionary.

UNIT II**9 Hours****LANGUAGE AND ITS COMMON USE**

Nouns -articles-Speaking about oneself-Listening to CD supplied with books-paying special attention to pronunciation

UNIT III**9 Hours****TECHNICAL DEUTSCHE**

Regular &Irregular verbs -Personal pronouns-family-Introduction to types of sentences

UNIT IV

9 Hours

INTERROGATION

Question words -Types of Questions -Nominative case-Verb Conjugation -country -nationalities

UNIT V

9 Hours

IMPLEMENTATION

Verbs to be & to have -conjugation -Hobbies -Framing basic Questions and answers

Total: 45 Hours

Reference(s)

1. Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALS FREMDSPRACHE, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2015.
2. Langenscheidt Eurodictionary, German English / English German, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009.
3. Grundkurs, DEUTSCH Lehrbuch Hueber München, 2007.

22HSJ01 JAPANESE**1 0 2 2****Course Objectives**

- To train students for N5 Level Examination
- To teach them use basic Japanese sentences in day-to-day conversation
- To make students familiar with the Japanese cultural facets and social etiquettes

Course Outcomes (COs)

1. Recognize and write Japanese alphabet
2. Speak using basic sounds of the Japanese language
3. Apply appropriate vocabulary needed for simple conversation in Japanese language
4. Apply appropriate grammar to write and speak in Japanese language
5. Comprehend the conversation and give correct meaning

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I**9 Hours****SELF INTRODUCTION / DEMONSTRATIVES / NOUN MODIFIERS**

Introduction to Japanese Japanese script - Pronunciation of Japanese(Hiragana (Katakana) Long vowels - Pronunciation of in,tsu,ga -Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. Speaking: Self Introduction - Listening: Listening to Greetings, Listening to specific information: Numbers, Time

UNIT II**9 Hours****TIME EXPRESSION / VERBS - PAST**

Introduction to time -Introduction of verbs -Listening to specific information

UNIT III**9 Hours****ADJECTIVES**

Word Sentence -Introduction to Adjectives -Technical Japanese Vocabulary -Pair Activity Day to day situational conversation
Listening to Japanese Alphabet Pronunciation -Simple Conversation.

UNIT IV

9 Hours

CONJUGATION OF II ADJECTIVE

Past tense of Noun sentences and Na adjective sentences -Past tense of ii adjective sentences - houga adjective desu -Technical Japanese Vocabulary -Individual Activity - Listening to conversation with related particles

UNIT V

9 Hours

CONJUGATION OF VERBS - TE FORM / TA FORM / NAI FORM / PLAIN FORM

N gahoshidesu - V masu form tai desu - Verb te form - Technical Japanese Vocabulary - Listening to different Counters, simple conversations with verbs and adjectives

Total: 45 Hours

Reference(s)

1. Minna no Nihongo Japanese for Everyone Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. Minna no Nihongo Japanese for Everyone Elementary Main Textbook 1-2 Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

22HSF01 FRENCH**1 0 2 2****Course Objectives**

- To prepare the students for DELF A1 Examination
- To teach them to converse fluently in French in day-to-day scenarios

Course Outcomes (COs)

1. To help students acquire familiarity in the French alphabet & basic vocabulary
2. Listen and identify individual sounds of French
3. Use basic sounds and words while speaking
4. Read and understand short passages on familiar topics
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I**9 Hours****ENTRER EN CONTACT**

La langue française, alphabets, les numéros, les jours, les mois. Grammaire Les verbes s'appeler, être, avoir, les articles définis, indéfinis Communication Saluer, s'informer sur quelqu'un, demander de se présenter Lexique L'alphabet, les nationalités, l'âge, les pays, les couleurs, les jours de la semaine, les mois de l'année, les professions

UNIT II**9 Hours****PARTAGER SON LIEU DE VIE**

Les français et leur habitat, des habitations insolites -Grammaire Verbes Conjugaison Présent (Avoir / Être / ER, IR, RE Régulier et Irrégulier) Adjectifs les propositions de lieu Communication Chercher un logement, décrire son voisin, s'informer sur un logement - Lexique L'habitat, les pièces, l'équipement, la description physique

UNIT III

9 Hours

VIVRE AU QUOTIDIEN LES LOISIRS DES FRANCAIS, LES GOUTS DES AUTRES, LES ACTIVITES QUOTIDIENNES

Grammaire Articles contractes, verbes vouloir, pouvoir, devoir, adjectifs interrogatifs, future proche
Communication Exprimer ses goûts, parler de ses loisirs, justifier un choix, exprimer une envie - Lexique le temps libre et les loisirs, les saisons, les activités quotidiennes, le temps (le matin, le soir, la nuit)

UNIT IV

9 Hours

COMPRENDRE SON ENVIRONNEMENT SOUVENIR A LA CULTURE

Grammaire Verbes Finir, Sortir, les adjectifs démonstratifs, le passé composé, l'imparfait
Communication Proposer à quelqu'un de faire quelque chose, raconter une sortie au passé, parler d'un film
Lexique Les sorties, la famille, l'art, les vêtements et les accessoires

UNIT V

9 Hours

GOUTER A LA CAMPAGNE

Grammaire La forme négative, les verbes acheter, manger, payer, articles partitifs, le pronom en de quantité

Communication Accepter et refuser une invitation, donner des instructions, commander au restaurant
Lexique Les services et les commerces, les aliments, les ustensiles, l'argent

Total: 45 Hours

Reference(s)

1. Grammaire Progressive du Français, CLE International, 2010
2. Saison1, Marie Noelle Cocton et al, Didier, 2014.
3. Préparation à l'examen du DELF A1 Hachette
4. Réussir le DELF A1 Bruno Girardeau
5. Website: Français Linguaphone Linguaphone Institute Ltd., London, 2000.
6. Français Harrisonburg : The Rosetta Stone : Fairfield Language Technologies, 2001

22IS001 INFORMATION STORAGE AND MANAGEMENT

3 0 0 3

Course Objectives

- To Understand the Challenges in Information Storage and Management.
- To Describe the Core Elements in a Data Center.
- To Understand RAID and its various Levels for Data Backup.

Course Outcomes (COs)

1. Explain Physical and Logical components of a Storage Infrastructure including Storage subsystems, RAID and Intelligent Storage Systems.
2. Describe Storage Networking Technologies such as FC-SAN, IP-SAN, FCoE, NAS and Object- based and Unified Storage.
3. Illustrate and articulate business continuity solutions, Backup and replications, along with archives for managing fixed content.
4. Explain key characteristics, Services, Deployment models, and Infrastructure components for Cloud Computing.
5. Implement the concept of Security Storage Infrastructure Management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2		3	3								3	
2			2	2	2				3				1	2
3	2								2		3		1	2
4		3		2									2	
5		2	2		2					2			3	3

UNIT I

9 Hours

STORAGE SYSTEM

Introduction to Information Storage-Virtualization and Cloud Computing-Key Data Center elements - Compute, Application and Storage Virtualization-Disk drive & Flash drive Components and Performance-RAID-Intelligent Storage System and Storage Provisioning (including virtual provisioning)

UNIT II

9 Hours

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Fiber Channel SAN components-FC Protocol and Operations-Block Level Storage Virtualization-iSCSI and FCIP as an IP-SAN solutions-Converged Networking option FCoE-Network Attached Storage (NAS) components-Protocol and Operations-File Level Storage Virtualization-Object based Storage and Unified Storage Platform.

UNIT III **9 Hours**

BACKUP, ARCHIVE AND REPLICATION

Business Continuity Terminologies-Planning and Solutions-Clustering and Multipathing to avoid Single points of failure -Backup and Recovery methods-Targets and Topologies-Data Deduplication and Backup in Virtualized environment-Fixed content and Data archive-Local replication in classic and Virtual environments-Remote replication in classic and Virtual environments-Three-site remote replication and Continuous Data protection.

UNIT IV **9 Hours**

CLOUD COMPUTING CHARACTERISTICS AND BENEFITS

Cloud Enabling Technologies-Characteristics of Cloud Computing -Benefits of Cloud Computing-Cloud Service Models Cloud Deployment models-Cloud Computing Infrastructure-Cloud Challenges, Cloud Migration considerations.

UNIT V **9 Hours**

SECURING AND MANAGING STORAGE INFRASTRUCTURE

Security threats and Countermeasures in various domains-Security solutions for FC-SAN, IP-SAN and NAS environments- Security in virtualized and Cloud environments-Monitoring and Managing various Information Infrastructure Components in classic and Virtual environments-Information Life cycle Management (ILM) and Storage tiering.

Total: 45 Hours

Reference(s)

1. Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments, 2nd Edition, EMC Educations Services, Wiley, May 2012.
2. Information Storage and Management: Storing, Managing, and Protecting Digital Information, EMC Education Services, Wiley, January 2010.
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE, 2nd Edition, Wiley, July 2009.
4. EMC Corporation, Information Storage and Management, Wiley, India.
5. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017.

22IS002 MANAGEMENT INFORMATION SYSTEM

3 0 0 3

Course Objectives

- Gain knowledge about the major types of information systems used in a business environment.
- Impart knowledge on the ethical, social, and security issues of information systems.
- Understand the processes of developing and implementing information systems.

Course Outcomes (COs)

1. Understand basic concepts of MIS and business functions.
2. Formulate solutions to social and ethical issues related to information technology infrastructure.
3. Apply the knowledge on database management systems to store hybrid information in a business organization.
4. Recognize the use of security mechanisms to share business information over various types of networks.
5. Explore the new IT initiatives for enhancing knowledge management information system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2		2	2	2				1		-	
2	2		2		2	2	2	2			2	3	-	-
3	2		2		3	3	3				2		-	
4	2		2		2	2	2				3		-	
5	2		2		2	2	2				3		-	

UNIT I

9 Hours

INTRODUCTION TO INFORMATION SYSTEMS

Information Systems in Global Business Today: Role of Information Systems in Business Today-Perspectives of Information Systems-Approaches to Information Systems-Global E-Business and Collaboration: Business Process and Information Systems-Types of Information Systems Enterprise Systems

UNIT II

9 Hours

INFORMATION TECHNOLOGY INFRASTRUCTURE

Information Systems, Organizations and Strategy: Organizations and Information Systems-Impact of Information Systems on organizations and Business Firms-Ethical and Social Issues in Information Systems: Understanding Ethical and Social Issues Related to Systems-Ethics in an information society-IT Infrastructure and Emerging Technologies: Infrastructure Components-Hardware Platform Trends-Software Platform Trends.

UNIT III **8 Hours**

DATABASES AND INFORMATION MANAGEMENT

Organizing Data in Traditional File Environment-Database Approach to Data Management-Using Databases to improve Business Performance and Decision Making-Managing Data Resources.

UNIT IV **9 Hours**

NETWORKS AND SECURITY

Telecommunications and Networking in today's Business Needs: Networking and Communication Trends-Key Digital Networking Technologies-Securing Information Systems: System Vulnerability-Business Value of Security and Control-Establishing Management Framework for Security and Control- Technologies and Tools for Protecting Information Resources.

UNIT V **10 Hours**

NEW IT INITIATIVES

Enterprise Applications: Enterprise Systems-Supply Chain Management Systems-Customer Relationship Management Systems- Electronic Commerce: Types of Electronic Commerce-M- Commerce Services and Applications-The Knowledge Management Landscape: Important Dimensions of Knowledge-The Knowledge Management Value Chain-Types of Knowledge Management Systems.

Total: 45 Hours

Reference(s)

1. Kenneth C. Laudon, Jane P. Laudon, Management Information Systems -Managing the digital firm, Pearson Education, 2012.
2. Kenneth Laudon, Jane Laudon, Management Information Systems-Managing the digital firm, Pearson 17th edition, 2021.
3. Keri E. Pearlson, Carol S. Saunders, Dennis F. Galletta, Managing and Using Information Systems: A Strategic Approach 7th Edition, 2019.
4. Waman S Jawadekar, Management Information Systems-Texts and Cases, the McGraw-Hill Company, 2009.
5. James O' Brien, Management Information Systems-Managing Information Technology in the E- business enterprise, McGraw-Hill Higher Education, 2011.
6. Turban, McLean and Wether, Information Technology for Management-Transforming Organisations in the Digital Economy, John Wiley, 2008.

22IS003 NOSQL DATABASE**2 0 2 3****Course Objectives**

- Explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems.
- Understand the architectures and common features of the main types of NoSQL databases (key-value stores, document databases, column-family stores, graph databases).
- Discuss the criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases.

Course Outcomes (COs)

1. Explain and compare different types of NoSQL Databases.
2. Compare and contrast RDBMS with different NoSQL databases.
3. Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4. Explain performance tune of Key-Value Pair NoSQL databases.
5. Apply Nosql development tools on different types of NoSQL Databases.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1	1								2	
2	3	2	1	1	1								2	
3	2	1	1	1	1								2	3
4	3	2	1	1	1								1	
5	2	2	1	1	1								2	2

UNIT I**6 Hours****INTRODUCTION TO NOSQL CONCEPTS**

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL.

UNIT II**6 Hours****KEY VALUE DATABASE**

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT III **6 Hours**

DOCUMENT ORIENTED DATABASE

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT IV **6 Hours**

COLUMNAR DATA MODEL

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT V **6 Hours**

DATA MODELING WITH GRAPH

Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

1 **5 Hours**

EXPERIMENT 1

Implementation of Document Document-Oriented Database (MongoDB) to perform CRUD operations, Indexing, Sharding query optimization and data modeling.

2 **5 Hours**

EXPERIMENT 2

Implementation of Column-Family Store (Apache Cassandra) to perform data modeling and querying.

3 **5 Hours**

EXPERIMENT 3

Create a database that stores road cars. Cars have a manufacturer ,a type. Each car has a maximum performance and a maximum torque value. Do the following: Test Cassandra's replication schema and consistency models.

4 **5 Hours**

EXPERIMENT 4

Implementation of Column-Family Store (Apache Cassandra) to set up replication across multiple nodes and observe read write operation.

5 **5 Hours**

EXPERIMENT 5

Implementation of Graph Database (Neo4j) to demonstrate graph algorithms.

6

5 Hours

EXPERIMENT 6

Download a zip code dataset at <http://media.mongodb.org/zips.json> .Use mongo import to import the zip code dataset into MongoDB. After importing the data, answer the following questions by using aggregation pipelines: (1) Find all the states that have a city called BOSTON. Find all the states and cities whose names include the string BOST. Each city has several zip codes. Find the city in each state with the most number of zip codes and rank those cities along with the states using the city populations. MongoDB can query on spatial information.

Total: 60 Hours

Reference(s)

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.
2. Dan Sullivan, NoSQL For Mere Mortals, 1st Edition, Pearson Education India, 2015. (ISBN- 13: 978-9332557338).
3. Dan McCreary and Ann Kelly, Making Sense of NoSQL: A guide for Managers and the Rest of us, 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022).
4. Kristina Chodorow, MongoDB: The Definitive Guide- Powerful and Scalable Data Storage, 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694).

22IS004 DATA COMPRESSION**3 0 0 3****Course Objectives**

- Understand the important issues in data compression.
- Develop a reasonably sophisticated data compression application.
- Learn different types of compression techniques used for audio, image and video compression.

Course Outcomes (COs)

1. Understand the basic mathematical models used in data compression.
2. Implement the Lossless compression techniques to compress different raw data.
3. Understand the conceptual basis for commonly used Lossy compression techniques.
4. Apply various audio compression techniques over real world data.
5. Analyze different types of image and video compression techniques.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	1	1								1	
2	2	2	3	2									2	
3	2	2											2	
4	2	1	3	3	2								2	3
5	1	2		2									3	

UNIT I**9 Hours****INTRODUCTION**

Mathematical Preliminaries, Lossy and Lossless compression, Application of compression-Huffman coding: Overview; The Huffman coding algorithm, Minimum variance Huffman codes; Application of Huffman coding for text compression.

UNIT II**9 Hours****LOSSLESS COMPRESSION**

Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42. Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG-LS; Multiresolution approaches; Facsimile encoding: Run-length coding, T.4 and T.6.

UNIT III**9 Hours****BASICS OF LOSSY CODING**

Some mathematical concepts: Introduction-Distortion Criteria-Models. Scalar quantization: Overview-The quantization problem-Uniform quantizer- Adaptive quantization.

UNIT IV **9 Hours**

AUDIO COMPRESSION

High quality digital audio, frequency and temporal masking, lossy sound compression-law and A-law, companding, and MP3 audio standard.

UNIT V **9 Hours**

IMAGE AND VIDEO COMPRESSION

PCM, DPCM JPEG, JPEG - LS , and JPEG 2000 standards- Intra frame coding, motion estimation and compensation, introduction to MPEG-2 H-264 encoder and decoder.

Total: 45 Hours

Reference(s)

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers, 4th Edition,2013
2. David Saloman,Data Compression: The complete reference, 3rd Edition,Springer publication,2007.
3. W.B.Pennebaker: JPEG still image compression standard, 1993

22IS005 DECISION SUPPORT SYSTEM**3 0 0 3****Course Objectives**

- To understand the major concepts in decision support systems.
- To apply knowledge based for any real life applications.
- To analyze a knowledge-based system for a smart production system.

Course Outcomes (COs)

1. Apply to perceive the characteristics of the decision models in real time or not.
2. Ability to locate and select appropriate data to support decision models.
3. Analyze to investigate and evaluate a decision model.
4. Analyze the characteristics and type of data required to develop and support decision models.
5. Apply the Characteristics and variables in the standardization of decision models.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1									
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								3	
5	2	1	1		3								2	

UNIT I**9 Hours****DECISION SUPPORT SYSTEMS**

An Overview DSS Configurations Characteristics and Capabilities of DSS, Components of DSS, The Data Management Subsystem, The Model Management Subsystem, The User Interface (Dialog) Subsystem, The Knowledge-Based Management Subsystem, The User, DSS Hardware, DSS Classifications.

UNIT II**8 Hours****KNOWLEDGE MANAGEMENT**

Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Initiatives, Approaches to Knowledge Management, Information Technology in Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management, Ensuring Success of Knowledge Management.

UNIT III**10 Hours****KNOWLEDGE ACQUISITION**

Knowledge Acquisition, Representation, and Reasoning Concepts of Knowledge Engineering, Scope and Types of Knowledge, Methods of Knowledge Acquisition from Experts, Knowledge Acquisition from Multiple Experts, Automated Knowledge Acquisition from Data and Documents, Knowledge Verification and Validation, Representation of

Knowledge, Reasoning in Rule-Based Systems, Explanation and Meta knowledge, Inference with Uncertainty, Expert Systems Development, Knowledge Acquisition and the Internet.

UNIT IV

9 Hours

MODELLING IN DECISION SUPPORT SYSTEMS

Modeling and Support Decision-Making Introduction and Definitions, Systems, Models, Phases of the Decision-Making Process, Decision-Making: The Intelligence Phase, The Design Phase, Decision-Making: The Choice Phase, The Implementation Phase, How Decisions Are Supported, Personality Types, Gender, Human Cognition, and Decision Styles.

UNIT V

9 Hours

FUTURE TRENDS AND TECHNIQUES

Advanced Intelligent Systems Machine-Learning Techniques; Case-Based Reasoning; Basic Concept of Neural Computing; Learning in Artificial Neural Networks; Developing Neural Network-Based Systems; Genetic Algorithms Fundamentals; Developing Genetic Algorithm Applications; Fuzzy Logic Fundamentals; Developing Integrated Advanced Systems.

Total: 45 Hours

Reference(s)

1. Gupta, J.N.D., Forgionne, G.A., and Manuel, M.T., Intelligent Decision-making Support Systems: Foundations, Applications and Challenges, Springer, 2006.
2. Iantovics, B., and Kountchev, R., Advanced Intelligent Computational Technologies and Decision Support Systems, Springer, 2014.
3. Tweedale, J.W, Neves-Silva, R., Jain, L.C., Phillips-Wren, G., Watada, J., and Howlett, R.J., Intelligent Decision Technology Support in Practice, Springer, 2016.
4. Valencia-Garcia, R, Paredes-Valverde, M.A., Salas-Zarate, M.P. and Alor-Hernandez, Giner., Exploring Intelligent Decision Support Systems, Springer, 2018.

22IS006 BUSINESS INTELLIGENCE**3 0 0 3****Course Objectives**

- To enable students to understand the role of mathematical models in business intelligence and develop skills in using them to make effective and timely decisions.
- To provide students with an introduction to data mining, data warehousing, and big data analytics, and enable them to apply these techniques in real-world scenarios.
- To equip students with the knowledge and skills required to deliver business intelligence effectively, including designing and presenting reports, visualizations, and dashboards.

Course Outcomes (COs)

1. Understand the role of data, information, and knowledge in making effective and timely decisions in a business context.
2. Acquire proficiency in data warehousing and apply it to solve business problems.
3. Understand the concept of big data and its impact on business intelligence.
4. Develop an understanding of different business intelligence user types, including standard reports, interactive analysis, and ad hoc querying.
5. Understand the concept of efficiency measures and their importance in business intelligence.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		2					2					-	
2	2	2	3	2									-	
3	1		2		3								-	
4	2	2	3										-	
5	1		2	2										

UNIT I**9 Hours****BUSINESS INTELLIGENCE**

Effective and timely decisions-Data, information and knowledge-Role of mathematical models-Business intelligence architectures: Cycle of a business intelligence analysis-Enabling factors in business intelligence projects-Development of a business intelligence system-Ethics and business intelligence.

UNIT II**10 Hours****INTRODUCTION TO DATA MINING AND DATA WAREHOUSING**

Data Modeling-Data Extraction-Transformation and Loading-Data Warehousing Case Studies Pattern matching-Association rule mining-Cluster analysis, outlier analysis-Text Mining-Web Analytics-Decision modelling and optimization.

UNIT III **9 Hours**

INTRODUCTION TO BIG DATA ANALYTICS

Introduction to Big Data-Hadoop Architecture-Hadoop Distributed File System (HDFS) MapReduce Framework-Pig-Hive-Business Intelligence Analytics: Descriptive analytics-Predictive analytics-Prescriptive analytics-Business Intelligence Analytics Case Studies.

UNIT IV **9 Hours**

KNOWLEDGE DELIVERY

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

UNIT V **8 Hours**

EFFICIENCY

Efficiency measures-The CCR model: Definition of target objectives-Peer groups-Identification of good operating practices; cross efficiency analysis-virtual inputs and outputs.

Total: 45 Hours

Reference(s)

1. Efraim Turban, Ramesh Sharda, Dursun Delen, Decision Support and Business Intelligence Systems, 9th Edition, Pearson 2013.
2. Larissa T. Moss, S. Atre, Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making, Addison Wesley, 2003.
3. Carlo Vercellis, Business Intelligence: Data Mining and Optimization for Decision Making, Wiley Publications, 2009.
4. David Loshin Morgan, Kaufman, Business Intelligence: The Savvy Managers Guide, Second Edition, 2012.
5. Data Warehousing, Data Mining, and OLAP by Alex Berson and Stephen J. Smith - 1st edition, McGraw-Hill Education.
6. Big Data: A Revolution That Will Transform How We Live, Work, and Think by Viktor Mayer-Schonberger and Kenneth Cukier - 1st edition, Mariner Books.

22IS007 VIRTUALIZATION IN CLOUD COMPUTING

3 0 0 3

Course Objectives

- Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud based applications.
- Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure.
- Identify major security and privacy problems in cloud computing environment.
- Apply the ability to use the architecture of cloud, service and delivery models.
- Implement the key enabling technologies that help in the development of cloud.

Course Outcomes (COs)

1. Analyze the concept of virtualization and its properties.
2. Apply different forms of virtualization.
3. Implement various architectures for implementing virtualization methods.
4. Create virtual machines and installing various operating systems.
5. Evaluate the performance of the virtual machines and deployed applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3										
2			1	3	2									
3			2	1	3									
4	1		2	1	3									
5	1		3		2									

UNIT I

9 Hours

UNDERSTANDING VIRTUALIZATION

Describing Virtualization-Microsoft Windows Drives Server Growth-Explaining Moores Law-Understanding the Importance of Virtualization-Examining Today's Trends-Virtualization and Cloud Computing-Understanding Virtualization Software Operation-Virtualizing Servers-Virtualizing Desktops-Virtualizing Applications.

UNIT II

9 Hours

HYPERVERSORS

Describing a Hypervisor-Exploring the History of Hypervisors-Understanding Type 1 Hypervisors-Type 2 Hypervisors-Role of a Hypervisor-Holodecks and Traffic Cops-Resource Allocation-Comparing Today's Hypervisors-VMware ESX-Citrix Xen-Microsoft Hyper-V-Other Solutions.

UNIT III

9 Hours

VIRTUAL MACHINES

Introduction to Virtual Machine-CPU's in a Virtual Machine-Memory in a Virtual Machine-Network Resources in a Virtual Machine-Storage in a Virtual Machine-Understanding How a Virtual Machine Works-Working with Virtual Machines-Virtual Machine Clones-Templates-Snapshots-OVF-Containers.

UNIT IV

9 Hours

CREATION OF VIRTUAL MACHINES

Understanding Configuration Options-Installing Windows on a Virtual Machine-Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions-Managing CPU's for a Virtual Machine-Configuring VM CPU Options-Managing Storage for a Virtual Machine-Managing Networking for a Virtual Machine- Copying a Virtual Machine-Managing Additional Devices in Virtual Machines.

UNIT V

9 Hours

AVAILABILITY

Increasing Availability-Protecting a Virtual Machine-Protecting Multiple Virtual Machines-Protecting Data Centers- Examining Virtual Infrastructure Performance Capabilities-Deploying Applications in a Virtual Environment-Understanding Virtual Appliances and vApps-Open Stack and Containers.

Total: 45 Hours

Reference(s)

1. Matthew Portney, Virtualization Essentials, John Wiley & Sons, Second Edition, 2016.
2. Kailash Jayaswal, Jagannath Kallakurchi,Donald J.Houde,Dr.devan Shah, Cloud Computing Black Book, Dreamtech press, 2015.
3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S,Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013.
4. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013.
5. <http://www.microsoft.com/learning/default.aspx>.
6. <https://www.oreilly.com/library/view/cloud-security-and/9780596806453/ch04.html>

22IS008 CLOUD SERVICES AND DATA MANAGEMENT

3 0 0 3

Course Objectives

- Analyze the basic concepts of Cloud and capabilities across the various Cloud service models.
- Analyze virtualization technology to derive the best practice model for deploying cloud based applications.
- Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and OpenStack.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment.

Course Outcomes (COs)

1. Apply Cloud Computing reference architecture for developing clouds.
2. Analyze the different forms of cloud service models.
3. Apply the characteristics and architecture of IaaS using various real world applications.
4. Evaluate PaaS concepts and architectures with real-world examples.
5. Analyze, and synthesize concepts related to the SaaS delivery model.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1								1	1
2	3	1	2	3	2								1	2
3	1	1	3	1	3								1	3
4	1	1	1	2	3								2	3
5	1	3	3	2	2								2	3

UNIT I

9 Hours

CLOUD COMPUTING REFERENCE ARCHITECTURE (CCRA)

Introduction to Cloud Computing Reference Architecture (CCRA), Benefits of CCRA, Architecture Overview, Versions and Application of CCRA for Developing Clouds.

UNIT II

9 Hours

INTRODUCTION OF DELIVERY MODELS IN CLOUD COMPUTING

Introduction to Cloud Delivery Models, List Various Cloud Delivery Models, Advantages of Delivery Models in Cloud, Trade-off in Cost to Install Versus Flexibility, Cloud Service Model Architecture.

9 Hours

UNIT III

INFRASTRUCTURE AS A SERVICE (IAAS)

Introduction to Infrastructure as a Service Delivery Model, Characteristics of IaaS, Architecture, Examples of IaaS, Applicability of IaaS in the Industry.

UNIT IV

9 Hours

PLATFORM AS A SERVICE (PAAS)

Introduction to Platform as a Service Delivery Model, Characteristics of PaaS, Patterns, Architecture and Examples of PaaS, Applicability of PaaS in the Industry.

UNIT V

9 Hours

SOFTWARE AS A SERVICE (SAAS)

Introduction to Software as a Service Delivery Model, Characteristics of SaaS, Architecture, Examples of SaaS, Applicability of SaaS in the Industry.

Total: 45 Hours

Reference(s)

1. (IBM ICE), Cloud Computing Architecture, IBM Global Technology Services Thought Leadership White Paper, April 2011.
2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013.
3. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, 2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'Reilly, SPD, 2011.

22IS009 CLOUD STORAGE TECHNOLOGIES**3 0 0 3****Course Objectives**

- Characterize the functionalities of logical and physical components of storage.
- Describe various storage networking technologies.
- Identify different storage virtualization technologies.
- Discuss the different backup and recovery strategies.
- Understand common storage management activities and solutions.

Course Outcomes (COs)

1. Analyze the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
2. Apply the usage of advanced intelligent storage systems and RAID.
3. Evaluate various storage networking architectures - SAN, including storage subsystems and virtualization.
4. Execute the different roles in providing disaster recovery and remote replication technologies.
5. Implement the security needs and security measures to be employed in information storage management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	3	3								3	3
2	3	1	2	3	3								2	3
3	1	1	3	2	2								3	
4	3	2	1	2	2								3	3
5	1	3	2	1	2								3	3

UNIT I**8 Hours****STORAGE SYSTEMS**

Cloud Storage Fundamentals and Architecture-Cloud Storage Providers and Services-Access methods (RESTful APIs, SDKs) for cloud object storage-Block storage technologies in cloud environments-File Storage in the Cloud: Network File System (NFS) and Server Message Block (SMB) protocols-Hybrid Cloud Storage-Data Migration-Data Lifecycle Management in the Cloud.

UNIT II**9 Hours****INTELLIGENT STORAGE SYSTEMS AND RAID**

Storage Tiering and Caching-Automated Data Placement and Load Balancing: Intelligent Algorithms for Data Placement, Load Balancing Strategies for Distributed Storage Systems, Dynamic Resource Allocation-RAID Technologies in Cloud Storage: RAID Levels-Data Striping, Mirroring, and Parity for Fault Tolerance-RAID Configuration and Performance Optimization.

UNIT III

10 Hours

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Storage Networking in Cloud Environments-Understanding storage protocols-Network-attached storage (NAS) vs. storage area network (SAN)-Storage virtualization techniques and technologies-Network-Attached Storage (NAS)-Storage Area Network (SAN)-iSCSI and Fiber Channel over IP (FCIP) in Cloud Storage-Network Virtualization and Overlay Networks-Storage Virtualization and Abstraction-Network Performance Optimization-Network Security in Cloud Storage.

UNIT IV

9 Hours

BACKUP, ARCHIVE AND REPLICATION

Cloud Backup: Strategies and Architecture, Data Deduplication and Compression, Security-Cloud Archive: Strategies and Architecture, Replication for Data Redundancy: Synchronous and asynchronous replication methods-Disaster Recovery in the Cloud-Hybrid Backup and Archiving in Cloud Environments- Backup and Archive Management in Cloud Environments.

UNIT V

9 Hours

SECURING STORAGE INFRASTRUCTURE

Storage Security Fundamentals: Key Security Principles, Threats and Vulnerabilities in Storage Infrastructure, Access Control and Authentication: Role-based Access Control (RBAC) and Permissions Management, Multi-factor authentication (MFA) for Storage Systems-Storage-level Encryption and Application-level Encryption-Storage infrastructure Management Functions and Processes.

Total: 45 Hours

Reference(s)

1. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), OReilly, 2009.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012.

22IS010 CLOUD AUTOMATION TOOLS AND APPLICATIONS

3 0 0 3

Course Objectives

- To learn the options for running automation tools, and load balancers in the cloud-native applications.
- To learn the configuration management in the cloud.
- To know why cloud automation is important.
- To learn what types of cloud automation tools can be used.
- To learn load balancing and auto scaling in the cloud.

Course Outcomes (COs)

1. Implement cloud native applications on AWS and Terraform.
2. Apply VM provisioning and migration in the cloud.
3. Analyze cloud automation and configuration.
4. Apply balance load and auto scaling in the cloud.
5. Analyze the AWS cloud formation use-case.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2	1	3								3	3
2		2			3								3	3
3			3	2	3								3	2
4			2		3								3	2
5			2		3								3	3

UNIT I

7 Hours

UNDERSTANDING THE CLOUD AUTOMATION

Introduction to Automation & Configuration Tools. Introduction to Terraform. Understanding Terraform Vs CloudFormation. Deploying and Destroying AWS environment with Terraform. Introduction to Packer.

UNIT II

9 Hours

ABSTRACTION AND VIRTUALIZATION

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding hypervisors Porting Applications, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Centre Automation.

UNIT III

9 Hours

AUTOMATION AND CONFIGURATION MANAGEMENT IN THE CLOUD

Cloud automation at scale, Cloud Configuration Management-unmanaged and managed configuration management, Modification of the capacity of the service, horizontal and vertical scaling, and automatic versus manual scaling. Migrating the business to Cloud. Automating cloud deployments-Balancers.

UNIT IV

9 Hours

LOAD BALANCING AND AUTO SCALING IN CLOUD

Managed instance groups, Auto scaling and health check, Overview of HTTP(S) load balancing. Example: HTTP load balancer, HTTP(S) load balancing, Configuring an HTTP Load Balancer with Auto scaling, SSL proxy load balancing, TCP proxy load balancing, Network load balancing, Internal load balancing, Configuring an Internal Load Balancer, Choosing a load balancer.

UNIT V

11 Hours

AWS CLOUDFORMATION USE-CASE

Introduction to AWS CloudFormation, AWS CloudFormation Features and Components, Working of AWS CloudFormation, setting up AWS CloudFormation, building a Pipeline for Test and Production Stacks, AWS CloudFormation Artifacts, Parameter Override Functions with Code Pipeline, Using AWS CLI. AWS CloudFormation, Terraform, VMware vs Center Configuration Manager (VCM), and Puppet.

Total: 45 Hours

Reference(s)

1. Bernd Ruecker, Practical Process Automation: Orchestration and Integration in Micro services and Cloud Native Architectures, O'Reilly Media, First Edition, 2021.
2. Douglas Comer, The Cloud Computing Book: The Future of Computing Explained, Chapman and Hall/CRC, First Edition, 2021.
3. Karen Tovmasyan, Mastering AWS CloudFormation: Plan, develop, and deploy your cloud infrastructure effectively using AWS CloudFormation, Packt Publishing Limited, First Edition, 2020.
4. Mikael Krief, Mitchell Hashimoto, Terraform Cookbook: Efficiently define, launch, and manage Infrastructure as Code across various cloud platforms, Packet Publishing Limited, 2020.
5. Yogesh Raheja, Dennis McCarthy, Automation with Puppet 5.0, Wiley, First Edition, 2018.

22IS011 SOFTWARE DEFINED NETWORKS**2023****Course Objectives**

- To understand the need for SDN and its data plane operations.
- To understand the functions of control plane.
- To comprehend the migration of networking functions to SDN environment.
- To explore various techniques of network function virtualization.
- To comprehend the concepts behind network virtualization.

Course Outcomes (COs)

1. Apply the motivation behind SDN.
2. Analyze the functions of the data plane and control plane.
3. Evaluate and develop network applications using SDN.
4. Execute network services using NFV.
5. Implement various use cases of SDN and NFV.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3	1	3								2	
2	2	1	2	2	3								2	
3	2	2	2	3	3								3	2
4	2	2	2	3	1								2	3
5	3	3	1	1	3								3	3

UNIT I**6 Hours****SDN: INTRODUCTION**

History of Software Defined Networking (SDN)-Modern Data Center-Traditional Switch Architecture-Why SDN-Evolution of SDN-How SDN Works-Centralized and Distributed Control and Data Planes.

UNIT II**6 Hours****SDN DATA PLANE AND CONTROL PLANE**

Data Plane functions and protocols-OpenFlow Protocol-Packet Processing and Performance Optimization-Flow Table - Control Plane Functions-Southbound Interface, Northbound Interface-SDN Controllers-Ryu, OpenDaylight, ONOS-Distributed Controllers.

UNIT III**6 Hours****SDN APPLICATIONS**

SDN Application Plane Architecture-Network Services Abstraction Layer-Traffic Engineering-Measurement and Monitoring-Security-Data Center Networking-Wide Area Networks (WAN)-Service Provider Networks-Internet Service Providers (ISPs).

UNIT IV **6 Hours**

NETWORK FUNCTION VIRTUALIZATION

Network Virtualization-NFV Architecture-Virtual LANs-OpenFlow VLAN Support-NFV Standards and Frameworks-NFV Concepts-Benefits and Requirements-Reference Architecture.

UNIT V **6 Hours**

NFV FUNCTIONALITY

NFV Infrastructure-Virtualized Network Functions-NFV Management and Orchestration-NFV Use Cases: Virtual Customer Premises Equipment, Virtual Evolved Packet Core, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV.

1 **6 Hours**

EXPERIMENT 1

Setup your own virtual SDN lab

i) Virtualbox/Mininet Environment for SDN - <http://mininet.org>

ii) <https://www.kathara.org>

iii) GNS3

2 **6 Hours**

EXPERIMENT 2

Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.

3 **6 Hours**

EXPERIMENT 3

Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.

4 **6 Hours**

EXPERIMENT 4

Create a simple end-to-end network service with two VNFs using vim-emu <https://github.com/containernet/vim-emu>

5 **6 Hours**

EXPERIMENT 5

Install OSM and onboard and orchestrate network service.

Total: 60 Hours

Reference(s)

1. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design, 1st Edition, CRC Press, 2014.
2. Ken Gray, Thomas D. Nadeau, Network Function Virtualization, Morgan Kauffman, 2016.
3. Oswald Coker, Siamak Azodolmolky, Software-Defined Networking with OpenFlow, 2nd Edition, OReilly Media, 2017.
4. Paul Goransson, Chuck Black Timothy Culver, Software Defined Networks: A Comprehensive Approach, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Thomas D Nadeau, Ken Gray, SDN: Software Defined Networks, OReilly Media, 2013.
6. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud, Pearson Education, 1st Edition, 2015.

22IS012 SECURITY AND PRIVACY IN CLOUD**3 0 0 3****Course Objectives**

- To Introduce Cloud Computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To understand the Identity, Access control in Cloud.
- To follow best practices for Cloud security using various design patterns.
- To be able to monitor and audit cloud applications for security.

Course Outcomes (COs)

1. Understand the cloud security concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Analyze the cloud policy, identity and Access Management.
4. Delivers various risks, audit and monitoring mechanisms in the cloud.
5. Applying the various architectural and design considerations for security in the cloud.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1	2								3	-
2	1	3	2	3	1								3	-
3	3	2	2	3	2								3	-
4	2	1	2	3	3								3	-
5	1	3	3	1	1								3	-

UNIT I**8 Hours****FUNDAMENTALS OF CLOUD SECURITY CONCEPTS**

Overview of Cloud Security-Security Services-Confidentiality, Integrity, Authentication, Non-repudiation, Access Control-Basic of Cryptography-Conventional and Public-key cryptography, Hash Functions, Authentication and Digital Signatures.

UNIT II**11 Hours****SECURITY DESIGN AND ARCHITECTURE FOR CLOUD**

Security Design Principles for Cloud Computing-Comprehensive Data Protection-End-to-end access control-Common Attack Vectors and threats-Network and Storage-Secure Isolation Strategies-Virtualization strategies-Inter-tenant network segmentation strategies-Data Protection strategies: Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT III**9 Hours****ACCESS CONTROL AND IDENTITY MANAGEMENT**

Access Control Requirements for Cloud infrastructure-User Identification-Authentication and Authorization-Roles-based Access Control-Multi-factor authentication-Single Sign-on, Identity Federation-Identity providers and service consumers-Storage and network access control options-OS Hardening and minimization-Verified and measured boot-Intruder Detection.

UNIT IV

8 Hours

CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud Bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT V

9 Hours

MONITORING, AUDITING AND MANAGEMENT

Proactive Activity Monitoring-Incident Response, Monitoring for Unauthorized Access, Malicious Traffic, Abuse of System Privileges-Events and Alerts-Auditing-Record generation, Reporting and Management, Tamper-Proofing Audit logs, Quality of Services, Secure Management, User Management, Identity Management, Security Information and Event Management.

Total: 45 Hours

Reference(s)

1. Dave Shackleford, Virtualization Security, SYBEX a Wiley Brand, 2013.
2. Mark C. Chu-Carroll, Code in the Cloud, CRC Press, 2011.
3. Mather, Kumaraswamy and Latif, Cloud Security and Privacy, Oreilly, 2011.
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, 2013.
5. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing, Wiley 2013.

22IS013 CYBER SECURITY**3 0 0 3****Course Objectives**

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

Course Outcomes (COs)

1. Understand the basics of cyber security, cybercrime and cyber law.
2. Classify various types of attacks and learn the tools to launch the attacks.
3. Apply various tools to perform information gathering for data security and integrity.
4. Apply intrusion techniques to detect intrusion and to observe network traffic for malicious transactions in the network.
5. Apply intrusion prevention techniques to prevent intrusion and to protect against known and unknown threats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	2								-	
2	1	3	1	3	3								2	
3	2	1	1	1	2								3	
4	3	3	2	2	1								3	
5	3	2	2	2	3								3	

UNIT I**9 Hours****INTRODUCTION**

Cyber Security-History of Internet-Impact of Internet-CIA Triad; Reason for Cyber Crime-Need for Cyber Security-History of Cyber Crime; Cybercriminals-A Global Perspective on Cyber Crimes-Classification of Cybercrimes

UNIT II**9 Hours****ATTACKS AND COUNTER MEASURES**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks-Security Breach-Types of Malicious Attacks -Malicious Software-Common Attack Vectors-Social engineering Attack-Wireless Network Attack-Web Application Attack-Attack Tools-Countermeasures.

UNIT III**9 Hours****RECONNAISSANCE**

Harvester-Who is-Netcraft-Host-Extracting Information from DNS -Extracting Information from E-mail Servers-Social Engineering Reconnaissance; Scanning-Port Scanning-Network Scanning and Vulnerability Scanning-Scanning Methodology-Ping Sweer Techniques-Nmap

Command Switches-SYN-Stealth-XMAS-NULL-IDLE -FIN Scans-Banner Grabbing and OS Fingerprinting Techniques.

UNIT IV

9 Hours

INTRUSION DETECTION

Host-Based Intrusion Detection-Network-Based Intrusion Detection-Distributed or Hybrid Intrusion Detection-Intrusion Detection Exchange Format-Honeypots-Example System Snort-Cyber Laws-The Indian IT Act-Cyber Crime and Punishment.

UNIT V

9 Hours

INTRUSION PREVENTION

Firewalls and Intrusion Prevention Systems: Need for Firewalls -Firewall Characteristics and Access Policy-Types of Firewalls -Firewall Basing-Firewall Location and Configurations-Intrusion Prevention Systems-Example Unified Threat Management Products.

Total: 45 Hours

Reference(s)

1. David Kim, Michael G. Solomon, Fundamentals of Information Systems Security, Jones & Bartlett Learning Publishers, 2013.
2. Patrick Engebretson, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy, Elsevier, 2011.
3. Kimberly Graves, CEH Official Certified Ethical hacker Review Guide, Wiley Publishers, 2007.
4. William Stallings, Lawrie Brown, Computer Security Principles and Practice, Third Edition, Pearson Education, 2015.
5. Georgia Weidman, Penetration Testing: A Hands-On Introduction to Hacking, No Starch Press, 2014.

22IS014 MODERN CRYPTOGRAPHY**3 0 0 3****Course Objectives**

- To learn about the basics of modern cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudo random permutation.
- To construct the basics of cryptanalytic techniques for ensuring data integrity.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

Course Outcomes (COs)

1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authentication.
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Apply the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Demonstrate the use of Message Authentication Codes to authenticate information transmitted between the users.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	
2	1	3	2	1	2							2	2	
3	1	1	2	3	2							3	1	
4	3	1	2	1	3							2	3	
5	2	3	3	3	3							1	2	

UNIT I**9 Hours****INTRODUCTION**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II**9 Hours****FORMAL NOTIONS OF ATTACKS**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model

UNIT III

9 Hours

RANDOM ORACLES

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF).

UNIT IV

9 Hours

BUILDING A PSEUDORANDOM PERMUTATION

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V

9 Hours

MESSAGE AUTHENTICATION CODES

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

Total: 45 Hours

Reference(s)

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 7th Edition, 2017.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), 2009.
3. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2007.
4. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2004.

22IS015 CYBER FORENSICS**3 0 0 3****Course Objectives**

- To understand the principles and concepts of computer forensics
- To learn to utilize forensic tools for network-based attacks.
- To identify and apply appropriate methodologies for forensics data.
- To identify and analyze the vulnerabilities in the network.
- To analyze the various hacking techniques and their impacts.

Course Outcomes (COs)

1. To understand the basics of computer forensics, legal and ethical considerations, and the importance of maintaining the integrity of digital evidence.
2. Apply different types of computer forensic tools to preserve the integrity of data in the network.
3. Analyze and validate forensics data from the communicating devices to detect intruders.
4. Apply the various firewall techniques to detect the vulnerabilities in the networks.
5. Implement real-world hacking techniques to test system security and to ensure the system's safety from hackers.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	2			2					2	
2	2	2	3	2	3			2					2	
3	2	1	3	2	2			3					2	
4	2	1	2	3	3			3					3	
5	2	2	2	2	3			3					3	

UNIT I**9 Hours****INTRODUCTION TO COMPUTER FORENSICS**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques- Incident and incident response methodology-Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team.-Forensics Technology and Systems-Understanding Computer Investigation-Data Acquisition.

UNIT II**9 Hours****EVIDENCE COLLECTION AND FORENSICS TOOLS**

Processing Crime and Incident Scenes-Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT III **9 Hours**

ANALYSIS AND VALIDATION

Validating Forensics Data-Data Hiding Techniques-Performing Remote Acquisition-Network Forensics-Email Investigations-Cell Phone and Mobile Devices Forensics.

UNIT IV **9 Hours**

E-MAIL SECURITY

PGP-S/MIME-Internet Firewalls for Trusted System: Roles of Firewalls-Firewall related terminology-Types of Firewalls- Firewall designs-SET for E-Commerce Transactions.

UNIT V **9 Hours**

ETHICAL HACKING IN WEB

Social Engineering-Denial of Service-Session Hijacking-Hacking Web servers-Hacking Web Applications-SQL Injection-Hacking Wireless Networks-Hacking Mobile Platforms.

Total: 45 Hours

Reference(s)

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
4. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, Cengage Learning, 2nd Edition, 2005.
5. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

22IS016 ETHICAL HACKING**3 0 0 3****Course Objectives**

- To learn about the importance of information security.
- To learn different scanning and enumeration methodologies and tools.
- To understand various hacking techniques and attacks.
- To be exposed to programming languages for security professionals.
- To understand the different phases in penetration testing.

Course Outcomes (COs)

1. Enumerate the numerous assaults carried out during ethical hacking and penetration testing.
2. Apply the hacking techniques and understand the tools to be used for hacking.
3. Understand the various vulnerabilities of Windows and Linux OS.
4. Apply the techniques to hack web servers and tools for it.
5. Determine the characteristics of the firewall, the intruder detection mechanisms, and the malicious software to protect the system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	2	2									
2	1	2	2	1	2									
3	1	2	-	2	2									
4	1	2	2	3	3									
5	1	2	1	2	2									

UNIT I**9 Hours****INTRODUCTION**

Ethical Hacking Overview-Role of Security and Penetration Testers-Penetration-Testing Methodologies-Laws of the Land-Overview of TCP/IP-The Application Layer-The Transport Layer-The Internet Layer-IP Addressing. Network and Computer Attacks -Malware-Protecting Against Malware Attacks. Intruder Attacks Addressing Physical Security.

UNIT II**9 Hours****SCANNING AND ENUMERATION**

Introduction to Scanning-Objectives-Scanning Methodology-Tools -Introduction to Enumeration-Enumeration Techniques-Enumeration Procedure-Tools.

UNIT III**9 Hours****SYSTEM HACKING**

Introduction-Cracking Passwords-Password Cracking Websites-Password Guessing-Password Cracking Tools-Password Cracking Countermeasures-Escalating Privileges-Executing Applications-Keyloggers and Spyware.

UNIT IV

9 Hours

PROGRAMMING FOR SECURITY PROFESSIONALS

Programming Fundamentals-C language-HTML-Perl-Windows OS Vulnerabilities-Tools for Identifying Vulnerabilities-Countermeasures-Linux OS Vulnerabilities-Tools for Identifying Vulnerabilities-Countermeasures.

UNIT V

9 Hours

NETWORK PROTECTION SYSTEMS

Access Control Lists-Cisco Adaptive Security Appliance Firewall-Configuration and Risk Analysis Tools for Firewalls and Routers-Intrusion Detection and Prevention Systems-Network-Based and Host-Based IDSs and IPSs-Web Filtering-Security Incident Response Teams-Honeypots.

Total: 45 Hours

Reference(s)

1. EC-Council, Ethical Hacking and Countermeasures: Attack Phases, Cengage Learning, 2010.
2. Jon Erickson, Hacking, 2nd Edition: The Art of Exploitation, No Starch Press Inc., 2008.
3. Michael T. Simpson, Kent Backman, James E. Corley, Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2013.
4. Patrick Engebretson, The Basics of Hacking and Penetration Testing-Ethical Hacking and Penetration Testing Made Easy, Second Edition, Elsevier, 2013.
5. RafayBoloach, Ethical Hacking and Penetration Testing Guide, CRC Press, 2014.

22IS017 CRYPTOCURRENCY AND BLOCK CHAIN TECHNOLOGIES

2 0 2 3

Course Objectives

- To understand the basics of Blockchain Technology.
- To learn Different protocols and consensus algorithms in Blockchain.
- To learn the Blockchain implementation frameworks.
- To experiment the Hyperledger Fabric, Ethereum networks.
- To understand the Blockchain Applications.

Course Outcomes (COs)

1. Understand emerging abstract models for Blockchain Technology.
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
5. Analyze the real life applications of Blockchain Technologies.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1										
4		2	2		3								2	
5	1	2	3	1	2								1	

UNIT I

7 Hours

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers-Block in a Blockchain, Transactions-The Chain and the Longest Chain-Permissioned Model of Blockchain, Cryptographic-Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II

6 Hours

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH-the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)-Hashcash PoW , Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn-Proof of Elapsed Time-Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1-chain code-Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue-DApps-NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance-Case Study.

1 **5 Hours**

EXPERIMENT 1

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

2 **5 Hours**

EXPERIMENT 2

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

3 **5 Hours**

EXPERIMENT 3

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.

4 **5 Hours**

EXPERIMENT 4

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.

5 **5 Hours**

EXPERIMENT 5

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

6 **5 Hours**

EXPERIMENT 6

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan.

Total: 60 Hours

Reference(s)

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, OReilly, 2014.
3. Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
5. Melanie Swan, Blockchain: Blueprint for a New Economy, OReilly, 2015.
6. Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing.

22IS018 MALWARE ANALYSIS**3 0 0 3****Course Objectives**

- Understand the fundamentals of malware, types and its effects.
- Identify and analyze various malware types by static and dynamic analysis.
- To deal with detection, analysis, understanding, controlling, and eradication of malware.

Course Outcomes (COs)

1. Understand the various concepts of malware analysis and their technologies used.
2. Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.
3. Understand the methods and techniques used by professional malware analysts.
4. To be able to safely analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	2								2	
2	3	3	2	2	2								2	
3	3	3	3	3	3								3	
4	3	3	3	3	3								3	
5	3	3	3	3	3								3	

UNIT I**9 Hours****INTRODUCTION AND BASIC ANALYSIS**

Introduction to Malware-Malware threats-Malware types: Viruses, Worms, Rootkits, Trojans, Bots, Spyware, Adware, Logic Bombs-Goals of Malware Analysis-AV Scanning-Hashing-Finding Strings Packing and Obfuscation-PE file format-Static -Linked Libraries and Functions-Static Analysis tools
Virtual Machines and their usage in Malware analysis-Sandboxing-Basic dynamic analysis-Malware execution-Process Monitoring-Viewing processes-Registry snapshots.

UNIT II**10 Hours****ADVANCED STATIC ANALYSIS**

The Stack-Conditionals-Branching-Rep Instructions-Disassembly -Global and local variables-Arithmetic operations-Loops-Function Call Conventions-C Main Method and Offsets. Portable Executable File Format-The PE File Headers and Sections-IDA Pro-Function analysis-Graphing-The Structure of a Virtual Machine-Analyzing Windows programs-Anti-static analysis techniques-obfuscation-packing-metamorphism-polymorphism.

UNIT III

10 Hours

ADVANCED DYNAMIC ANALYSIS

Live malware analysis-dead malware analysis-analyzing traces of malware-system calls-api calls-registries-network activities. Anti-dynamic analysis techniques-VM detection techniques-Evasion techniques-Malware Sandbox-Monitoring with Process Monitor-Packet Sniffing with Wireshark-Kernel vs. User-Mode Debugging-OllyDbg-Breakpoints-Tracing - Exception Handling-Patching.

UNIT IV

8 Hours

MALWARE FUNCTIONALITY

Downloaders and Launchers-Backdoors-Credential Stealers-Persistence Mechanisms-Handles-Mutexes-Privilege Escalation-Covert malware launching-Launchers-Process Injection-Process Replacement-Hook Injection-Detours-APC injection.

UNIT V

8 Hours

ANDROID MALWARE ANALYSIS

Android Malware Analysis: Android architecture-App development cycle-APKTool-APKInspector-Dex2Jar-JD-GUI-Static and Dynamic Analysis-Case Study: Smartphone (Apps) Security.

Total: 45 Hours

Reference(s)

1. Michael Sikorski and Andrew Honig, Practical Malware Analysis by No Starch Press, 2012, ISBN: 9781593272906
2. Bill Blunden, The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System, Second Edition, Jones & Bartlett Publishers, 2009.
3. Jamie Butler and Greg Hogg, Rootkits: Subverting the Windows Kernel by 2005, Addison-Wesley Professional.
4. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SebastienJosse, Practical Reverse Engineering:x86,x64,ARM, Windows Kernel, Reversing Tools, and Obfuscation, 2014.
5. Victor Marak, Windows Malware Analysis Essentials Packt Publishing, OReilly, 2015.
6. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, Android Malware and Analysis, CRC Press, Taylor and Francis Group, 2015.

22IS019 AGILE SOFTWARE DEVELOPMENT**3 0 0 3****Course Objectives**

- To provide students with a theoretical as well as practical understanding of agile software development practices.
- To understand the Agile Scrum framework and development practices.
- To apply software design principles and refactoring techniques to achieve agility.
- To understand agile requirements and perform testing activities within an agile project.
- To understand the benefits and pitfalls of working in an agile team in terms of quality assurance.

Course Outcomes (COs)

1. Understand genesis of Agile and driving forces for choosing Agile techniques.
2. Apply the Agile Scrum framework and development practices.
3. Apply iterative software development processes by planning and executing them.
4. Analyze the impact of the success of social aspects behind the software testing.
5. Analyze techniques and tools for improving team collaboration and management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2									2		
2	2	2	2											
3	1		2		2							2		
4	1		2		2							2	-	
5	1		2		2							2	-	

UNIT I**9 Hours****AGILE METHODOLOGY**

Theories for Agile management-agile software development-traditional model vs. agile model-classification of agile methods -agile manifesto and principles-agile project management-agile team interactions-ethics in agile teams-agility in design, testing-agile documentations-agile drivers, capabilities and values.

UNIT II**9 Hours****AGILE PROCESSES**

Extreme Programming: Method overview-lifecycle-work products, roles and practices-Lean production-SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Kanban model.

UNIT III**9 Hours****AGILITY AND KNOWLEDGE MANAGEMENT**

Agile information systems-agile decision making-Earl ACEs schools of KM-institutional knowledge evolution cycle-development, acquisition, refinement, distribution, deployment, leveraging-KM in software engineering-managing software knowledge-challenges of migrating to agile methodologies-agile knowledge sharing-role of story-cards-Story-card Maturity Model(SMM).

UNIT IV

9 Hours

AGILITY AND REQUIREMENTS ENGINEERING

Impact of agile processes in RE-current agile practices-variance-overview of RE using agile-managing unstable requirements-requirements elicitation-agile requirements abstraction model-requirements management in agile environment, agile requirements prioritization-agile requirements modeling and generation-concurrency in agile requirements generation.

UNIT V

9 Hours

AGILITY AND QUALITY ASSURANCE

Agile Interaction Design-Agile product development-Agile Metrics-Feature Driven Development (FDD)-Financial and Production Metrics in FDD-Agile approach to Quality Assurance-Test Driven Development-Pair programming: Issues and Challenges-Agile approach to Global Software Development.

Total: 45 Hours

Reference(s)

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), Agile Software Development, Current Research and Future Directions, Springer Verlag Berlin Heidelberg, 2010.
2. David J. Anderson; Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
3. Hazza and Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, VIII edition, 2009.
4. Craig Larman, Agile and Iterative Development: A managers Guide, Addison-Wesley, 2004.
5. Kevin C. Desouza, Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007.

22IS020 UI AND UX DESIGN**3 0 0 3****Course Objectives**

- Study about designing web pages and understand the difference between UI and UX Design.
- To understand the concept of UX design and how it has evolved.
- Able to understand UX design process and methodology.
- Learning the Importance and scope of Interaction design, User centered design.

Course Outcomes (COs)

1. Understand to do user research, persona mapping, customer journey mapping.
2. Design of interactive products Methods of interaction design Tools for interaction design.
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests Learning steps for digital products.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													
2	1	2	2		1									
3		3	3		1									
4		2	2											
5		2	2											

UNIT I**9 Hours****USER-CENTERED DESIGN PROCESS**

Scripting Languages-HTML, CSS-Fundamentals of graphics design, principles of visual design-Overview of UI and UX Design-Overview of the UX Design Process-Difference between User Interface (UI) vs User Experience (UX)-Defining problem and vision statement-Persona creation-Primary and Secondary persona-Requirement definition-Creative ideation-brainstorming and ideation techniques-Scenarios and functionality extraction-Information Architecture-Task flows-Wireframe design.

UNIT II**9 Hours****FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN**

Design Principles for UX and UI Design-UI Elements-Patterns- Material Design (Google) and Human Interface Design (Apple) guidelines-Interaction Principles and Interaction Behaviour-Master the Brand Platforms and Style Guides-comments and current UI patterns-Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

UNIT III**9 Hours****ELEMENTARY SKETCHING**

Principles of Sketching-Core Responsive Design-Wireframing vs Wireflows-Click through Wireframing Prototyping-Wireflow Creation-Work with different tools-Figma-Low-High Fidelity Design: Inclusive Design and Designing for Accessibility-Building High-Fidelity Mockups-Designing Efficiently with Tools-Interaction Patterns-Designing animations and interactions.

UNIT IV

9 Hours

UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING

Building a Design System-Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration-Use of grids in UI design-Design animations and interaction patterns for key UI elements.

UNIT V

9 Hours

USABILITY EVALUATION AND PRODUCT DESIGN

Type of usability evaluation-Qualitative & Quantitative evaluation-Guerilla testing , A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud-Think aloud-Introduction and advantages- Designing evaluation protocol-Conducting usability evaluation study-Conduct Usability Test explicit-Synthesize Test Findings- practices in corporate World-Product Design : Types of products & solutions-Design Psychology for e-commerce sites , CMS-Design Thinking Life Cycle.

Total: 45 Hours

Reference(s)

1. Norman, Donald A. The Design of Everyday Things. Basic Books, 2002.
2. Wilbent. O. Galitz ,The Essential Guide To User Interface Design, John Wiley&Sons, 2001.
3. Alan Cooper,The Essential Of User Interface Design, Wiley Dream Tech Ltd.,2002.
4. Baecker, Ronald M., Jonathan Grudin, et al. Readings in Human-Computer Interaction: Toward the Year 2000.
5. Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed. Addison Wesley, 2004.

22IS021 WEB FRAMEWORKS**3 0 0 3****Course Objectives**

- Understand the architecture behind an Angular application and how to use it.
- To understand the significance of using MongoDB as a database system.
- To understand the role of React in designing front-end components.
- Build a Web Server in Node and understand how it really works.
- Develop a web application and API using web frameworks.

Course Outcomes (COs)

1. Apply modules and components and Animations for creating Forms and developing web pages.
2. Create web applications by performing CRUD operations in database using web frameworks.
3. Design Progressive Web Application with dynamic HTML web pages using Angular.
4. Designing single page applications with reusable UI components using React CSS and SaaS.
5. Use Node Package Manager and Node packages for Server Side programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		2				2	2				
2	1		1		3				2	2				
3	1		2		2				2	2				
4	1		1		3				2	2				
5	1		1		3				1	1				

UNIT I**9 Hours****ANGULAR FRONT-END FRAMEWORK**

Introduction-Setup-Architecture: Modules, Components, Services and DI fundamentals-Components and Templates-Configuration-Forms-Observables and RxJS-Boot Strapping-Ng Modules-Dependency Injection-Http Client-Router and Navigation-Animations.

UNIT II**9 Hours****FRAMEWORKS WITH DATABASES**

MongoDB-MongoDB Basics-Documents-Collections-Query Language-Installation-The mongo Shell-Schema Initialization-MongoDB Node.js Driver-Reading from MongoDB-Writing to MongoDB-CRUD operations-projections-Indexing-Aggregation-Replication-Sharding-Creating backup-Deployment.

UNIT III**9 Hours****ANGULAR TECHNIQUES**

Service workers & PWA-Server side rendering-Angular Libraries- Schematics-CLI Builders-Angular Ivy-Web Workers.

UNIT IV**9 Hours****REACT**

React Introduction-React ES6-React Render HTML-React JSX-Components-React Classes-Composing Components-Passing Data-Dynamic Composition-React state-setting State-Async State

Initialization-Event Handling Communicating from Child to Parent-Stateless Components-Designing components-React Forms- React CSS-React SaaS.

UNIT V

9 Hours

NODE JS BACK-END FRAMEWORK

Node.js basics-Local and Export Modules-Node Package Manager- Node.js web server-Node.js File system-Node Inspector-Node.js EventEmitter-Frameworks for Node.js-Express.js Web App-Serving static Resource-Node.js Data Access.

Total: 45 Hours

Reference(s)

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasam Subramanian, A Press Publisher, 2019.
2. Christoffer Noring, Pablo Deeleman, Learning Angular, Packt Publishing Limited, 2nd Revised edition edition, 2017.
3. Caleb Dayley Brad Dayley, Brendan Dayley ,Node.js, MongoDB and Angular Web Development, 2nd Edition, Pearson, 2018.
4. Shyam Seshadri, Angular: Up and Running- Learning Angular, Step by Step , OReilly; First edition, 2018.

22IS022 APP DEVELOPMENT**2 0 2 3****Course Objectives**

- To facilitate students to understand android SDK.
- To help students to gain a basic understanding of Android application development.
- To inculcate working knowledge of Android Studio development tool.

Course Outcomes (COs)

1. Identify fundamental concepts of mobile programming that make it unique from programming for other platforms.
2. Analyze the essential of Android Application with their anatomy and terminologies.
3. Apply rapid prototyping techniques to design, develop and deploy the Android Applications.
4. Analyze the essentials of User Interface Design in IoS with SQLite Database.
5. Design the flutter applications on the Android marketplace for distribution.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3									
2	1	2	2		3									
3	1		2		3									
4	1	1	2		3								2	
5	1	2	2		3									

UNIT I**6 Hours****INTRODUCTION TO ANDROID**

The Android Platform, Android SDK, Eclipse Installation, Android Installation, building your First Android application, Understanding the Android Manifest file.

UNIT II**6 Hours****ANDROID APPLICATION DESIGN ESSENTIALS**

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Using Intent Filter, Permissions.

UNIT III**9 Hours****COMMON ANDROID APIS**

Testing Android applications, Publishing Android applications, Using Android Data and Storage APIs, managing data using Sqlite, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Applications to the World.

UNIT IV**9 Hours****IOS USER INTERFACE DESIGN ESSENTIALS**

Ios features, UI implementation, Touch frameworks, Data persistence using Core Data and SQLite, Integrating calendar and address book with social media application, Using Wifi, iPhone marketplace.

UNIT V

8 Hours

APP DEVELOPMENT WITH FLUTTER

Flutter Introduction, Create First Flutter Application, Exploring commonly used flutter widgets: Container, Margin, Padding and Box Constraints, Custom Fonts, Column and Expanded Widgets, Image Asset, Raised Button, and Alert Dialog .

1

2 Hours

EXPERIMENT 1

Develop a simple application with one EditText so that the user can write some text in it. Create a button called Convert Text to Speech that converts the user input text into voice.

2

2 Hours

EXPERIMENT 2

Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.

3

2 Hours

EXPERIMENT 3

Create a SIGNUP activity with Username and Password. Validation of password should happen based on the following rules:

- 1.Password should contain uppercase and lowercase letters.
2. Password should contain letters and numbers.
- 3.Password should contain special characters.
- 4.Minimum length of the password (the default value is 8).
- 5.On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying Successful Login or else display a toast message saying Login Failed. The user is given only two attempts and after that display a toast message saying Failed Login Attempts and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.

4

4 Hours

EXPERIMENT 4

Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name.

5

4 Hours

EXPERIMENT 5

Create an activity like a phone dialler with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.

6

4 Hours

EXPERIMENT 6

Implement UI elements like TextFields, Label, Toolbar, Statusbar, Tabbar.

7

4 Hours

EXPERIMENT 7

Implement the Hello World App using Flutter.

Total: 60 Hours

Reference(s)

1. Lauren Darcey and Shane Conder, Android Wireless Application Development, Pearson Education, 2nd ed. (2011)
2. Reto Meier, Professional Android 2 Application Development, Wiley India Pvt Ltd.
3. Mark L Murphy, Beginning Android, Wiley India Pvt Ltd.
4. Android Application Development All in one for Dummies by Barry Burd.
5. Alberto Miola, Flutter Complete Reference: Create beautiful, fast and native apps for any device.
6. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, Beginning iOS Development: Exploring the iOS SDK, Apress, 2013.

22IS023 SOFTWARE TESTING AND AUTOMATION**3 0 0 3****Course Objectives**

- Understand the importance of software testing in the software development process.
- Analyze different testing methodologies and techniques to create test plans, test cases, and test scripts.
- Apply automation testing tools and frameworks to design and implement automated test suites.

Course Outcomes (COs)

1. Understand the importance of testing in the software development process.
2. Compare the different test case design strategies.
3. Analyze the different levels of testing and their importance.
4. Apply test management techniques and the role of a test specialist.
5. Analyze the software test automation and its requirements.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	3	2	1		1									
2	2	3	2		2									
3	2	2	2		2									
4	2	3	2		3									
5	3	2	1		3									

UNIT I**9 Hours****INTRODUCTION**

Basic definitions-Software Testing Principles-The Testers Role in a Software Development Organization-Origins of Defects-Cost of Defects-Defect Classes-The Defect Repository and Test Design-Defect Examples-Developer or Tester Support of Developing a Defect Repository.

UNIT II**9 Hours****TEST CASE DESIGN STRATEGIES**

Test Scenarios-Test Cases-Test case Design Strategies-Black Box Approach to Test Case Design-Using White Box Approach to Test design-Test Adequacy Criteria-Static testing vs. Structural testing-Code functional testing-Coverage and Control Flow Graphs-Covering Code Logic-Paths-Code complexity testing-Additional White box testing approaches-Test Coverage.

UNIT III**9 Hours****LEVELS OF TESTING**

Types of testing-manual and automation-Introduction to testing methods-White-box, Black-box and Grey-box-Functional testing-Non-functional testing-Introduction to levels of testing-Unit Testing, Integration Testing, System Testing, User Acceptance Testing - Introduction to types of testing-Regression Testing, Smoke Testing, Database Testing, Usability Testing, Load Testing, Stress Testing, Performance Testing, Compatibility Testing, Security Testing, Internationalization Testing, Localization Testing.

UNIT IV

9 Hours

TEST MANAGEMENT

People and organizational issues in testing-Organization structures for testing teams-testing services-Test Planning-Test Plan Components-Test Plan Attachments-Locating Test Items-test management-test process-Reporting Test Results-Introducing the test specialist-Skills needed by a test specialist-Building a Testing Group-The Structure of Testing Group-The Technical Training Program.

UNIT V

9 Hours

TEST AUTOMATION

Software test automation-Design and Architecture for Automation-Automation testing-Automation Tools-Selenium Web Driver-Create Selenese Commands-TestNG-TestNG Annotations-Jmeter-Assertions in JMeter-Junit.

Total: 45 Hours

Reference(s)

1. Srinivasan Desikan and Gopaldaswamy Ramesh, Software Testing Principles and Practices, Pearson Education, 2006.
2. Ilene Burnstein, Practical Software Testing, Springer International Edition, 2003.
3. Edward Kit, Software Testing in the Real World Improving the Process, Pearson Education, 1995.
4. Boris Beizer, Software Testing Techniques 2nd Edition, Van Nostrand Reinhold, New York, 1990.
5. Aditya P. Mathur, Foundations of Software Testing Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

22IS024 DEVOPS**3 0 0 3****Course Objectives**

- To introduce DevOps terminology, definition & concepts.
- To understand the different Version control tools like Git, Mercurial.
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment.
- To understand Configuration management using Ansible.
- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real-world problems.

Course Outcomes (COs)

1. Understand different actions performed through Version control tools like Git.
2. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
3. Ability to Perform Automated Continuous Deployment.
4. Ability to do configuration management using Ansible.
5. Understand how to leverage Cloud-based DevOps tools using Azure DevOps.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2									
2	3	3	3	3	2									
3	2	2	2	3	2									
4	2	2	2	2	2									
5	2	2	2	2	2									

UNIT I**7 Hours****INTRODUCTION TO DEVOPS**

Devops Essentials-Introduction to AWS, GCP, Azure-Version control systems: Git and GitHub.

UNIT II**10 Hours****COMPILE AND BUILD USING MAVEN**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles-Maven repositories (local, central, global)-Maven plugins-Maven create and build Artifacts-Dependency Management-Installation of Gradle- understanding build using Gradle.

UNIT III**12 Hours****CONTINUOUS INTEGRATION USING JENKINS**

Install & Configure Jenkins-Jenkins Architecture Overview- creating a Jenkins Job-Configuring a Jenkins job-Introduction to Plugins-Adding Plugins to Jenkins-commonly used plugins (Git Plugin,Parameter Plugin-HTML Publisher-Copy Artifact, and Extended choice parameters). Configuring Jenkins to work with Java- Git-and Maven-Creating a Jenkins Build and Jenkins workspace.

UNIT IV

9 Hours

CONFIGURATION MANAGEMENT USING ANSIBLE

Ansible Introduction-Installation-Ansible master or slave configuration-YAML basics-Ansible Modules-Ansible Inventory files- Ansible playbooks-Ansible Roles-and ad-hoc commands in Ansible.

UNIT V

7 Hours

BUILDING DEVOPS PIPELINES USING AZURE

Create GitHub Account, Create Repository-Create Azure Organization-Create a new pipeline-Build a sample code-Modify azure-pipelines-yaml file.

Total: 45 Hours

Reference(s)

1. Roberto Vormittag, A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, Linux for Beginners: An Introduction to the Linux Operating System and Command Line, Kindle Edition, 2014
3. Hands-On Azure DevOps: Cid Implementation For Mobile, Hybrid, And Web Applications Using Azure DevOps And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback-1 January 2020 by Mitesh Soni.
4. Jeff Geerling, Ansible for DevOps: Server and configuration management for humans, First Edition, 2015.
5. David Johnson, Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps, Second Edition, 2016.
6. Mariot Tsitoara, Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer, Second Edition, 2019.

22IS025 EXPLORATORY DATA ANALYSIS**2 0 2 3****Course Objectives**

- To outline an overview of exploratory data analysis.
- To implement data cleaning and preparation techniques.
- To perform descriptive statistics and data visualization techniques to present insights from the data.
- To apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high- dimensional data.

Course Outcomes (COs)

1. Understand the fundamentals of exploratory data analysis.
2. Implement the data cleaning and preparation techniques.
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data.
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns.
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3								2	
2	2	2	2	3	3								3	
3	2	3	2	2	3								3	3
4	2	2	2	2	3								3	3
5	2	2	3	2	1								3	3

UNIT I**6 Hours****EXPLORATORY DATA ANALYSIS**

Overview of Exploratory Data Analysis-importance of EDA-data analysis process: data collection, data cleaning, and data exploration-Introduction to common data types and formats- Introduction to Python-data analysis libraries.

UNIT II**6 Hours****DATA CLEANING AND PREPARATION**

Introduction to data quality issues and common data cleaning techniques-Handling missing data and outliers-Data transformation techniques-Feature engineering and variable creation.

UNIT III**6 Hours****DESCRIPTIVE STATISTICS AND DATA VISUALIZATION**

Descriptive statistics: measures of central tendency, dispersion, and shape-Data visualization principles and best practices-Exploratory data visualization using Matplotlib and Seaborn

UNIT IV

6 Hours

EXPLORATORY DATA ANALYSIS TECHNIQUES

Univariate analysis: exploring single variables-Bivariate analysis: exploring relationships between variables- Multivariate analysis: analyzing relationships among multiple variables- Exploring time series data.

UNIT V

6 Hours

DIMENSIONALITY REDUCTION TECHNIQUES

Introduction to dimensionality reduction-Principal Component Analysis (PCA) and its applications-Distributed Stochastic Neighbor Embedding (t-SNE) for visualization

1

5 Hours

EXPERIMENT 1

Explore the Titanic dataset using descriptive statistics and data visualization.

1. Load the Titanic dataset.
2. Calculate the descriptive statistics for each variable.
3. Create a variety of data visualizations to explore the relationships between variables.
4. Interpret the results of the descriptive statistics and data visualizations.

2

5 Hours

EXPERIMENT 2

Clean and prepare the California housing dataset for analysis.

1. Identify and handle missing data.
2. Identify and remove outliers.
3. Convert categorical variables to numerical variables.
4. Explore the distribution of the data after cleaning and preparing it.

3

5 Hours

EXPERIMENT 3

Perform univariate analysis on the Iris dataset.

1. Calculate the descriptive statistics for each variable.
2. Create a variety of data visualizations to explore the distribution of each variable.
3. Interpret the results of the descriptive statistics and data visualizations.

4

5 Hours

EXPERIMENT 4

Perform bivariate analysis on the Boston housing dataset.

1. Explore the relationship between housing prices and different features of the houses, such as the number of rooms, the lot size, and the crime rate.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the bivariate analysis.

5

5 Hours

EXPERIMENT 5

Perform multivariate analysis on the Wine dataset.

1. Explore the relationships between different features of the wine, such as the color, the acidity, and the alcohol content.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the multivariate analysis.

6

5 Hours

EXPERIMENT 6

Apply dimensionality reduction techniques to the MNIST dataset.

1. Use PCA to reduce the dimensionality of the dataset from 784 dimensions to 2 dimensions.
2. Visualize the reduced data using a scatter plot.
3. Interpret the results of the dimensionality reduction.

Total: 60 Hours

Reference(s)

1. Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking , O''Reilly Media, Inc., 2013. (Unit 1)
2. McKinney, Wes. Python for Data Analysis. O''Reilly Media, Inc., 2022. (Unit 1, 3, 5)
3. Knaflic, Cole Nussbaumer. Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons, 2015. (Unit 2)
4. Kazil, Jacqueline, and Katharine Jarmul. Data wrangling with python: tips and tools to make your life easier. O''Reilly Media, Inc., 2016. (Unit 3)
5. Wickham, Hadley, and Garrett Grolemund. R for data science: import, tidy, transform, visualize,and model data. O''Reilly Media, Inc., 2016. (Unit 4, 5)
6. Matthew O. Ward, Georges Grinstein, Daniel Keim, Interactive Data Visualization: Foundations, Techniques, and Applications, 2nd Edition, CRC press, 2015.

22IS026 RECOMMENDER SYSTEMS**3 0 0 3****Course Objectives**

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

Course Outcomes (COs)

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
4. Implement a simple recommender system.
5. Learn about Evaluating Paradigms of recommender systems and its applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1								-	
2	1	2	1	1	1								2	3
3	2	3	1	1	1								2	3
4	3	2	2	2	1								2	3
5	2	2	1	2	1								3	

UNIT I**9 Hours****INTRODUCTION**

Introduction and basic taxonomy of recommender systems- Traditional and non-personalized-Recommender Systems-Overview of data mining methods for recommender systems-similarity measures-Dimensionality reduction-Singular Value Decomposition (SVD)

UNIT II**9 Hours****CONTENT-BASED RECOMMENDATION SYSTEMS**

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III**9 Hours****COLLABORATIVE FILTERING**

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection)

UNIT IV

9 Hours

ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction-Types of Attacks-Detecting attacks on recommender systems-Individual attack-Group attack-Strategies for robust recommender design-Robust recommendation algorithms.

UNIT V

9 Hours

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms-User Studies-Online and Offline evaluation-Goals of evaluation design-Design Issues-Accuracy metrics-Limitations of Evaluation measures

Total: 45 Hours

Reference(s)

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011)
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

22IS027 BIG DATA ANALYTICS**3 0 0 3****Course Objectives**

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in mapreduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics.

Course Outcomes (COs)

1. Understand the big data and use cases from selected business domains.
2. Understand NoSQL big data management.
3. Utilize map reduce analytics and related tools.
4. Understand the basics of Hadoop.
5. Apply the usage of Hadoop related tools for Big Data Analytics.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	2	1	1		1								3	
2	2	2	3		3								3	
3	1	3	3		3								3	2
4	2	2	2		3								2	
5	2	2	1		3								2	3

UNIT I**9 Hours****UNDERSTANDING BIG DATA**

Introduction to big data-Convergence of key trends- Unstructured data-Industry examples of big data-Web analytics- Big data applications-Big data technologies-Introduction to Hadoop-Open source technologies-Cloud and big data-Mobile business intelligence-Crowd sourcing analytics-Inter and trans firewall analytics.

UNIT II**9 Hours****NOSQL DATA MANAGEMENT**

Introduction to NoSQL-Aggregate data models-Key-value and document data models-Relationships-Graph databases-Schema less databases-Materialized views-Distribution models-Master-slave replication-Consistency-Cassandra-Cassandra data model-Cassandra examples-Cassandra clients

UNIT III**9 Hours****MAP REDUCE APPLICATIONS**

MapReduce workflows-Unit tests with MRUnit-Test data and local tests-Anatomy of MapReduce job run-Classic Map-reduce-YARN-Failures in classic Map-reduce and YARN-Job scheduling-Shuffle and sort-Task execution-MapReduce types-Input formats-Output formats.

UNIT IV

9 Hours

BASICS OF HADOOP

Data format-Analyzing data with Hadoop-Scaling out-Hadoop streaming-Hadoop pipes-Design of Hadoop distributed file system (HDFS)-HDFS concepts-Java interface-Data flow-Hadoop I/O-Data integrity-Compression-Serialization-Avro-File-based data structures-Cassandra-Hadoop integration.

UNIT V

9 Hours

HADOOP RELATED TOOLS

Hbase-Data model and implementations-Hbase clients-Hbase examples-Praxis-Pig-Grunt-Pig data model-Pig Latin-Developing and testing Pig Latin scripts-Hive-Data types and file formats-HiveQL data definition-HiveQL data manipulation-HiveQL queries.

Total: 45 Hours

Reference(s)

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley,2013.
2. Eric Sammer, Hadoop Operations, O'Reilly, 2012.
3. Sadalage, Pramod J. NoSQL distilled, 2013
4. E. Capriolo, D. Wampler, and J. Rutherglen, Programming Hive, O'Reilly, 2012.
5. Lars George, HBase: The Definitive Guide, O'Reilly, 2011.
6. Eben Hewitt, Cassandra: The Definitive Guide, O'Reilly, 2010.

22IS028 NEURAL NETWORKS AND DEEP LEARNING

2023

Course Objectives

- To understand the major concepts in deep neural networks.
- To apply Convolutional Neural Network architectures for any real-life applications
- To analyze the key computations underlying deep learning to build and train deep neural networks for various tasks.

Course Outcomes (COs)

1. Apply Convolution Neural Network for any suitable applications.
2. Analyze the various categories of associative memory and unsupervised learning networks.
3. Apply Convolutional Neural Networks and its variants for any suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
5. Apply autoencoders and generative models for suitable applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1									-
2	2	2	2		3									-
3	1	3	3		3									-
4	2	2	2		3									-
5	2	2	1		3									-

UNIT I

6 Hours

UNDERSTANDING NEURAL NETWORKS

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction

Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT II

6 Hours

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative

Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III **6 Hours**

THIRD-GENERATION NEURAL NETWORKS

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation-Motivation-Pooling-Variants of the basic Convolution Function- Structured Outputs-Data Types-Efficient Convolution Algorithms-Neuroscientific Basis-Applications: Computer Vision,Image Generation,Image Compression.

UNIT IV **6 Hours**

DEEP FEEDFORWARD NETWORKS

History of Deep Learning-A Probabilistic Theory of Deep Learning-Gradient Learning-Chain Rule and Backpropagation-Regularization: Dataset Augmentation-Noise Robustness-Early Stopping,Bagging and Dropout-batch normalization-VC Dimension and Neural Nets.

UNIT V **6 Hours**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks: Introduction-Recursive Neural Networks-Bidirectional RNNs-Deep Recurrent Networks-Applications: Image Generation, Image Compression, Natural Language Processing-Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders.

1 **3 Hours**

EXPERIMENT 1

Implement simple vector addition in TensorFlow.

2 **3 Hours**

EXPERIMENT 2

Implement a regression model in Keras.

3 **3 Hours**

EXPERIMENT 3

Implement a perceptron in TensorFlow/Keras Environment.

4 **3 Hours**

EXPERIMENT 4

Implement a Feed-Forward Network in TensorFlow/Keras.

5 **3 Hours**

EXPERIMENT 5

Implement an Image Classifier using CNN in TensorFlow/Keras.

6 **3 Hours**

EXPERIMENT 6

Improve the Deep learning model by fine tuning hyperparameters.

7 **3 Hours**

EXPERIMENT 7

Implement a Transfer Learning concept in Image Classification.

8 **3 Hours**

EXPERIMENT 8

Using a pre trained model on Keras for Transfer Learning

9 **3 Hours**

EXPERIMENT 9

Perform Sentiment Analysis using RNN

10 **3 Hours**

EXPERIMENT 10

Implement an LSTM based Autoencoder in TensorFlow/Keras.

Total: 60 Hours

Reference(s)

1. S Rajasekaran, G A Vijayalakshmi Pai, Neural Networks, FuzzyLogic and Genetic Algorithm,Synthesis and applications, PHI Learning, 2017
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer International Publishing, 1st Edition, 2018.
3. James A Freeman, David M S Kapura,Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
5. Francois Chollet, Deep Learning with Python, Second Edition, Manning Publications, 2021.
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

22IS029 NATURAL LANGUAGE PROCESSING**3 0 0 3****Course Objectives**

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

Course Outcomes (COs)

1. Understand basics of linguistics, probability and statistics associated with NLP
2. Implement a Part-of-Speech Tagger
3. Design and implement a sequence labeling problem for a given domain
4. Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP
5. Implement a simple chatbot using dialogue system concepts

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	2
3	1	3	3		3								2	3
4	2	2	2		3								2	3
5	2	2	1		3								2	3

UNIT I**9 Hours****INTRODUCTION**

Natural Language Processing-Components-Basics of Linguistics and Probability and Statistics-Words-Tokenization-Morphology-Finite State Automata.

UNIT II**9 Hours****STATISTICAL NLP AND SEQUENCE LABELING**

N-grams and Language models-Smoothing-Text classification- Bayes classifier-Evaluation-Vector Semantics-TF-IDF-Word2Vec-Evaluating Vector Models-Sequence Labeling-Part of Speech-Part of Speech Tagging-Named Entities-Named Entity Tagging.

UNIT III**9 Hours****CONTEXTUAL EMBEDDING**

Constituency-Context Free Grammar-Lexicalized Grammars-CKY Parsing-Earley's algorithm Evaluating Parsers-Partial Parsing- Dependency Relations-Dependency Parsing-Transition Based-Graph Based.

UNIT IV **9 Hours**

COMPUTATIONAL SEMANTICS

Word Senses and WordNet-Word Sense Disambiguation-Semantic Role Labeling-Proposition Bank-FrameNet-Selectional Restrictions-Information Extraction-Template Filling.

UNIT V **9 Hours**

DISCOURSE ANALYSIS AND SPEECH PROCESSING

Discourse Coherence-Discourse Structure Parsing-Centering and Entity Based Coherence-Question Answering-Factoid Question Answering-Classical QA Models-Chatbots and Dialogue systems-Frame based Dialogue Systems-Dialogue State Architecture.

Total: 45 Hours

Reference(s)

1. Daniel Jurafsky and James H.Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (Prentice Hall Series in Artificial Intelligence), 2020.
2. Jacob Eisenstein. Natural Language Processing, MIT Press, 2019.
3. Samuel Burns Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.
4. Christopher Manning,Foundations of Statistical Natural Language Processing, MIT Press,2009.
5. Nitin Indurkha,Fred J. Damerau,Handbook of Natural Language Processing, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010.

22IS030 COMPUTER VISION**3 0 0 3****Course 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

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in image processing and computer vision.
2. Implement basic and some advanced image processing techniques in OpenCV.
3. Apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To apply 3D image reconstruction techniques.
5. To design and develop innovative image processing and computer vision applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		1		2	1	3	2	2	3
3	3	3	2	2	3				1	1	2	2	2	2
4	2	3	3	2	3				2	1	2	3	2	2
5	2	3	3	2	2	2			2	1	2	3	2	3

UNIT I**9 Hours****INTRODUCTION TO IMAGE FORMATION AND PROCESSING**

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**9 Hours****FEATURE DETECTION, MATCHING AND SEGMENTATION**

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**9 Hours****FEATURE-BASED ALIGNMENT**

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

9 Hours

3D RECONSTRUCTION

Shape from X-Active range finding-Surface representations-Point-based representations
Volumetric representations-Model-based reconstruction-Recovering texture maps and
albedos.

UNIT V

9 Hours

IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images-Light fields and Lumigraphs-Environment mattes-
Video-based Rendering-Object detection-Face recognition-Instance recognition-Category
recognition-Context and scene understanding-Recognition databases and test sets.

Total: 45 Hours

Reference(s)

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

22IS031 MULTIMEDIA DATA COMPRESSION**3 0 0 3****Course Objectives**

- Acquire knowledge of the basics of compression techniques.
- Understand the categories of compression for Data.
- Explore the modalities of image and video compression algorithms.
- Understand the basics of consistency of data availability in storage devices.

Course Outcomes (COs)

1. Describe the importance of multimedia compression and compare the various compression algorithms.
2. Illustrate the applications of various Data compressions techniques
3. Compare various compression algorithms for Image and Video compression.
4. Analyze the various audio compression techniques.
5. Design and develop multimedia application in various domains.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		1			1					1	1	2	
2	2		3			3					2	2	2	3
3	2		2			3					2	2	1	
4	2		2			3					3	3	3	
5	2		3			3					3	3		3

UNIT I**9 Hours****INTRODUCTION TO MULTIMEDIA COMPRESSION**

Multimedia-Special features of multimedia-Graphics, Image and Video representations-Fundamental concepts of video, digital audio-Need for compression-Taxonomy of compression Algorithms-Error Free Compression-Lossy Compression.

UNIT II**9 Hours****DATA COMPRESSION**

Introduction-Lossless and Lossy Compression-Basics of Huffmann coding-Arithmetic coding-Dictionary techniques-Context based compression-Applications

UNIT III**9 Hours****IMAGE AND VIDEO COMPRESSION**

Image Compression:Lossless Image compression-JPEG-CALIC-JPEG LS-Prediction using conditional averages-Progressive Image Transmission-Lossless Image compression formats-Applications-Facsimile encoding. Video Compression:Introduction-Motion Compensation-Video Signal Representation-H.261-MPEG-1-MPEG-2-H.263.

UNIT IV

9 Hours

AUDIO COMPRESSION

Audio compression-DPCM-Adaptive PCM-adaptive predictive coding-linear Predictive coding code excited LPC-Perpetual coding. Audio compression Techniques-m^{1/4} Law and A Law companding-Speech compression-Frequency domain and filtering-Basic sub band coding-Application to speech coding-G.722-Application to audio coding-MPEG audio.

UNIT V

9 Hours

MULTIMEDIA COMMUNICATION

Tele Services-Implementation of Conversational Services, Messaging Services, Retrieval Services, Tele Action Services, Tele Operation Services-Media Consumption-Media Entertainment- Virtual Reality-Interactive Audio-Interactive Video-Games.

Total: 45 Hours

Reference(s)

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008.
3. David Salomon, A concise introduction to data compression, 2008.
4. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019.
5. Ralf Steinmetz, Klara Nahrstedt, Multimedia computing, communications, and applications, Pearson India, 2009.
6. Ranjan Parekh, Principles of Multimedia, Second Edition, McGraw Hill Education, 2017.

22IS032 STREAMING MEDIA TOOLS AND TECHNOLOGIES

2023

Course Objectives

- Understand the basics of Audio and Video Streaming
- Understand the basics of Streaming media
- Familiar with Streaming Technologies and tools

Course Outcomes (COs)

1. Understand the basics of Audio and Video Streaming
2. Develop Streaming media Applications
3. Implement applications using streaming technologies.
4. Demonstrate the use of streaming stages and tools
5. Analyze streaming services

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1							1	1	
2	3	2	1	1	1							1	2	3
3	3	2	2	1	2							1	2	3
4	3	2	2	1	2							1		
5	3	3	1	2	2							1	2	

UNIT I

6 Hours

BASICS OF AUDIO AND VIDEO STREAMING

Introduction-IP Networks-World Wide Web-Video formats-Video compression-Audio compression

UNIT II

6 Hours

BASICS OF STREAMING MEDIA

Introduction to streaming media-Video streaming-Audio Streaming-Stream serving-Live webcasting-Media Players

UNIT III

6 Hours

STREAMING TECHNOLOGIES AND APPLICATIONS

Associated Technologies and Applications-Rights Management-Content Distribution-Applications of Streaming Media

UNIT IV

6 Hours

STREAMING STAGES AND TOOLS

Broadcasting Area-setting up your home studio-Preparing stage -starting your first-video broadcast-Top live streaming third party apps:vMix v.2x-OBS studio-FFSPLIT-VidBalsterX-Xsplit-ManyCam-Wirecast v.7 studio

UNIT V **6 Hours**

STREAMING SERVICES

Software as a Service websites-Top 7 live streaming websites: Light stream-Smiletime-BlueJeans-BeLive Tv-Vidpresso Live-Zoom w webinar addon-Crowdcast

1 **4 Hours**

EXPERIMENT 1

Use any popular open source tool like HandBrake to compress, modify format and other attributes of audio and video.

2 **4 Hours**

EXPERIMENT 2

Set up a DLNA service for streaming media from windows 10

3 **4 Hours**

EXPERIMENT 3

Implement media casting using Google Cast SDK on TV like device

4 **4 Hours**

EXPERIMENT 4

Setup streaming media servers using open sources tools like kodi, Stremio etc.,

5 **4 Hours**

EXPERIMENT 5

Use any Screen Capture software tools like OBS studio, FFsplit etc., to create live video streaming and broadcasting.

6 **5 Hours**

EXPERIMENT 6

Create simple live webcast

7 **5 Hours**

EXPERIMENT 7

Create an example tutorial content by combing the tutor with screen capture using any of the tools and make them available for streaming

Total: 60 Hours

Reference(s)

1. David Austerberry, The Technology of Audio and Video Streaming, Second Edition, Taylor and Francis 2013
2. Lenald Best, Bests Guide to Live Stream Video Broadcasting, BCB Live Teaching series,2017.
3. Helen M Heneveld Audio, Video and Streaming Media Technologies, Smart Home and office technologies, 2018.

4. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor & Francis, 2019
5. Tay Vaughan, Multimedia: Making it Work, McGraw Hill Education, Ninth Edition, 2017.
6. Lenald Best, Bests Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.

22IS033 METAVERSE**2023****Course Objectives**

- Understand the History of Metaverse.
- Explore the role of Metaverse to connect the real world and blockchain.
- Understand the advanced development of blockchain in the future.
- Study an open ecosystem of smart properties and assets.
- Explore the integration of futuristic technologies such as blockchain, crypto currency, DAO, AR/VR

Course Outcomes (COs)

1. Understand the History of Metaverse.
2. Summarize the technologies involved in metaverse.
3. Illustrate the adoption of blockchain by metaverse.
4. Implement the applications of AR,VR and MR in metaverse.
5. Analyze some use cases of metaverse.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	3	3	3	3	2							1		
2	3	3	3	3	2							2		
3	3	3	3	3	2							2	2	
4	3	3	3	3	2							3	2	3
5	3	3	3	3	2							3	2	

UNIT I**6 Hours****INTRODUCTION TO METAVERSE**

Introduction to metaverse and immersive experience-History of metaverse-Metaverse value chain with 7 layer.

UNIT II**6 Hours****TECHNOLOGIES INVOLVED IN THE METAVERSE**

Metaverse as a product of Extended Reality-Augmented Reality (AR)- Virtual Reality (VR)- Benefits of AR/VR-Difference between AR/ VR-Mixed Reality (MR)-Artificial Intelligence (AI)- Introduction in Metaverse-Financial and Economics of Metaverse-Benefits of Metaverse.

UNIT III**6 Hours****BLOCKCHAIN ADOPTION IN METAVERSE**

Blockchain Overview-History of Blockchain-Need of Decentralization in MV-Smart Contract Capabilities in Blockchain-Blockchain in Metaverse-Understanding Tokens-Understanding the NFT-NFT Token Standards-NFTs in MV-Cryptocurrency in MV.

UNIT IV **6 Hours**

AR, VR, AND MR IN METAVERSE

Everything about VR (Virtual Reality)-Everything about AR (Augmented Reality)- Everything about MR (Mixed Reality)-Block chain Identity Management in Metaverse-NFT (non-fungible token) for Metaverse-Introduction to NFTs-History of NFTs-Benefits of NFTs.

UNIT V **6 Hours**

USE-CASES

Gaming in Metaverse-Meetings in Metaverse-Virtual Learning in Metaverse-Social Interactions in Metaverse-Virtual Real-estate in Metaverse-e-commerce in Metaverse-Travel in Metaverse-Personalized Avatars-Digital Identity in Metaverse.

1 **6 Hours**

EXPERIMENT 1

Installations:

Hardware Required: Android phone, Cardboard Viewer, PC with Dedicated Graphics Card and atleast 32GB RAM.

Software required: Android Studio, Cardboard SDK, Android NDK, Google Carboard XR plugin for Unity, Unity, Nethereum library to (as needed)

2 **6 Hours**

EXPERIMENT 2

Using Google Cardboard SDK for Creating simple AR/VR (XR) applications in Unity

3 **6 Hours**

EXPERIMENT 3

Creating blockchain applications in metaverse, by creating virtual assets, smart Contracts for exchange of assets using utility tokens and NFTs.

4 **6 Hours**

EXPERIMENT 4

Create any Metaverse based application for an educational institution.

5 **6 Hours**

EXPERIMENT 5

Create any Metaverse based application for a healthcare application.

Total: 60 Hours

Reference(s)

1. The Metaverse: And How It Will Revolutionize Everything Kindle Edition by Matthew Ball , Publisher : Liveright ,2022
2. The Metaverse Handbook: Innovating for the Internets Next Tectonic Shift Kindle Edition by QuHarrison Terry (Author), Scott Keeney (Author), Paris Hilton (Foreword), Publisher: Wiley; 1st edition ,2022
3. Metaverse Made Easy: A Beginners Guide to the Metaverse, Dr.Liew Voon Kiong,Publisher, Liew Voon Kiong, 2022

4. Metaverse For Beginners and Advanced: A Complete Journey Into the Metaverse Virtual World (Web 3.0), Darell Freeman, Publisher Darell Freeman, 2022
5. Metaverse Glossary - Your Gateway to the Future , Ravindra Dastikop, Evincepublishing, 2022
6. The Metaverse: Prepare Now for the Next Big Thing Paperback, Terry Winters, Winters media Publication 2021

22IS034 IMAGE AND VIDEO ANALYTICS**3 0 0 3****Course Objectives**

- Understand the basics of image processing techniques for computer vision.
- Learn the techniques used for image pre-processing.
- Discuss the various object detection techniques.
- Understand the various Object recognition mechanisms.
- Elaborate on the video analytics techniques.

Course Outcomes (COs)

1. Interpret the importance of multimedia compression and compare the various compression algorithms.
2. Illustrate the applications of various Data compressions techniques
3. Compare various compression algorithms for Image and Video compression.
4. Analyze the Multimedia storage on disks.
5. Examine multimedia application in various domains.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		1			1					1	1	2	
2	2		3			3					2	2	2	
3	2		2			3					2	2	2	
4	2		2			3					3	3	3	
5	2		3			3					3	3	2	

UNIT I**9 Hours****INTRODUCTION**

Basic concepts-Image functions and types-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**9 Hours****IMAGE PRE-PROCESSING**

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-Image restoration.

UNIT III **9 Hours**

OBJECT DETECTION USING MACHINE LEARNING

Object localization-Object detection-Object detection methods -Deep Learning framework for Object detection-bounding box approach-Intersection over Union (IoU)-Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

UNIT IV **9 Hours**

FACE RECOGNITION AND GESTURE RECOGNITION

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-Deep Face solution by Facebook-FaceNet for Face Recognition-Implementation using FaceNet-Gesture Recognition.

UNIT V **9 Hours**

VIDEO ANALYTICS

Video Processing-use cases of video analytics-Vanishing Gradient and exploding gradient problem-ResNet architecture-ResNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-Implementation using ResNet and Inception v3.

Total: 45 Hours

Reference(s)

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision, 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer Verlag London Limited,2011.
4. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, Video Analytics for Business Intelligence, Springer, 2012.
5. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education, 2003.
6. E. R. Davies, (2012), Computer & Machine Vision, Fourth Edition, Academic Press.

22IS035 WEARABLE DEVICES APPLICATIONS**3 0 0 3****Course Objectives**

- Understand the basics of Wearable Computing, Wearable Devices and Technologies.
- Explore about basics of Security Challenges.
- Understand the concepts of Applications of wearables in Health Care.
- Acquire knowledge about the advanced applications of Wearable Computing.

Course Outcomes (COs)

1. Understand the basics of Wearable Computing
2. Explain the various devices and technologies of Wearable computing
3. Analyze the challenges of Security issues in Wearable computing
4. Discuss the applications of Wearable computing in health sector
5. Discover the advanced trends in wearable computing

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	3		1			1					1	1		
2	2		3			3					2	2	2	
3	2		2			3					2	2	3	
4	2		2			3					3	3	1	2
5	2		3			3					3	3	2	1

UNIT I**9 Hours****WEARABLE COMPUTING**

Introduction to Wearable Computers-Design Considerations-Wearable Interactions-Design Guidelines and Evaluation-Future Trends in Wearable Computing-Benefits

UNIT II**9 Hours****WEARABLE DEVICES AND TECHNOLOGIES**

Health and Fitness Wearables-The Promise and Perils of Wearable Technologies-Confidential Data Storage system for wearable platforms-Management and Security issues in Wearable platforms.

UNIT III**9 Hours****SECURITY CHALLENGES**

Authenticity Challenges of Wearable Technologies-Wearable Computing: Security Challenges, BYOD, Privacy, and Legal Aspects-Security, Privacy, and Ownership Issues With the Use of Wearable Health Technologies-Wearable Devices: Ethical Challenges and Solutions.

UNIT IV

9 Hours

HEALTH CARE APPLICATION

IoT for Ambient Assisted Living: Care4Me-A Healthcare Support System-Study of Real-Time Cardiac Monitoring System: A Comprehensive Survey-Co-Designing Wearable Technology Together with Visually Impaired Children

UNIT V

9 Hours

ADVANCED APPLICATIONS

Securing the Human Cloud: Applying Biometrics to Wearable Technology-Context-Aware Mobile and Wearable Device Interfaces -An Overview of Telemedicine Technologies for Healthcare Applications-Internet of Things in E-Health: An Application of Wearables in Prevention and WellBeing-Wearable ECG Monitoring and Alerting System Associated With Smartphone

Total: 45 Hours

Reference(s)

1. Vivian Genaro Motti, Wearable Interaction, Springer Nature, 2020.
2. Marc L. Resnick (Bentley University, USA) and Alina M. Chircu, Wearable Devices: Ethical Challenges and Solutions, IGI Global Publisher 2018.
3. Edward Sazonov and Michael R. Neuman (Editors), Wearable Sensors Fundamentals, Implementation and Applications, Elsevier, 2015.
4. Wearable Applications Research, devices and Interactions, Internet of Medical Things Paradigm of Wearable Devices, 1st Edition, 2021 by CRC Press.
5. Wearable Technologies: Concepts, Methodologies, Tools, and Applications (Critical Explorations) 1st Edition, 2018
6. Information Resources Management Association (Author, Editor), Wearable Technologies: Concepts, Methodologies, Tools, and Applications (Critical Explorations) 1st Edition, 2018.

22IS036 3D PRINTING AND DESIGN**3 0 0 3****Course Objectives**

- Learn the basics of 3D printing.
- Explain the principles of 3D printing technique.
- Illustrate the inkjet technology and laser technology.
- Analyze the applications of 3D printing.

Course Outcomes (COs)

1. Understand the basic concepts of 3D printing technology.
2. Outline the processes and materials used in 3D printing.
3. Explain the concepts and working principles of 3D printing using inkjet technique.
4. Explain the working principles of 3D printing using laser technique.
5. Analyze the various methods for designing and modeling for industrial applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		1			1					1	1		
2	2		3			3					2	2		
3	2		2			3					2	2		
4	2		2			3					3	3		
5	2		3			3					3	3		

UNIT I**9 Hours****INTRODUCTION**

Introduction; Design considerations-Material, Size, Resolution, Process; Modelling and viewing-3D; Scanning; Model preparation-Digital; Slicing; Software; File formats

UNIT II**9 Hours****PRINCIPLE**

Processes-Extrusion, Wire, Granular, Lamination, Photo polymerisation; Materials-Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection-Processes, applications, limitations;

UNIT III**9 Hours****INKJET TECHNOLOGY**

Printer-Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations-Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication-Continuous jet, Multijet; Powder based fabrication -Colourjet-Applications to manufacturing.

UNIT IV

9 Hours

LASER TECHNOLOGY

Light Sources-Types, Characteristics; Optics-Deflection, Modulation; Material feeding and flow-Liquid, powder; Printing machines-Types, Working Principle, Build Platform, Print bed Movement, Support structures-Applications.

UNIT V

9 Hours

INDUSTRIAL APPLICATIONS

Securing the Human Cloud: Applying Biometrics to Wearable Technology-Context-Aware Mobile and Product Models, manufacturing-Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends;-cloud based additive manufacturing-Research-Agile tooling.

Total: 45 Hours

Reference(s)

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.
3. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
4. Joan Horvath, Mastering 3D Printing, APress, 2014

22IS037 OPEN SOURCE SOFTWARE**3 0 0 3****Course Objectives**

- Introduce open source technology for development of web applications.
- Understand open source scripting language for programming in web environment i.e. PHP.
- Familiar with the open source management system and connection with database.
- Learn open source web server, software tools.

Course Outcomes (COs)

1. Analyze the need of open source technology, open source development model, application of open sources, aspects of open source movement.
2. Apply the basic syntax of PHP, common PHP scripts elements.
3. Implement open source database management system - MySQL.
4. Demonstrate the creation of the server side scripting using PHP, implement PHP database connectivity, perform operation on database and open source database management system.
5. Analyze the software tool and process like Eclipse IDE, Selenium ID and open source web servers.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2					2							
2		2					3							
3		2					3						2	3
4		2					2						3	3
5		2					2							

UNIT I**9 Hours****INTRODUCTION**

The need of open Sources, advantages of Open sources application , Open Source Development Model Licences and Patents ,FOSS, BSD, Free Software Movement, commercial software vs. Open Source software, Commercial aspects of Open Source movement-Certification courses issues-global and Indian. Copyrights and copy lefts, Application of Open Sources. Problems with traditional commercial software

UNIT II**9 Hours****OPEN SOURCE SCRIPTING LANGUAGE**

Introduction: What is PHP?-Basic Syntax of PHP-programming in web environment-Common PHP Script Elements-Using Variables-Constants-Data types-Operators; Statements-Working With Arrays -Using Functions-OOP-String Manipulation and Regular Expression , File and Directory Handling , Working With Forms , Introduction to advanced PHP concepts

UNIT III

9 Hours

OPEN SOURCE DATABASE MANAGEMENT SYSTEM

MySQL: Introduction-Setting up an account-Starting, Terminating and writing your own MySQL Programs-Record Selection Technology-Working with Strings-Date and Time- Sorting Query Results module-Generating Summary-Working with Metadata-Using Sequences-MySQL and Web.

UNIT IV

9 Hours

PHP AND SQL DATABASE

PHP and LDAP ; PHP Connectivity ; Sending and receiving emails , PHP Database Connectivity: Retrieving data from MySQL - Manipulating data in MySQL using PHP

UNIT V

9 Hours

WEB SERVER AND OPEN SOURCE TOOLS

Apache Web server-Working with web server-Configuring and using apache web server, WAMP server, Lighttpd, Fford, Nginx, Savant, tornado. Open Source Software tools and Processors: Introduction-Eclipse IDE Platform-Compilers-Model driven architecture tools-Selenium ID-Features and uses Government Policy toward Open Source (E- Governance)-Wikipedia as an open Source Project Case Studies: Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC, Open Office.

Total: 45 Hours

Reference(s)

1. The Linux Kernel Book Rem Card, Eric Dumas and Frank Mevel Wiley Publications sons, 2003
2. MySQL Bible Steve Suchring John Wiley sons, 2002
3. Programming PHP Rasmus Lerdorf and Levin Tatroe O'Reilly Publications, 2002

22IS038 OPEN STACK ESSENTIALS**3 0 0 3****Course Objectives**

- Familiarize students with the practical aspects of IaaS (Infrastructure as a Service) cloud computing model.
- Familiarize students with the installation and configuration procedure of compute, storage and networking components of openstack platform for establishing enterprise private cloud.

Course Outcomes (COs)

1. Explain Openstack Architecture and list the components in it.
2. Interpret Identity Management and the role of image management using web interface.
3. Summarize network management in neutron.
4. Implement the block storage to the instance using Dashboard.
5. Exemplify the architecture of swift and its role in object storage.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2	2											3
2		2	2	2										3
3		3	3	3										3
4		2	2	2										2
5		2	2	3										2

UNIT I**9 Hours****ARCHITECTURE AND COMPONENT OVERVIEW**

OpenStack Architecture-DashBoard-Keystone-Glance-Neutron - Nova - Cinder - swift - ceilometer - Heat-Summary.

UNIT II**9 Hours****IDENTITY MANAGEMENT**

RDO Installation: Installing RDO using packstack-Identity Management:Services and End Points-Hierarchy of User,tenants and roles-creating a user-creating a tenant-Granting a role-Interacting with keystone in dashboard-End Points in the dashboard-Image Management: Glance as a registry of images- using the web interface-Building an image

UNIT III**9 Hours****NETWORK MANAGEMENT**

Networking and Neutron - Open VSwitch Configuration - Creating a network - Web Interface Management - External Network Access - Web Interface External Network Setup

UNIT IV

9 Hours

INSTANCE MANAGEMENT AND BLOCK STORAGE

Instance Management: Managing Flavors-Managing Key Pairs- Launching an Instance-Managing Floating IP address-Managing Security groups-Communicating with Instances-Launching an Instances using Web Interface-Creating and Using block storage -Attaching the block storage to an Instance-Managing Cinder Volumes in the Web Interface-Backing Storages

UNIT V

9 Hours

OBJECT STORAGE AND TELEMETRY

Object Storage: Architecture of swift cluster-Creating and Using Object Storage-Object File Management in Web Interface- Using Object Storage on an Instance-Ring Files-Telemetry: Understanding Data Store-Ceilometer's Configuration Terms- Graphing the data Tools : Wireshark and Packet tracer.

Total: 45 Hours

Reference(s)

1. Dan Radez, OpenStack Essentials, PackT publishing, 2015
2. Omar Khedhar, "Mastering Openstack", PackT Publishing, 2015
3. docs.openstack.org

22IS039 BIOINFORMATICS ALGORITHMS**3 0 0 3****Course Objectives**

- Adapt basic knowledge on various techniques and areas of applications in bioinformatics.
- Analyze common problem in bioinformatics, alignment techniques, ethical issues, public data sources, and evolutionary modelling.
- Discover the practical use of tools for specific bioinformatic areas.

Course Outcomes (COs)

1. Apply knowledge of bioinformatics in a practical project.
2. Develop the ability for critical assessment of scientific research publications in bioinformatics.
3. Analyze processed data with the support of analytical and visualization tool.
4. Apply the different approaches used for data integration and data management, including data warehouse and wrapper approaches.
5. Compare the databases, tools, repositories and be able to use each one to extract specific information.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2				1					1	
2	1	3	2	2				1					2	
3	1	2	2	2	3			1					2	3
4	1	2	2	2				1					2	3
5	1	2	2	2	2			1					2	

UNIT I**9 Hours****INTRODUCTION TO BIOINFORMATICS**

Need for Bioinformatics technologies-Overview of Bioinformatics technologies Structural bioinformatics-Data format and processing-Secondary resources and applications- Role of Structural bioinformatics-Biological Data Integration System-Biological Data Acquisition: Retrieval methods for DNA sequence, protein sequence and protein structure information

UNIT II**9 Hours****DATABASES**

Introduction to Bioinformatics and Computational Biology, Introduction to Operating systems, Linux commands, File transfer protocols ftp and telnet, Biological sequences, Biological databases, Genome specific databases, Data file formats, Data life cycle, Database management system models, Kernel Recompile, Basics of Structured Query Language (SQL).

UNIT III

9 Hours

DATA PROCESSING

Data-Access, Retrieval and Submission: Standard search engines; Data retrieval tools-Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local versus global, Distance metrics, Similarity and homology, Scoring matrices.

UNIT IV

9 Hours

SCORING MATRICES AND DATABASE SEARCH METHODS

Pairwise sequence alignment: Global alignment, Local alignment, Scoring functions, concepts behind General gap, affine gap penalty and amino acid substitution matrices (PAM, BLOSUM, GONNET), Statistical significance. BLAST: Algorithm, types, Blast output and applications. FASTA, Difference between BLAST & FASTA, Rings and Protection Rings.

UNIT V

9 Hours

APPLICATIONS FOR BIOINFORMATICS

Perl Basics, Perl applications for bioinformatics- Bioperl, Linux Operating System, mounting/unmounting files, tar, gzip / gunzip, telnet, ftp, developing applications on Linux OS, Understanding and Using Biological Databases, Overview of Java, CORBA, XML, Web deployment concepts.

Total: 45 Hours

Reference(s)

1. Bioinformatics: Sequence and Genome Analysis David W. Mount, David Mount
2. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press
3. Fundamental concepts of Bioinformatics-D E Krane and M L Raymer, Pearson Education.
4. Bioinformatics: with fundamentals of genomics and proteomics -Shubha Gopal, et.al., Mc Graw Hill.
5. Mount, D.W, Bioinformatics Sequence and Genome Analysis, 2nd Edition, Cold Spring Harbor Laboratory Press, 2004.
6. Introduction to Bioinformatics by V. Kothekar, 1 st Edition, (2006), Dhruv Publications, Delhi.

22IS040 FAULT TOLERANT COMPUTING**3 0 0 3****Course Objectives**

- To understand reliability engineering in a system perspective.
- To determine the type of redundancy either in the form of hardware or software module and the optimum number of redundant units.
- To understand the fault detection and activation technique of the necessary standby units in the repairable system in a quantitative manner

Course Outcomes (COs)

1. Interpret the fundamental concepts of fault-tolerance and discuss the appropriate hardware detection and recovery techniques for a given environment
2. Discuss the Information Redundancy and Fault Tolerant Networks in terms of Network Topologies and their Resilience and Routing.
3. Develop skills in modeling and evaluating fault-tolerant architectures in terms of reliability, availability and safety
4. Analyses the merits and limitations of fault-tolerant design
5. Describe the fault injection attacks and detect the injected faults in an attempt to foil the attacks.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2		2	2								3	
2		2		2	2								3	
3		2		2	2								2	3
4		2		2	2								1	
5		2		2	2								2	

UNIT I**10 Hours****HARDWARE FAULT TOLERANCE**

Preliminaries - Fault classification-Types of Redundancy; Basic measures of Fault Tolerance-Hardware Fault Tolerance- The rate of hardware failures-Failure rate, Reliability, and Mean Time to Failure-Canonical and Resilient Structures-Other Reliability Evaluation Techniques-Fault-Tolerance-Processor-Level techniques-Byzantine Failures.

UNIT II**9 Hours****INFORMATION REDUNDANCY AND FAULT-TOLERANT NETWORKS**

Coding-Resilient Disk Systems; Data Replication-Algorithm-Based Fault Tolerance-Measures of Resilience-Common Network Topologies and their Resilience-Fault-Tolerant Routing.

UNIT III **9 Hours**

SOFTWARE FAULT TOLERANCE

Acceptance Tests-Single-Version Fault Tolerance-N-Version Programming-Recovery Block Approach-Preconditions, Postconditions and Assertions-Exception Handling-Software Reliability Models-Fault-Tolerant Remote Procedure Calls

UNIT IV **9 Hours**

CHECKPOINTING

Checkpointing-Checkpoint Level-Optimal Checkpointing-An Analytical Model-Cache-Aided Rollback Error Recovery- Checkpointing in Distributed Systems-Checkpointing in Shared Memory Systems-Checkpointing in Real-Time Systems-Other uses of Checkpointing

UNIT V **8 Hours**

FAULT DETECTION IN CRYPTOGRAPHIC SYSTEMS

Overview of Ciphers-Security Attacks through Fault Injection-Countermeasures-Case Studies:Non-Stop Systems-Stratus Systems -Cassini Command and Data Sub-System; IBM G5-IBM Sysplex-n Itanium

Total: 45 Hours

Reference(s)

1. Israel Koren, C. Mani Krishna: Fault-Tolerant Systems, Elsevier, 2020.
2. Parag K. Lala, : Fault Tolerant and Fault Testable Hardware Design, BS Publications,2011.
3. D. K. Pradhan (Ed): fault Tolerant Computer Systems Design, Prentice Hall, 1996.
4. K. S. Trivedi: Probability, Statistics with Reliability, Queuing and Computer Science Applications, John Wiley, 2002.

22IS041 DIGITAL MARKETING**3 0 0 3****Course Objectives**

- To Provide an Overview of Digital Marketing plans.
- To Provide a Foundation of a Greater market share and Increasing brand awareness.

Course Outcomes (COs)

1. Identify some of the latest digital marketing trends and skills sets needed for today's Marketer.
2. Discover the hottest techniques to help to successfully plan, predict, and manage your digital Marketing campaigns
3. Evaluate the importance of your digital marketing assets, which ones actually matter the most to your business
4. Assess digital marketing as a term career opportunity
5. Understand experiments using A/B testing

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2		2	2									
2		2		2	2									
3		3		3	3									
4		2		2	2									
5		2		2	2									

UNIT I**9 Hours****INTRODUCTION OF DIGITAL MARKETING**

Introduction of Digital Marketing-Planning Digital Marketing Campaigns-Website designing with Word Press-Essentials of a website.

UNIT II**9 Hours****SEARCH ENGINE OPTIMIZATION**

Introduction to Search Engines-Key word Research and Competition-On page Optimization-Off page Optimization-Local SEO-Search Engine Algorithm Updates-SEO Reporting

UNIT III**9 Hours****GOOGLE ADWORDS**

PPC Advertising (Online Advertisement)-Display Advertising- Google Shopping Ads-Introduction to Bing Ads-Mobile Marketing -Video Marketing-Google online Advertisement program- Certification

UNIT IV

9 Hours

SOCIAL MEDIA MARKETING

Introduction to SMM -Facebook Marketing-Facebook Advertising -Twitter Marketing & Ads-YouTube Marketing-LinkedIn Marketing-InstaGram Marketing-Email Marketing-Pinterest Marketing-Online Reputation Management-Inbound Marketing- Google Analytics-Audience Reports-Traffic Reports-Behavior Reports

UNIT V

9 Hours

EXPERIMENTAL TESTING

Conversion Tracking-Personality Development-Google AdSense- Getting Started as Freelancer-Affiliate Marketing

Total: 45 Hours

Reference(s)

1. Shivani Karwal, Digital Marketing Handbook: A Guide to Search Engine Optimization Paperback - Import, 25 Nov 2015.
2. Philip Kotler and Gary Armstrong, Principles of marketing, Pearson education, 2010.
3. Michael Millerth, B2B Digital Marketing: Using the Web to Market Directly to Businesses, first edition, Que Biz-Tech series 2012.
4. Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice, Paperback - Import, 2012.

22IS042 DESIGN THINKING**3 0 0 3****Course Objectives**

- To understand and compare the important of design thinking
- To identify the steps in the design thinking (DT) process

Course Outcomes (COs)

1. Interpret the importance of design thinking and steps in the DT process
2. Analyze empathize phase of design thinking
3. Compare the different perspectives on personas in the define phase
4. Analyze the ideate phase of design thinking
5. Recognize the importance of the prototype and testing phase in DT

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2			2					2	2		
2	2		2			2					2	2		
3	2		2			2					2	2		
4	2		2			2					2	2		
5	2		2			2					2	2		

UNIT I**9 Hours****INTRODUCTION**

Introduction-Importance of Design Thinking (DT)-Design Thinking for business-Design Thinking for an Individual-Steps in the DT process-Empathize -Define-Ideate-Prototype-Test.

UNIT II**9 Hours****EMPATHY PHASE**

Empathy Phase:-Steps in the empathize phase of DT-Empathy- What, How, Why-Different types to developing Empathy towards People-Steps required to conduct an immersion activity-How to empathize. Introduction to Immersion Activity-Conducting an immersion activity-DT question template for Immersion activity.

UNIT III**9 Hours****DEFINE PHASE**

Creating personas-Steps to create personas in the define phase of DT-Creating your own Persona-Four Different Perspectives on Personas-Goal-directed Personas, Role-Based Personas, Engaging Personas, Fictional Personas-Steps to create your Engaging Personas and Scenarios-Steps to create problem statements in the define phase of DT-Problem statements-Defining problem statements-Problem statements in define phase of DT.

UNIT IV

9 Hours

IDEATE PHASE

How to Ideate-Steps in the ideate phase of DT-Applying the steps in the ideate phase of DT-Ideation games-Six Thinking Hats and Million-dollar idea-Ideate to find solution- Characteristics Required for Successful Ideation-Doodling for expressing ideas-Importance of storytelling in presenting ideas and prototypes-Storytelling in DT.

UNIT V

9 Hours

PROTOTYPE AND TESTING PHASE

Importance of the prototype phase in DT-Prototype your idea- Create a prototype-Types of Prototyping Low-Fidelity Prototyping and High-Fidelity Prototyping-Guidelines for Prototyping-Service value proposition-Creating a value proposition statement-Testing in Design Thinking-Test the Prototype-Role of DT in your work-DT for better coding-Agile and DT complement each other to deliver customer Satisfaction -Satori.

Total: 45 Hours

Reference(s)

1. Mauricio Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena and Beatriz Russo, Design Thinking: Business innovation, MJV Press, First Edition, 2014.
2. Mads Soegaard, The Basics of User Experience Design by Interaction Design Foundation, Kindle Edition.
3. Nir Eyal, Hooked: How to Build Habit-Forming Products, Penguin Publishers, Kindle Edition, 2011.
4. Rod Judkins, The Art of Creative Thinking, Hachette Book Publishing, Kindle Edition, 2015.
5. Dan Senior and Saul Singer, Start Up Nation, Twelve Publishers, Kindle Edition, 2011.
6. Simon Sinek, Start with Why, Portfolio Publishers, Kindle Edition, 2011.

22ISH01 EXPLORATORY DATA ANALYSIS**2023****Course Objectives**

- To outline an overview of exploratory data analysis.
- To implement data cleaning and preparation techniques.
- To perform descriptive statistics and data visualization techniques to present insights from the data.
- To apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high- dimensional data.

Course Outcomes (COs)

1. Understand the fundamentals of exploratory data analysis.
2. Implement the data cleaning and preparation techniques.
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data.
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns.
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3								2	
2	2	2	2	3	3								3	
3	2	3	2	2	3								3	3
4	2	2	2	2	3								3	3
5	2	2	3	2	1								3	3

UNIT I**6 Hours****EXPLORATORY DATA ANALYSIS**

Overview of Exploratory Data Analysis-importance of EDA-data analysis process: data collection, data cleaning, and data exploration-Introduction to common data types and formats- Introduction to Python-data analysis libraries.

UNIT II**6 Hours****DATA CLEANING AND PREPARATION**

Introduction to data quality issues and common data cleaning techniques-Handling missing data and outliers-Data transformation techniques-Feature engineering and variable creation.

UNIT III **6 Hours**

DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Descriptive statistics: measures of central tendency, dispersion, and shape-Data visualization principles and best practices-Exploratory data visualization using Matplotlib and Seaborn

UNIT IV **6 Hours**

EXPLORATORY DATA ANALYSIS TECHNIQUES

Univariate analysis: exploring single variables-Bivariate analysis: exploring relationships between variables- Multivariate analysis: analyzing relationships among multiple variables- Exploring time series data.

UNIT V **6 Hours**

DIMENSIONALITY REDUCTION TECHNIQUES

Introduction to dimensionality reduction-Principal Component Analysis (PCA) and its applications-Distributed Stochastic Neighbor Embedding (t-SNE) for visualization

1 **5 Hours**

EXPERIMENT 1

Explore the Titanic dataset using descriptive statistics and data visualization.

1. Load the Titanic dataset.
2. Calculate the descriptive statistics for each variable.
3. Create a variety of data visualizations to explore the relationships between variables.
4. Interpret the results of the descriptive statistics and data visualizations.

2 **5 Hours**

EXPERIMENT 2

Clean and prepare the California housing dataset for analysis.

1. Identify and handle missing data.
2. Identify and remove outliers.
3. Convert categorical variables to numerical variables.
4. Explore the distribution of the data after cleaning and preparing it.

3 **5 Hours**

EXPERIMENT 3

Perform univariate analysis on the Iris dataset.

1. Calculate the descriptive statistics for each variable.
2. Create a variety of data visualizations to explore the distribution of each variable.
3. Interpret the results of the descriptive statistics and data visualizations.

4 **5 Hours**

EXPERIMENT 4

Perform bivariate analysis on the Boston housing dataset.

1. Explore the relationship between housing prices and different features of the houses, such as the number of rooms, the lot size, and the crime rate.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the bivariate analysis.

5

5 Hours

EXPERIMENT 5

Perform multivariate analysis on the Wine dataset.

1. Explore the relationships between different features of the wine, such as the color, the acidity, and the alcohol content.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the multivariate analysis.

6

5 Hours

EXPERIMENT 6

Apply dimensionality reduction techniques to the MNIST dataset.

1. Use PCA to reduce the dimensionality of the dataset from 784 dimensions to 2 dimensions.
2. Visualize the reduced data using a scatter plot.
3. Interpret the results of the dimensionality reduction.

Total: 60 Hours

Reference(s)

1. Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking , O'Reilly Media, Inc., 2013. (Unit 1)
2. McKinney, Wes. Python for Data Analysis. O'Reilly Media, Inc., 2022. (Unit 1, 3, 5)
3. Knaflic, Cole Nussbaumer. Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons, 2015. (Unit 2)
4. Kazil, Jacqueline, and Katharine Jarmul. Data wrangling with python: tips and tools to make your life easier. O'Reilly Media, Inc., 2016. (Unit 3)
5. Wickham, Hadley, and Garrett Grolemund. R for data science: import, tidy, transform, visualize, and model data. O'Reilly Media, Inc., 2016. (Unit 4, 5)
6. Matthew O. Ward, Georges Grinstein, Daniel Keim, Interactive Data Visualization: Foundations, Techniques, and Applications, 2nd Edition, CRC press, 2015.

22ISH02 RECOMMENDER SYSTEMS**3 0 0 3****Course Objectives**

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

Course Outcomes (COs)

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
4. Implement a simple recommender system.
5. Learn about Evaluating Paradigms of recommender systems and its applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1								-	
2	1	2	1	1	1								2	3
3	2	3	1	1	1								2	3
4	3	2	2	2	1								2	3
5	2	2	1	2	1								3	

UNIT I**9 Hours****INTRODUCTION**

Introduction and basic taxonomy of recommender systems- Traditional and non-personalized-Recommender Systems-Overview of data mining methods for recommender systems-similarity measures-Dimensionality reduction-Singular Value Decomposition (SVD)

UNIT II**9 Hours****CONTENT-BASED RECOMMENDATION SYSTEMS**

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III**9 Hours****COLLABORATIVE FILTERING**

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection)

UNIT IV

9 Hours

ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction-Types of Attacks-Detecting attacks on recommender systems-Individual attack-Group attack-Strategies for robust recommender design-Robust recommendation algorithms.

UNIT V

9 Hours

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms-User Studies-Online and Offline evaluation-Goals of evaluation design-Design Issues-Accuracy metrics-Limitations of Evaluation measures

Total: 45 Hours

Reference(s)

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011)
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

22ISH03 BIG DATA ANALYTICS**3 0 0 3****Course Objectives**

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in mapreduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics.

Course Outcomes (COs)

1. Understand the big data and use cases from selected business domains.
2. Understand NoSQL big data management.
3. Utilize map reduce analytics and related tools.
4. Understand the basics of Hadoop.
5. Apply the usage of Hadoop related tools for Big Data Analytics.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	2	1	1		1								3	
2	2	2	3		3								3	
3	1	3	3		3								3	2
4	2	2	2		3								2	
5	2	2	1		3								2	3

UNIT I**9 Hours****UNDERSTANDING BIG DATA**

Introduction to big data-Convergence of key trends- Unstructured data-Industry examples of big data-Web analytics- Big data applications-Big data technologies-Introduction to Hadoop-Open source technologies-Cloud and big data-Mobile business intelligence-Crowd sourcing analytics-Inter and trans firewall analytics.

UNIT II**9 Hours****NOSQL DATA MANAGEMENT**

Introduction to NoSQL-Aggregate data models-Key-value and document data models-Relationships-Graph databases-Schema less databases-Materialized views-Distribution models-Master-slave replication-Consistency-Cassandra-Cassandra data model-Cassandra examples-Cassandra clients

UNIT III**9 Hours****MAP REDUCE APPLICATIONS**

MapReduce workflows-Unit tests with MRUnit-Test data and local tests-Anatomy of MapReduce job run-Classic Map-reduce-YARN-Failures in classic Map-reduce and YARN-Job scheduling-Shuffle and sort-Task execution-MapReduce types-Input formats-Output formats.

UNIT IV

9 Hours

BASICS OF HADOOP

Data format-Analyzing data with Hadoop-Scaling out-Hadoop streaming-Hadoop pipes-Design of Hadoop distributed file system (HDFS)-HDFS concepts-Java interface-Data flow-Hadoop I/O-Data integrity-Compression-Serialization-Avro-File-based data structures-Cassandra-Hadoop integration.

UNIT V

9 Hours

HADOOP RELATED TOOLS

Hbase-Data model and implementations-Hbase clients-Hbase examples-Praxis-Pig-Grunt-Pig data model-Pig Latin-Developing and testing Pig Latin scripts-Hive-Data types and file formats-HiveQL data definition-HiveQL data manipulation-HiveQL queries.

Total: 45 Hours

Reference(s)

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley,2013.
2. Eric Sammer, Hadoop Operations, O'Reilly, 2012.
3. Sadalage, Pramod J. NoSQL distilled, 2013
4. E. Capriolo, D. Wampler, and J. Rutherglen, Programming Hive, O'Reilly, 2012.
5. Lars George, HBase: The Definitive Guide, O'Reilly, 2011.
6. Eben Hewitt, Cassandra: The Definitive Guide, O'Reilly, 2010.

22ISH04 NEURAL NETWORKS AND DEEP LEARNING

2 0 2 3

Course Objectives

- To understand the major concepts in deep neural networks.
- To apply Convolutional Neural Network architectures for any real-life applications
- To analyze the key computations underlying deep learning to build and train deep neural networks for various tasks.

Course Outcomes (COs)

1. Apply Convolution Neural Network for any suitable applications.
2. Analyze the various categories of associative memory and unsupervised learning networks.
3. Apply Convolutional Neural Networks and its variants for any suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
5. Apply autoencoders and generative models for suitable applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1									-
2	2	2	2		3									-
3	1	3	3		3									-
4	2	2	2		3									-
5	2	2	1		3									-

UNIT I

6 Hours

UNDERSTANDING NEURAL NETWORKS

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction

Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT II

6 Hours

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative

Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III **6 Hours**

THIRD-GENERATION NEURAL NETWORKS

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation-Motivation-Pooling-Variants of the basic Convolution Function- Structured Outputs-Data Types-Efficient Convolution Algorithms-Neuroscientific Basis-Applications: Computer Vision,Image Generation,Image Compression.

UNIT IV **6 Hours**

DEEP FEEDFORWARD NETWORKS

History of Deep Learning-A Probabilistic Theory of Deep Learning-Gradient Learning-Chain Rule and Backpropagation-Regularization: Dataset Augmentation-Noise Robustness-Early Stopping,Bagging and Dropout-batch normalization-VC Dimension and Neural Nets.

UNIT V **6 Hours**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks: Introduction-Recursive Neural Networks-Bidirectional RNNs-Deep Recurrent Networks-Applications: Image Generation, Image Compression, Natural Language Processing-Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders.

1 **3 Hours**

EXPERIMENT 1

Implement simple vector addition in TensorFlow.

2 **3 Hours**

EXPERIMENT 2

Implement a regression model in Keras.

3 **3 Hours**

EXPERIMENT 3

Implement a perceptron in TensorFlow/Keras Environment.

4 **3 Hours**

EXPERIMENT 4

Implement a Feed-Forward Network in TensorFlow/Keras.

5 **3 Hours**

EXPERIMENT 5

Implement an Image Classifier using CNN in TensorFlow/Keras.

6 **3 Hours**

EXPERIMENT 6

Improve the Deep learning model by fine tuning hyperparameters.

7 **3 Hours**

EXPERIMENT 7

Implement a Transfer Learning concept in Image Classification.

8 **3 Hours**

EXPERIMENT 8

Using a pre trained model on Keras for Transfer Learning

9 **3 Hours**

EXPERIMENT 9

Perform Sentiment Analysis using RNN

10 **3 Hours**

EXPERIMENT 10

Implement an LSTM based Autoencoder in TensorFlow/Keras.

Total: 60 Hours

Reference(s)

1. S Rajasekaran, G A Vijayalakshmi Pai, Neural Networks, FuzzyLogic and Genetic Algorithm,Synthesis and applications, PHI Learning, 2017
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer International Publishing, 1st Edition, 2018.
3. James A Freeman, David M S Kapura,Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
5. Francois Chollet, Deep Learning with Python, Second Edition, Manning Publications, 2021.
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

22ISH05 NATURAL LANGUAGE PROCESSING**3 0 0 3****Course Objectives**

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

Course Outcomes (COs)

1. Understand basics of linguistics, probability and statistics associated with NLP
2. Implement a Part-of-Speech Tagger
3. Design and implement a sequence labeling problem for a given domain
4. Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP
5. Implement a simple chatbot using dialogue system concepts

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	2
3	1	3	3		3								2	3
4	2	2	2		3								2	3
5	2	2	1		3								2	3

UNIT I**9 Hours****INTRODUCTION**

Natural Language Processing-Components-Basics of Linguistics and Probability and Statistics-Words-Tokenization-Morphology-Finite State Automata.

UNIT II**9 Hours****STATISTICAL NLP AND SEQUENCE LABELING**

N-grams and Language models-Smoothing-Text classification- Bayes classifier-Evaluation-Vector Semantics-TF-IDF-Word2Vec-Evaluating Vector Models-Sequence Labeling-Part of Speech-Part of Speech Tagging-Named Entities-Named Entity Tagging.

UNIT III**9 Hours****CONTEXTUAL EMBEDDING**

Constituency-Context Free Grammar-Lexicalized Grammars-CKY Parsing-Earley's algorithm Evaluating Parsers-Partial Parsing- Dependency Relations-Dependency Parsing-Transition Based-Graph Based.

UNIT IV **9 Hours**

COMPUTATIONAL SEMANTICS

Word Senses and WordNet-Word Sense Disambiguation-Semantic Role Labeling-Proposition Bank-FrameNet-Selectional Restrictions-Information Extraction-Template Filling.

UNIT V **9 Hours**

DISCOURSE ANALYSIS AND SPEECH PROCESSING

Discourse Coherence-Discourse Structure Parsing-Centering and Entity Based Coherence-Question Answering-Factoid Question Answering-Classical QA Models-Chatbots and Dialogue systems-Frame based Dialogue Systems-Dialogue State Architecture.

Total: 45 Hours

Reference(s)

1. Daniel Jurafsky and James H.Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (Prentice Hall Series in Artificial Intelligence), 2020.
2. Jacob Eisenstein. Natural Language Processing, MIT Press, 2019.
3. Samuel Burns Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.
4. Christopher Manning,Foundations of Statistical Natural Language Processing, MIT Press,2009.
5. Nitin Indurkha,Fred J. Damerau,Handbook of Natural Language Processing, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010.

22ISH06 COMPUTER VISION**3 0 0 3****Course 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

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in image processing and computer vision.
2. Implement basic and some advanced image processing techniques in OpenCV.
3. Apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To apply 3D image reconstruction techniques.
5. To design and develop innovative image processing and computer vision applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		1		2	1	3	2	2	3
3	3	3	2	2	3				1	1	2	2	2	2
4	2	3	3	2	3				2	1	2	3	2	2
5	2	3	3	2	2	2			2	1	2	3	2	3

UNIT I**9 Hours****INTRODUCTION TO IMAGE FORMATION AND PROCESSING**

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**9 Hours****FEATURE DETECTION, MATCHING AND SEGMENTATION**

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**9 Hours****FEATURE-BASED ALIGNMENT**

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 **9 Hours**

3D RECONSTRUCTION

Shape from X-Active range finding-Surface representations-Point-based representations
Volumetric representations-Model-based reconstruction-Recovering texture maps and
albedos.

UNIT V **9 Hours**

IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images-Light fields and Lumigraphs-Environment mattes-
Video-based Rendering-Object detection-Face recognition-Instance recognition-Category
recognition-Context and scene understanding-Recognition databases and test sets.

Total: 45 Hours

Reference(s)

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

22ISM01 EXPLORATORY DATA ANALYSIS**2023****Course Objectives**

- To outline an overview of exploratory data analysis.
- To implement data cleaning and preparation techniques.
- To perform descriptive statistics and data visualization techniques to present insights from the data.
- To apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high- dimensional data.

Course Outcomes (COs)

1. Understand the fundamentals of exploratory data analysis.
2. Implement the data cleaning and preparation techniques.
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data.
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns.
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3								2	
2	2	2	2	3	3								3	
3	2	3	2	2	3								3	3
4	2	2	2	2	3								3	3
5	2	2	3	2	1								3	3

UNIT I**6 Hours****EXPLORATORY DATA ANALYSIS**

Overview of Exploratory Data Analysis-importance of EDA-data analysis process: data collection, data cleaning, and data exploration-Introduction to common data types and formats- Introduction to Python-data analysis libraries.

UNIT II**6 Hours****DATA CLEANING AND PREPARATION**

Introduction to data quality issues and common data cleaning techniques-Handling missing data and outliers-Data transformation techniques-Feature engineering and variable creation.

UNIT III **6 Hours**

DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Descriptive statistics: measures of central tendency, dispersion, and shape-Data visualization principles and best practices-Exploratory data visualization using Matplotlib and Seaborn

UNIT IV **6 Hours**

EXPLORATORY DATA ANALYSIS TECHNIQUES

Univariate analysis: exploring single variables-Bivariate analysis: exploring relationships between variables- Multivariate analysis: analyzing relationships among multiple variables- Exploring time series data.

UNIT V **6 Hours**

DIMENSIONALITY REDUCTION TECHNIQUES

Introduction to dimensionality reduction-Principal Component Analysis (PCA) and its applications-Distributed Stochastic Neighbor Embedding (t-SNE) for visualization

1 **5 Hours**

EXPERIMENT 1

Explore the Titanic dataset using descriptive statistics and data visualization.

1. Load the Titanic dataset.
2. Calculate the descriptive statistics for each variable.
3. Create a variety of data visualizations to explore the relationships between variables.
4. Interpret the results of the descriptive statistics and data visualizations.

2 **5 Hours**

EXPERIMENT 2

Clean and prepare the California housing dataset for analysis.

1. Identify and handle missing data.
2. Identify and remove outliers.
3. Convert categorical variables to numerical variables.
4. Explore the distribution of the data after cleaning and preparing it.

3 **5 Hours**

EXPERIMENT 3

Perform univariate analysis on the Iris dataset.

1. Calculate the descriptive statistics for each variable.
2. Create a variety of data visualizations to explore the distribution of each variable.
3. Interpret the results of the descriptive statistics and data visualizations.

4 **5 Hours**

EXPERIMENT 4

Perform bivariate analysis on the Boston housing dataset.

1. Explore the relationship between housing prices and different features of the houses, such as the number of rooms, the lot size, and the crime rate.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the bivariate analysis.

5

5 Hours

EXPERIMENT 5

Perform multivariate analysis on the Wine dataset.

1. Explore the relationships between different features of the wine, such as the color, the acidity, and the alcohol content.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the multivariate analysis.

6

5 Hours

EXPERIMENT 6

Apply dimensionality reduction techniques to the MNIST dataset.

1. Use PCA to reduce the dimensionality of the dataset from 784 dimensions to 2 dimensions.
2. Visualize the reduced data using a scatter plot.
3. Interpret the results of the dimensionality reduction.

Total: 60 Hours

Reference(s)

1. Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking , O'Reilly Media, Inc., 2013. (Unit 1)
2. McKinney, Wes. Python for Data Analysis. O'Reilly Media, Inc., 2022. (Unit 1, 3, 5)
3. Knaflic, Cole Nussbaumer. Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons, 2015. (Unit 2)
4. Kazil, Jacqueline, and Katharine Jarmul. Data wrangling with python: tips and tools to make your life easier. O'Reilly Media, Inc., 2016. (Unit 3)
5. Wickham, Hadley, and Garrett Grolemund. R for data science: import, tidy, transform, visualize,and model data. O'Reilly Media, Inc., 2016. (Unit 4, 5)
6. Matthew O. Ward, Georges Grinstein, Daniel Keim, Interactive Data Visualization: Foundations, Techniques, and Applications, 2nd Edition, CRC press, 2015.

22ISM02 RECOMMENDER SYSTEMS**3 0 0 3****Course Objectives**

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

Course Outcomes (COs)

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
4. Implement a simple recommender system.
5. Learn about Evaluating Paradigms of recommender systems and its applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1								-	
2	1	2	1	1	1								2	3
3	2	3	1	1	1								2	3
4	3	2	2	2	1								2	3
5	2	2	1	2	1								3	

UNIT I**9 Hours****INTRODUCTION**

Introduction and basic taxonomy of recommender systems- Traditional and non-personalized-Recommender Systems-Overview of data mining methods for recommender systems-similarity measures-Dimensionality reduction-Singular Value Decomposition (SVD)

UNIT II**9 Hours****CONTENT-BASED RECOMMENDATION SYSTEMS**

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III**9 Hours****COLLABORATIVE FILTERING**

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection)

UNIT IV

9 Hours

ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction-Types of Attacks-Detecting attacks on recommender systems-Individual attack-Group attack-Strategies for robust recommender design-Robust recommendation algorithms.

UNIT V

9 Hours

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms-User Studies-Online and Offline evaluation-Goals of evaluation design-Design Issues-Accuracy metrics-Limitations of Evaluation measures

Total: 45 Hours

Reference(s)

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011)
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

22ISM03 BIG DATA ANALYTICS**3 0 0 3****Course Objectives**

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in mapreduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics.

Course Outcomes (COs)

1. Understand the big data and use cases from selected business domains.
2. Understand NoSQL big data management.
3. Utilize map reduce analytics and related tools.
4. Understand the basics of Hadoop.
5. Apply the usage of Hadoop related tools for Big Data Analytics.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	2	1	1		1								3	
2	2	2	3		3								3	
3	1	3	3		3								3	2
4	2	2	2		3								2	
5	2	2	1		3								2	3

UNIT I**9 Hours****UNDERSTANDING BIG DATA**

Introduction to big data-Convergence of key trends- Unstructured data-Industry examples of big data-Web analytics- Big data applications-Big data technologies-Introduction to Hadoop-Open source technologies-Cloud and big data-Mobile business intelligence-Crowd sourcing analytics-Inter and trans firewall analytics.

UNIT II**9 Hours****NOSQL DATA MANAGEMENT**

Introduction to NoSQL-Aggregate data models-Key-value and document data models-Relationships-Graph databases-Schema less databases-Materialized views-Distribution models-Master-slave replication-Consistency-Cassandra-Cassandra data model-Cassandra examples-Cassandra clients

UNIT III**9 Hours****MAP REDUCE APPLICATIONS**

MapReduce workflows-Unit tests with MRUnit-Test data and local tests-Anatomy of MapReduce job run-Classic Map-reduce-YARN-Failures in classic Map-reduce and YARN-Job scheduling-Shuffle and sort-Task execution-MapReduce types-Input formats-Output formats.

UNIT IV

9 Hours

BASICS OF HADOOP

Data format-Analyzing data with Hadoop-Scaling out-Hadoop streaming-Hadoop pipes-Design of Hadoop distributed file system (HDFS)-HDFS concepts-Java interface-Data flow-Hadoop I/O-Data integrity-Compression-Serialization-Avro-File-based data structures-Cassandra-Hadoop integration.

UNIT V

9 Hours

HADOOP RELATED TOOLS

Hbase-Data model and implementations-Hbase clients-Hbase examples-Praxis-Pig-Grunt-Pig data model-Pig Latin-Developing and testing Pig Latin scripts-Hive-Data types and file formats-HiveQL data definition-HiveQL data manipulation-HiveQL queries.

Total: 45 Hours

Reference(s)

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley,2013.
2. Eric Sammer, Hadoop Operations, O'Reilly, 2012.
3. Sadalage, Pramod J. NoSQL distilled, 2013
4. E. Capriolo, D. Wampler, and J. Rutherglen, Programming Hive, O'Reilly, 2012.
5. Lars George, HBase: The Definitive Guide, O'Reilly, 2011.
6. Eben Hewitt, Cassandra: The Definitive Guide, O'Reilly, 2010.

22ISM04 NEURAL NETWORKS AND DEEP LEARNING

2 0 2 3

Course Objectives

- To understand the major concepts in deep neural networks.
- To apply Convolutional Neural Network architectures for any real-life applications
- To analyze the key computations underlying deep learning to build and train deep neural networks for various tasks.

Course Outcomes (COs)

1. Apply Convolution Neural Network for any suitable applications.
2. Analyze the various categories of associative memory and unsupervised learning networks.
3. Apply Convolutional Neural Networks and its variants for any suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
5. Apply autoencoders and generative models for suitable applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1									-
2	2	2	2		3									-
3	1	3	3		3									-
4	2	2	2		3									-
5	2	2	1		3									-

UNIT I

6 Hours

UNDERSTANDING NEURAL NETWORKS

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction

Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT II

6 Hours

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative

Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III **6 Hours**

THIRD-GENERATION NEURAL NETWORKS

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation-Motivation-Pooling-Variants of the basic Convolution Function- Structured Outputs-Data Types-Efficient Convolution Algorithms-Neuroscientific Basis-Applications: Computer Vision,Image Generation,Image Compression.

UNIT IV **6 Hours**

DEEP FEEDFORWARD NETWORKS

History of Deep Learning-A Probabilistic Theory of Deep Learning-Gradient Learning-Chain Rule and Backpropagation-Regularization: Dataset Augmentation-Noise Robustness-Early Stopping,Bagging and Dropout-batch normalization-VC Dimension and Neural Nets.

UNIT V **6 Hours**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks: Introduction-Recursive Neural Networks-Bidirectional RNNs-Deep Recurrent Networks-Applications: Image Generation, Image Compression, Natural Language Processing-Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders.

1 **3 Hours**

EXPERIMENT 1

Implement simple vector addition in TensorFlow.

2 **3 Hours**

EXPERIMENT 2

Implement a regression model in Keras.

3 **3 Hours**

EXPERIMENT 3

Implement a perceptron in TensorFlow/Keras Environment.

4 **3 Hours**

EXPERIMENT 4

Implement a Feed-Forward Network in TensorFlow/Keras.

5 **3 Hours**

EXPERIMENT 5

Implement an Image Classifier using CNN in TensorFlow/Keras.

6 **3 Hours**

EXPERIMENT 6

Improve the Deep learning model by fine tuning hyperparameters.

7 **3 Hours**

EXPERIMENT 7

Implement a Transfer Learning concept in Image Classification.

8 **3 Hours**

EXPERIMENT 8

Using a pre trained model on Keras for Transfer Learning

9 **3 Hours**

EXPERIMENT 9

Perform Sentiment Analysis using RNN

10 **3 Hours**

EXPERIMENT 10

Implement an LSTM based Autoencoder in TensorFlow/Keras.

Total: 60 Hours

Reference(s)

1. S Rajasekaran, G A Vijayalakshmi Pai, Neural Networks, FuzzyLogic and Genetic Algorithm,Synthesis and applications, PHI Learning, 2017
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer International Publishing, 1st Edition, 2018.
3. James A Freeman, David M S Kapura,Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
5. Francois Chollet, Deep Learning with Python, Second Edition, Manning Publications, 2021.
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

22ISM05 NATURAL LANGUAGE PROCESSING**3 0 0 3****Course Objectives**

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

Course Outcomes (COs)

1. Understand basics of linguistics, probability and statistics associated with NLP
2. Implement a Part-of-Speech Tagger
3. Design and implement a sequence labeling problem for a given domain
4. Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP
5. Implement a simple chatbot using dialogue system concepts

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	2
3	1	3	3		3								2	3
4	2	2	2		3								2	3
5	2	2	1		3								2	3

UNIT I**9 Hours****INTRODUCTION**

Natural Language Processing-Components-Basics of Linguistics and Probability and Statistics-Words-Tokenization-Morphology-Finite State Automata.

UNIT II**9 Hours****STATISTICAL NLP AND SEQUENCE LABELING**

N-grams and Language models-Smoothing-Text classification- Bayes classifier-Evaluation-Vector Semantics-TF-IDF-Word2Vec-Evaluating Vector Models-Sequence Labeling-Part of Speech-Part of Speech Tagging-Named Entities-Named Entity Tagging.

UNIT III**9 Hours****CONTEXTUAL EMBEDDING**

Constituency-Context Free Grammar-Lexicalized Grammars-CKY Parsing-Earley's algorithm Evaluating Parsers-Partial Parsing- Dependency Relations-Dependency Parsing-Transition Based-Graph Based.

UNIT IV **9 Hours**

COMPUTATIONAL SEMANTICS

Word Senses and WordNet-Word Sense Disambiguation-Semantic Role Labeling-Proposition Bank-FrameNet-Selectional Restrictions-Information Extraction-Template Filling.

UNIT V **9 Hours**

DISCOURSE ANALYSIS AND SPEECH PROCESSING

Discourse Coherence-Discourse Structure Parsing-Centering and Entity Based Coherence-Question Answering-Factoid Question Answering-Classical QA Models-Chatbots and Dialogue systems-Frame based Dialogue Systems-Dialogue State Architecture.

Total: 45 Hours

Reference(s)

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (Prentice Hall Series in Artificial Intelligence), 2020.
2. Jacob Eisenstein. Natural Language Processing, MIT Press, 2019.
3. Samuel Burns Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.
4. Christopher Manning, Foundations of Statistical Natural Language Processing, MIT Press, 2009.
5. Nitin Indurkha, Fred J. Damerau, Handbook of Natural Language Processing, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover, 2010.

22ISM06 COMPUTER VISION**3 0 0 3****Course 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

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in image processing and computer vision.
2. Implement basic and some advanced image processing techniques in OpenCV.
3. Apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To apply 3D image reconstruction techniques.
5. To design and develop innovative image processing and computer vision applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		1		2	1	3	2	2	3
3	3	3	2	2	3				1	1	2	2	2	2
4	2	3	3	2	3				2	1	2	3	2	2
5	2	3	3	2	2	2			2	1	2	3	2	3

UNIT I**9 Hours****INTRODUCTION TO IMAGE FORMATION AND PROCESSING**

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**9 Hours****FEATURE DETECTION, MATCHING AND SEGMENTATION**

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**9 Hours****FEATURE-BASED ALIGNMENT**

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 **9 Hours**

3D RECONSTRUCTION

Shape from X-Active range finding-Surface representations-Point-based representations
Volumetric representations-Model-based reconstruction-Recovering texture maps and
albedos.

UNIT V **9 Hours**

IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images-Light fields and Lumigraphs-Environment mattes-
Video-based Rendering-Object detection-Face recognition-Instance recognition-Category
recognition-Context and scene understanding-Recognition databases and test sets.

Total: 45 Hours

Reference(s)

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

**22OCE01 ENERGY CONSERVATION AND
MANAGEMENT**

3 0 0 3

Course Objectives

- To develop an understanding and analyze the energy data of industries
- To carryout energy accounting and balancing
- To conduct energy audit and suggest methodologies for energy savings and
- To utilize the available resources in optimal ways

Course Outcomes (COs)

1. Classify and characterize the various energy utilization techniques.
2. Identify suitable technique to provide an energy efficient system.
3. Identify the need for thermal systems with latest technologies.
4. Choose suitable techniques doe conserving energy with respect to emerging trends.
5. Assess the impact economics on the conservation of energy.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1										1	3
2	1	3									1	3
3	1	3									2	3
4	1	3	2								3	3
5	1	2	2								1	3

UNIT I

9 Hours

INTRODUCTION

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II

9 Hours

ELECTRICAL SYSTEMS

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III

9 Hours

THERMAL SYSTEMS

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and Encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, And And Insulators & Refractories

UNIT IV **9 Hours**

ENERGY CONSERVATION IN MAJOR UTILITIES

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems
– Cooling Towers – D.G. sets

UNIT V **9 Hours**

ECONIMICS

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept .

Total: 45 Hours

Reference(s)

1. Energy Manager Training Manual (4 Volumes) available at www.energymanagertraining.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.
2. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.
3. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
4. Dryden. I.G.C., “The Efficient Use of Energy” Butterworths, London, 1982
5. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
6. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

22OEC01 BASICS OF ANALOG AND DIGITAL ELECTRONICS

3 0 0 3

Course Objectives

- Understand the working of diodes and transistors in electronic circuits.
- Understand the analog operational amplifier and its applications.
- Understand the implementation of combinational and sequential circuits in digital systems.

Course Outcomes (COs)

1. Apply the diodes and transistors in regulators and amplifiers and analyze their characteristics.
2. Illustrate the working of analog IC with different configurations and its applications.
3. Simplification of Boolean expressions using K-map and implementation of combinational circuits.
4. Analyze the Flip flops and memory configurations in digital circuits.
5. Classify and analyze A/D and D/A converters with its parameters.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2	3	1								
2	2	2	3									
3	2	2	3	2								
4	2	2	3	3								
5	2	2	3	3								

UNIT I

9 Hours

SEMICONDUCTORS DEVICES

Conductor, Semiconductors & Insulators, Semiconductors: intrinsic & extrinsic, energy band diagram - Mobility - Electrons and holes - The P-N junction diode - Zener diode - Avalanche effect- Rectifier Circuits Half wave, Full wave circuits, Efficiency, PIV, Ripple factor and AC and DC current and voltage in rectifier. PNP and NPN Bipolar junction Transistors - H parameters equivalent circuit - Common emitter amplifier - DC behavior: the load slope and the Q point - AC behavior - Emitter follower amplifier - Field effect transistors: JFET and MOSFET.

UNIT II

9 Hours

OPERATIONAL AMPLIFIERS: DC PERFORMANCE

The operational amplifier - Input resistance, Output resistance, Open loop gain - Bias currents - Offset currents - Offset voltage - Differential mode gain - Common mode gain - Common mode rejection ratio - Negative feedback - Open loop gain and closed loop gain - Inverter amplifier - Non-inverter amplifier - The voltage follower - Transimpedance amplifier (Current to voltage converter) - Differential amplifier. Adders, Subtractors, Comparator, Integrator and Differentiator.

UNIT III

9 Hours

DIGITAL TECHNIQUES: COMBINATIONAL CIRCUITS

Numbering systems - Binary, octal and hexadecimal numbers - Boole algebra - Conversion and operations - AND gate- OR gate - Inverter - NAND gate - NOR gate - Exclusive OR gate. Morgan's laws. Combinational Circuits: Truth tables, logic expressions, Logic simplification using K- map, half and full adder/subtractor, multiplexers, demultiplexers, Logic families: TTL and CMOS.

UNIT IV

9 Hours

DIGITAL TECHNIQUES: SEQUENTIAL CIRCUITS

Gated Latches & Flip Flops- Level triggered and Edge triggered Flip-Flops, Flop (FF) types: RS type. JK FF. JK FF Master slave. D FF. T FF. Flip Flop Conversion. Shift registers, Counters. Memories Structure: address and data bus. ROM, PROM, EPROM and flash RAM. Volatiles Memories: RAM, SRAM, DRAM. Addressing modes.

UNIT V

9 Hours

DIGITAL TO ANALOG CONVERTERS AND ANALOG TO DIGITAL CONVERTERS

DIGITAL TO ANALOG CONVERTERS: Input latch. Binary Weighted Resistor Network. R-2R Ladder Resistor Network. Pulse Width Modulation. Resolution. Accuracy. Linearity. Zero Offset. Settling Time. Glitches. ANALOG TO DIGITAL CONVERTERS: Sampling. Real time sampling and equivalent time sampling. Sampling frequency. Sampling theorem (Nyquist). Anti-aliasing filtering. Sampling and holding. Conversion.

Total: 45 Hours

Reference(s)

1. L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, 2012.
2. J Millman, C. Halkias & Satyabrata Jit, Electronic Devices and Circuits, Tata McGraw-Hill, 2010.
3. Ramakant A.Gayakwad, OP-AMP and Linear IC's, Prentice Hall of India, 2002.
4. D.RoyChoudhry, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.
5. Thomas L.Floyd, Digital Fundamentals, Prentice Hall, 11th Edition, 2015.
6. M.Morris Mano, Michael D Ciletti Digital Design 4th edition Pearson, 2011.

22OEC02 MICROCONTROLLER PROGRAMMING

3 0 0 3

Course Objectives

- Understand Series of Microcontrollers in terms of architecture, Programming and Interfacing.
- Learn Programming of PIC series of microcontrollers and learn building of hardware circuits using PIC 16F series of Microcontrollers
- Learn the emerging trends in the design of advanced Microcontrollers.

Course Outcomes (COs)

1. Interpret the components and functionalities of 8051 Microcontrollers.
2. Develop microprocessor applications using the Assembly Language Program
3. Illustrate the working nature of PIC microcontroller on various versions
4. Illustrate the interfacing of different peripherals using PIC Microcontroller
5. Analyze the architecture and instruction set of ARM Microcontroller

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1									
2	1	3	1									
3	1	1	2		1							
4	1	1	2		3							
5	1	1	3		2							

UNIT I

9 Hours

8-BIT MICROCONTROLLER

Introduction-Intel 8051 architecture-Counters and Timers-Serial Interface- Interrupts- Interfacing to external memory and 8255- Instruction set- Address modes.

UNIT II

9 Hours

8051 ALP AND APPLICATIONS

Assembly language program- Timers and Counters programming- DAC- ADC- Sensor- Keyboard and LCD.

UNIT III

9 Hours

PIC MICROCONTROLLER

PIC Microcontroller features- PIC Architecture, Program Memory, Addressing Modes, Instruction Set, Instruction Format- Byte-oriented Instructions- Bit-oriented Instructions- Literal Instructions- Control Instructions (CALL & GOTO) - Destination Designator. MPLAB overview: Using MPLAB, Toolbars, Select Development Mode and Device type, Project, Text Editor, Assembler, MPLAB operations.

UNIT IV **9 Hours**

PIC HARDWARE

Reset, Clock, Control registers, Register banks, Program Memory Paging, Ports, Interrupts, Timer and Counter, Watchdog Timer, Power up timer, Sleep mode, and I2C bus- A/D converter.

UNIT V **9 Hours**

HIGH PERFORMANCE RISC ARCHITECTURE

ARM: The ARM architecture- ARM organization and implementation- The ARM instruction set- The THUMB instruction set- Basic ARM Assembly Language Program- ARM CPU Cores.

FOR FURTHER READING

Introduction- Architecture- Registers- Memory- Instruction set- Addressing Modes- I/O Pins- Timers- Counters- Interrupts.

Total: 45 Hours

Reference(s)

1. Ayala, Kenneth, "The 8051 Microcontroller", Thomson, 3rd Edition, 2004.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", Person Education, 2nd Edition, 2004.
3. John B.Peatman, "Design with Microcontrollers", Person Education", 1st Edition, 2004.
4. Steave Furber, "ARM system-on-chip architecture" Addison Wesley, 2nd Edition, 2000.
5. A.V.Deshmukh, "Microcontrollers: Theory and Applications", Tata Mc Graw Hill, 12th reprint, 2005.

22OEC03 PRINCIPLES OF COMMUNICATION SYSTEMS

3 0 0 3

Course Objectives

- To study the various analog and digital modulation techniques
- To study the various digital communication techniques
- To enumerate the idea of spread spectrum modulation
- To study the design concepts of satellite and optical communication

Course Outcomes (COs)

1. Illustrate the process involved in Amplitude, Frequency and phase modulation systems.
2. Analyze the performance of different digital modulation /demodulation techniques.
3. Analyze Pulse Code Modulation scheme for the transmission of analog data in digital format.
4. Apply the concepts of spread spectrum modulation techniques to eradicate interference in wireless communication.
5. Analyze the system design of satellite and optical communication.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	2									
2	3	2										
3	3	2										
4	2	2	2									
5	3	2										

UNIT I

9 Hours

FUNDAMENTALS OF ANALOG COMMUNICATION

Principles of amplitude modulation, AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM Voltage distribution, AM power distribution, Angle modulation. FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation, Frequency analysis of angle modulated waves. Bandwidth requirements for Angle modulated waves

UNIT II

9 Hours

DIGITAL COMMUNICATION

Introduction, Shannon limit for information capacity, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) Minimum Shift Keying (MSK), Phase Shift Keying (PSK), BPSK, QPSK, 8 PSK Quadrature Amplitude Modulation (QAM), Bandwidth Efficiency, Comparison of various Digital Communication System (ASK - FSK - PSK - QAM).

UNIT III

9 Hours

DIGITAL TRANSMISSION

Introduction, Pulse modulation, PCM, PCM sampling, sampling rate, signal to quantization noise rate, companding, delta modulation, adaptive delta modulation, differential pulse code modulation, pulse transmission, Intersymbol interference, eye patterns.

UNIT IV

9 Hours

SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES

Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques, wireless communication, TDMA and CDMA in wireless communication systems, source coding of speech for wireless communications.

UNIT V

9 Hours

SATELLITE AND OPTICAL COMMUNICATION

Satellite Communication Systems-Keplers Law, LEO and GEO Orbits, footprint, Link model- Optical Communication Systems-Elements of Optical Fiber Transmission link, Types, Losses, Sources and Detectors.

Total: 45 Hours

Reference(s)

1. Wayne Tomasi, Advanced Electronic Communication Systems, 6/e, Pearson Education, 2007.
2. Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons. 2001.
3. H.Taub, D L Schilling, G Saha, Principles of Communication, 3/e, 2007.
4. B.P.Lathi, Modern Analog And Digital Communication systems, 3/e, Oxford University Press, 2007
5. Dennis Roddy, "Satellite Communications", Third Edition, Mc Graw Hill International Editions, 2001.
6. Gerd Keiser, Optical Fiber Communication, McGraw-Hill International, Singapore, 4th edition., 2011.

21OEC04 PRINCIPLES OF COMPUTER COMMUNICATION AND NETWORKS

3 0 0 3

Course Objectives

- To understand the concept of data communication and networking models.
- To study the various networking Components and Networks.
- To explore the routing, addressing and security and management aspects of computer networks.

Course Outcomes (COs)

1. Classify the types of computer networks and analyze the seven layers of OSI model.
2. Analyze the basic operations of Routing Algorithms and Routing devices
3. Analyze the local and wide area networking technologies.
4. Apply the ISDN and ATM interface connections in broadband networks.
5. Analyze the security and management techniques related with networks.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	1	1								
2	1	2	2	3								
3	1	1	2	3								
4	1	1	3									
5	1	2	3	3								

UNIT I

9 Hours

NETWORK FUNDAMENTALS

Types of Computer Networks: by Area, by Topology; Communication Services: Serial and Parallel, Synchronous and Asynchronous, Simplex and Duplex, Analog and Digital; Speed and Capacity; Multiplexing and Switching; Network Architecture: OSI Seven-Layer Network model.

UNIT II

9 Hours

INTERNETWORKING AND COMPONENTS

Routing Concepts: Routing Algorithms, RIP, RIP-2, OSPF and other routing Protocols; Switches and Hubs: Store and Forward Switch, Cut-Through Switch, Hybrid Switch, Performance of Switches ; Repeaters; Repeater Vs Hubs; Bridges: Standards, Bridges Vs Repeaters; Routers and Gateways.

UNIT III

9 Hours

LOCAL AND WIDE AREA NETWORKING TECHNOLOGIES

LAN Components and Topologies; Access Techniques; Transmission Protocols and Media; Ethernet and IEEE 802.3 Networks: History, 10-MBPS Ethernet, Switched Ethernet, 100-MBPS Ethernet, and Gigabit Ethernet.

UNIT IV

9 Hours

BROADBAND NETWORKS

ISDN: Evolution, ISDN Channel and Interface Structures; Broadband ISDN: Basics, Principles and General Architecture; Asynchronous Transfer Mode(ATM): Introduction, Concepts, Components, Connection Supported by ATM network and Concept of Virtual Channel and Virtual Path, Traffic control and Congestion Control, Operation and Maintenance aspects.

UNIT V

9 Hours

NETWORK SECURITY AND MANAGEMENT

Security: Need of Security, Security Threats, Vulnerabilities, Methods, tools and Techniques for Attacks; Network Security: Levels of Security, Cryptosystems; Data Encryption Standard (DES), Public Key Cryptography, Firewalls; Network Management: Functions and Elements, Distribution of Management; Simple Network Management Protocol (SNMP), Remote Network Management Services.

Total: 45 Hours

Reference(s)

1. Michael A.Gallo, William M. Hancock, Computer Communications and Networking Technologies, 1 Ed, Thomson Learning, 2002.
2. Kenneth C. Mansfield, Jr.James L. Antonakos, An Introduction to Computer Networking, 1Ed, Prentice Hall of India, 2002
3. A Shanmugam, S Rajeev, Computer Communication Networks, 1Ed, ISTE Learning Materials Centre, 2001
4. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schaffer, 3rd edition, 2010, Prentice Hall
5. Digital Signal Processing by Sanjit Mitra, 4th edition, 2011, McGraw-Hill, New York, NY

22OEI01 PROGRAMMABLE LOGIC CONTROLLERS**3 0 0 3****Course Objectives**

- To impart knowledge about automation and architecture of PLC
- To understand the PLC programming using timers, counters and advanced PLC functions
- To familiarize the student with PLC based applications

Course Outcomes (COs)

1. Outline the fundamental Concepts of Automation
2. Conclude the architecture, interfacing and communication techniques of PLC
3. Execute the suitable PLC Programming languages
4. Attribute the various functions and instruction sets of PLC
5. Generate a suitable logical programming for given applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1		2	2		3							
2	2	1		2	2		3							
3	2	1		2	2		3							
4	2	1		2	2		3							
5	2	1		2	2		3							

UNIT I**10 Hours****INTRODUCTION TO AUTOMATION**

Evolution of automation -Types of automation - Fixed, flexible and programmable automation - Batch process and continuous process - open loop system and closed loop system - Function of sensors - Proximity sensors: Capacitive and Inductive - Infrared and Laser Push-buttons and toggle switches - Actuators: Solenoid valve - servo motor - electromagnetic relays.

UNIT II**9 Hours****ARCHITECTURE OF PLC**

Components of PLC - sink and source I/O cards - Processor - Memory: Types of memory, Input and Output modules: Discrete, Analog -Scan time of PLC -Interfacing computer and PLC: RS232, RS485, and Ethernet - Selection criteria for PLC.

UNIT III**8 Hours****PLC PROGRAMMING**

Programming languages - Ladder logic components: User and bit Instructions, branch instructions, internal relay instruction Boolean logic using ladder logic programming, Latching -Timers: On Delay timer, OFF Delay timer and Retentive timer - Counters: Up Counter and Down Counter.

UNIT IV

10 Hours

ADVANCED PLC FUNCTONS

Instructions in PLC: Program Control Instructions, Math Instructions, Data Manipulation Instructions: Data compare operations, Data transfer operations - Sequencer and Shift register instructions- Analog Instructions: PID Controller - Scaling Instructions.

UNIT V

8 Hours

APPLICATIONS OF PLC

Case Studies: Bottle filling system - Pick and place robot - Car Parking - Traffic light control (4 ways with pedestrian signal) -Elevators - Pneumatic stamping system - alarm annunciator system.

Total: 45 Hours

Reference(s)

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2015.
2. Benjamin C Kuo, Automatic Control Systems, Prentice Hall of India, New Delhi, 2014.
3. John Park, Steve Mackay, Edwin Wright, Practical data communications for instrumentation and control, Newnes, Elsevier, 2015.
4. K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2014.
5. John W Webb and Ronald A Resis, Programmable Logic Controller, Prentice Hall of India Pvt. Ltd., New Delhi, 2013.

22OEI02 SENSOR TECHNOLOGY

3 0 0 3

Course Objectives

- To impart knowledge about various sensors in multidisciplinary engineering domain
- To familiarize students with different applications and its material handling technology
- To understand the concept of sensing circuits and its static and dynamic characteristics

Course Outcomes (COs)

6. Conclude the static and dynamic characteristics of measuring instruments
7. Compare the characteristics and working principles of Resistance, Inductance and Capacitance type sensors
8. Construct the interfacing and signal conditioning circuit for measurement system using different types of sensor
9. Analyze and select the suitable sensor for different industrial applications
10. Combine the modern technologies and smart materials to design various sensors

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	2	3	2	1	1									
3	1	2	3	3	1									
4	2	1	1	3	3									
5	1	2	1	2	3									

UNIT I

8 Hours

SENSORS FUNDAMENTALS AND CHARACTERISTICS

Sensors: Principles of Sensing - Sensor Classification and terminology- Units of Measurements - Measurands- Sensor Characteristics: Static and Dynamic.

UNIT II

8 Hours

PHYSICAL PRINCIPLES OF SENSING

Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements.

UNIT III

9 Hours

INTERFACE ELECTRONIC CIRCUITS

Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.

UNIT IV

10 Hours

SENSORS IN DIFFERENT APPLICATION AREA

Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors.

UNIT V

10 Hours

SENSOR MATERIALS AND TECHNOLOGIES

Materials, Surface Processing- MEMS microsystem components- Microfluidics microsystem components - Nano Technology- Smart Materials.

Total: 45 Hours

Reference(s)

1. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer, 2016.
2. D. Patranabis, Sensors and Transducers, 2nd Edition, Prentice Hall India Pvt. Ltd, New Delhi, 2009.
3. Guozhen Shen, Zhiyong Fan, “Flexible Electronics: From Materials to Devices”, 1st Edition, World Scientific Publishing Co, Singapore, 2015.
4. Horowitz, P., and W. Hill. The Art of Electronics. 2nd ed. Cambridge University Press, 1989.

22OEI03 FUNDAMENTALS OF VIRTUAL INSTRUMENTATION 3 0 0 3**Course Objectives**

- Understand the basic components of Virtual Instrumentation system.
- Learn the developing VIs based on Lab VIEW software.
- To learn to develop applications based on Virtual Instrumentation system.

Course Outcomes (COs)

11. Outline the concepts of traditional instruments and virtual instruments
12. Conclude the overview of modular programming and the structuring concepts in VI programming
13. Attribute the procedure to install DAQ in various OS and its interfacing methods
14. Implement the VI toolsets for specific applications
15. Generate the applications using Virtual Instrumentation software

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1										
2	3	3	2	2	2					2	2	2		
3	2	2	2	1										
4	3	3	3	1	2					1	2	2		
5	3	2	2	1	2				-	1	2	2		

UNIT I**9 Hours****INTRODUCTION**

Virtual Instrumentation: Historical perspective - advantages - block diagram and architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II**9 Hours****VI PROGRAMMING TECHNIQUES**

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, State machine, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT III**9 Hours****DATA ACQUISITION**

Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards - Data acquisition cards with serial communication - VI

Chassis requirements. SCSI, PCI, PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

UNIT IV

9 Hours

VI TOOLSETS

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, windowing and filtering. Application of VI in process control designing of equipments like oscilloscope, Digital multimeter, Design of digital Voltmeters with transducer input Virtual Laboratory, Web based Laboratory.

UNIT V

9 Hours

APPLICATIONS

Distributed I/O modules- Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

Total: 45 Hours

Reference(s)

1. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey,1997.
2. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newness, 2000.

**22OEI04 OPTOELECTRONICS AND LASER
INSTRUMENTATION**

3 0 0 3

Course Objectives

- To enhance the student knowledge in fiber optics fundamentals and fabrication
- To be recognized with industrial applications of fibers
- To understand the fundamental concepts about lasers
- To identify and describe various fiber optic imaging and optoelectronic sensor applications

Course Outcomes (COs)

16. Attribute the properties of optical fibers, their light sources and detectors.
17. Implement the fiber-optic sensor for the measurement of various physical quantities.
18. Conclude the fundamentals of laser, types of laser and its working.
19. Outline the applications of laser for industrial applications.
20. Differentiate the use of laser instruments for various medical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	3	2	1	2										
3	3	2	1											
4	3	2	2	2										
5	3	2	2	2										

UNIT I

9 Hours

OPTICAL FIBERS AND THEIR PROPERTIES

Introduction to optical fibers - Light guidance - Numerical aperture - Dispersion - Different types of fibers and their properties - Light Sources for fiber optics, Photo detectors, source coupling, splicing and connectors.

UNIT II

9 Hours

INDUSTRIAL APPLICATION OF OPTICAL FIBERS

Fiber optics instrumentation system - optical fiber sensors, Measurement of pressure, temperature, current, voltage and liquid level - fiber optic communication set up - different types of modulators - detectors.

UNIT III

9 Hours

LASER FUNDAMENTALS

Fundamental characteristics of lasers: laser rate equation - three level system - four level system - properties of laser beams - laser modes - resonator configuration - Q- switching and mode locking - cavity dumping - types of lasers: gas lasers, solid state lasers, liquid lasers and semiconductor lasers.

UNIT IV

9 Hours

INDUSTRIAL APPLICATION OF LASERS

Lasers for measurement of distance and length, velocity, acceleration, atmospheric effects, sonic boom, pollutants - material processing: laser heating, melting, welding and trimming of materials - removal and vaporization - calculation of power requirements of laser for material processing.

UNIT V

9 Hours

HOLOGRAM AND MEDICAL APPLICATIONS

Holography: basic principle, methods - holographic interferometry and application, holography for non-destructive - medical applications of lasers, laser and tissue interactive - laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

Total: 45 Hours

Reference(s)

1. John M. Senior, Optical Fiber Communications - Principles and Practice, Prentice Hall of India, 2010.
2. John F. Ready, Industrial Applications of Lasers, Academic Press, 2012.
3. Gerd Keiser, Optical Fiber Communication, Mc Graw Hill, New York, 2013.
4. S.C. Gupta, Textbook on Fiber Optics Communications and its application, Prentice Hall of India, 2012.
5. John Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2011.
6. R. P. Khare, Fiber Optics and Optoelectronics, Oxford University Press, 2011.

21OME01 DIGITAL MANUFACTURING**3 0 0 3****Course Objectives**

- To understand the process of generating 3D Computer Aided Design (CAD) model by different method.
- To explain the constructional features and develop simple program for CNC lathe and Milling machines.
- To provide an exhaustive knowledge on various generic process and benefits of Additive Manufacturing.
- To familiarize about materials and process parameters of liquid and solid based AM techniques.
- To educate powder based methodology and emerging trends with case studies, applications of AM techniques.

Course Outcomes (COs)

1. Design a 3D model from the 2D data.
2. Develop a CNC program for simple components.
3. Generate stl file and manipulate parameters of AM machine
4. Select appropriate liquid or solid materials based AM process to the respective application
5. Select appropriate process to fabricate a functional/prototype for aerospace, automotive, electronics, manufacturing and medical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2		2								1	2
2	2	2	2		2								1	2
3	2	2	2		2								1	2
4	2	2	2		2								1	3
5	2	2	2		2								1	2

UNIT I**9 Hours****CAD MODELING**

Introduction - Design process - Stages. CAD - Input and Output devices, Modeling methods - Wire frame modelling, Surface modelling, Solid modelling - Constructive Solid Geometry and Boundary Representation Techniques. CAD/CAM data exchange - IGES, STEP. Product Life cycle management (PLM).

UNIT II**10 Hours****AUTOMATION AND CNC MACHINES**

Introduction to Automation - Definition, types, reasons for automating. CNC Machines - Principles, types, features, advantages, applications. CNC Machine structure - Linear motion

bearings, Recirculating ball bearings, drive system, and control system. CNC Lathe and Milling programming - Linear and circular interpolation, threading and drilling programs.

UNIT III

7 Hours

ADDITIVE MANUFACTURING

Introduction - Impact of Additive Manufacturing (AM) and Tooling on Product Development - Distinction between AM and CNC Machining - The Generalized AM Process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing - AM Benefits - Classification of AM process

UNIT IV

8 Hours

LIQUID AND SOLID MATERIAL BASED SYSTEMS

Stereo lithography Apparatus (SLA), Digital Light Processing (DLP), Fused Deposition Modelling (FDM) and Laminated Object Manufacturing (LOM) - Working Principle, Construction, Process, Materials and Applications

UNIT V

11 Hours

POWDER BASED PROCESSES AND APPLICATIONS OF ADDITIVE MANUFACTURING

Selective Laser Sintering (SLS), Color Jet Printing (CJP), Electron Beam Melting (EBM) and Laser Engineered Net Shaping (LENS) - Working Principle, Construction, Process Variables, Materials and Applications. Reverse Engineering using 3D scanner. Application of Additive Manufacturing in Medical field, Manufacturing, Automotive industries, Aerospace and Electronics and Retail industries.

Total: 45 Hours

Reference(s)

1. Ibrahim Zeid, R.Sivasubramania, CAD/CAM Theory and Practice, Tata McGraw Hill, 2010.
2. M. Aditan, B.S. Pabala, CNC Machines, New age International, 2012.
3. C. K. Chua, K. F. Leong and C. S. Lim, Rapid prototyping: Principles and applications, Cambridge University Press, 2010.
4. D. T.Pham, S. S.Dimov, Rapid manufacturing, Springer-Verlag, London, 2001.
5. I. Gibson, D. W. Rosen, and B. Stucker, Additive Manufacturing Technologies 3D Printing, Rapid Prototyping and Direct Digital Manufacturing, Springer, 2015
<http://www.springer.com/978-1-4939-2112-6>
6. www.grabcad.com, www.all3dp.com

**210ME02 INDUSTRIAL PROCESS
ENGINEERING**

3 0 0 3

Course Objectives

- To impart the knowledge on production planning methodologies and layout design
- To learn about production planning and its control methods
- To provide the knowledge of work study, process charts and ergonomic condition
- To impart the knowledge on inventory control and material handling
- To learn about system analysis and different types of maintenance processes

Course Outcomes (COs)

1. Select proper plant layout for the required production system
2. Plan the resources required for the production and to perform the control methods
3. Apply work study method, prepare charts to outline the process and develop ergonomic condition suitable for the processes.
4. Analyze the inventory required based on production needs and material handling
5. Perform system analysis and use different types of maintenance process for smooth operations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1		1									2
2	3	3	1		2						2			2
3	1	3	3		2									2
4	2	3	1		2									2
5	2	3	1		2									2

UNIT I

9 Hours

INDUSTRIAL ENGINEERING AND PRODUCTION SYSTEM

Industrial engineering - Concept, History and development, Applications, Roles of Industrial engineer- Production management, Industrial engineering versus production management, operations management. Plant layout, Criteria for good layout, Types of layout - Process layout, Product layout, Combination layout and fixed position layout, Flow (material movement) pattern, Workstation Selection and design.

UNIT II

10 Hours

PROCESS PLANNING AND PRODUCTION CONTROL

Introduction to Process planning-Definition, Procedure, Process selection, Machine capacity, Process sheet.Process analysis - Group technology, classification and coding system, formation of component family - Production planning, loading, scheduling. Production control - dispatching, routing - Progress control bar, curve, Gantt chart, route and schedule chart.

UNIT III

8 Hours

WORK STUDY AND ERGONOMICS

Work study - Definition, Need, Advantages, objectives of method study and work measurement, method study procedure, Process chart - symbols, outline process chart, flow process chart, principles of motion economy, ergonomics- applications of ergonomic principles in the shop floor- work benches-seating arrangement, Industrial physiology.

UNIT IV

10 Hours

INVENTORY MANAGEMENT

Inventory control, classification, management, objectives, functions. Economic order quantity, Economic batch quantity, inventory models, ABC analysis, Material Requirement Planning (MRPI), Manufacturing Resource Planning (MRPII), Operating cycle, lean manufacturing, Supply chain management - Material handling.

UNIT V

8 Hours

SYSTEM ANALYSIS AND MAINTENANCE

System concept - system analysis, systems engineering, value engineering, value control, types of values. Plant maintenance - objectives, importance. Maintenance engineer - duties, functions and responsibilities. Types - breakdown, scheduled, preventive and predictive - Plant maintenance schedule, Condition monitoring.

Total: 45 Hours

Reference(s)

1. Khanna O.P., Industrial Engineering and management, Dhanpat Rai Publications.,2010
2. Martand T.Telsang, Industrial Engineering and Production Management, S Chand Publishers,2006
3. Panneerselvam R., Production and operations management, Heritage Publishers, 2006
4. Ravi Shankar, Industrial Engineering and Management, Golgotia Publications Pvt. Ltd., New Delhi, 2009

21OME03 MAINTENANCE ENGINEERING**3 0 0 3****Course Objectives**

- To understand the principles, objectives and importance of maintenance adopted in industry for successful progress.
- To introduce different maintenance categories, its merits and types of lubrication.
- To expose the idea of condition monitoring, methods and instruments used for allied measurements.
- To learn about failure analysis and repair methods for few mechanical elements.
- To promote computerization in maintenance and inventory management.

Course Outcomes (COs)

1. Explain the principles, objectives and importance of maintenance adopted in industry.
2. Select the suitable maintenance category and lubrication type.
3. Apply the appropriate methods and instruments for condition monitoring.
4. Analyze the failures of mechanical systems and select suitable repair methods.
5. Utilize computers in maintenance and inventory management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												2
2	2	2												2
3					2	2	1							2
4	1	2	1		2	2	2							2
5	2	2	2		1	1	1							2

UNIT I**9 Hours****PRINCIPLES OF MAINTENANCE PLANNING**

Basic principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound maintenance systems - Maintenance organization - Maintenance economics.

UNIT II**9 Hours****MAINTENANCE CATEGORIES AND LUBRICATION**

Maintenance categories - Comparative merits of each category - Preventive maintenance, Maintenance schedules, Repair cycle - Total Productive Maintenance - Principles and methods of lubrication.

UNIT III **9 Hours**

CONDITION MONITORING

Condition based maintenance - Cost comparison with and without Condition Monitoring - Methods and instruments for condition monitoring - Noise, vibration, wear and temperature measurement.

UNIT IV **9 Hours**

FAILURE ANALYSIS AND REPAIR METHODS

Failure analysis - Failures and their development - Role of Non Destructive Testing in failure analysis - Repair methods for bearings, cylinder block, fuel pump, shaft.

UNIT V **9 Hours**

COMPUTER AIDED MAINTENANCE MANAGEMENT

Approach towards Computerization in maintenance - computer-aided maintenance management system (CAMMS) - Advantages of CAMMS - spare parts and inventory centre performance reporting.

FURTHER READING

Retrofitting, objectives, classification of retrofitting, cost effectiveness through retrofitting (economical aspects), circumstances leading to retrofitting, features and selection for retrofitting.

Total: 45 Hours

Reference(s)

1. Srivastava S.K, Maintenance Engineering, S Chand and Company, 2010.
2. Mishra R.C, Pathak K, Maintenance Engineering and Management, Second edition, Prentice Hall India Learning Pvt. Ltd., 2012.
3. Keith Mobley R, Lindley R. Higgins and Darrin J. Wikoff, Maintenance Engineering Handbook, Seventh edition, McGraw-Hill Professional, 2008.
4. Davies A, Handbook of Condition Monitoring: Techniques and Methodology, Springer, 2012.
5. Otegui Jose Luis, Failure Analysis, Fundamentals and Applications in Mechanical Components, Nineteenth edition, Springer, 2014.

210ME04 SAFETY ENGINEERING**3 0 0 3****Course Objectives**

- To study the principles of safety management system.
- To introduce the provisions contained in the industrial laws.
- To provide knowledge on safety requirements for engineering industry.
- To learn safety requirement for chemical industry.
- To study the various safety measures adopted in construction industries.

Course Outcomes (COs)

1. Explain safety management system of an industry.
2. Implement the provisions of acts and rules in industries.
3. Implement and review the safety performance followed in various industries
4. Evaluate safety appraisal in chemical industries.
5. Generate safety reports on construction industries.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1					2	1		1						2
2					1			3					2	1
3	2											3	1	
4	2	3							2				2	
5					2					3				3

UNIT I**8 Hours****SAFETY MANAGEMENT**

Concepts - Evolution, International Labour Organization (ILO), National Safety Council, Techniques - Job Safety Analysis (JSA), Safety survey, Safety inspection, Safety Sampling, Accident Reporting and Investigation - Concept of an accident, Accident causation models, cost of accident, investigation, Safety Performance Monitoring - Safety indices.

UNIT II**10 Hours****SAFETY AND LAW**

Factory Act 1948-Safety and Health chapters, Tamil Nadu Factories Rules- Safety and Health chapters, Environment and Pollution Laws, Building and other construction works act 1996, Electricity Rules.

UNIT III**10 Hours****SAFETY IN ENGINEERING INDUSTRIES**

Safety in machine shop,- Principles of machine guarding - Personal protective equipment-Safety in handling industrial gases - Safety in cold forming and hot working of metals- Safety in finishing, inspection and testing, heat treatment, electro plating, leak test, radiography.

UNIT IV **9 Hours**

SAFETY IN CHEMICAL INDUSTRIES

Safety in process design, unit operations, pressure vessel, heat exchanger, safety valves -Plant commissioning and inspection, pressure vessel, Plant maintenance and emergency planning, management of maintenance HAZOP study.

UNIT V **8 Hours**

SAFETY IN CONSTRUCTION INDUSTRY

Construction regulations, contractual clauses, permit to work, - Education and training-Hazards of construction and prevention- excavation, scaffolding, dismantling, road works, construction of high rise buildings - Working at heights,-Working on fragile roofs, work permit systems- Construction machinery, cranes, chain pulley blocks, earth moving equipment, conveyors- Manual handling, Safety in demolition work, - Safety in confined spaces

FOR FURTHER READING

Case Studies- Major accidents at Flixborough, UK, Seveso, Italy, Victoria Dock, India, Bhopal, India.

Total: 45 Hours

Reference(s)

1. Blake R.B., Industrial Safety, Prentice Hall, Incorporated, New Jersey,1973.
2. National Safety Council, Accident Prevention Manual for Industrial Operations, Chicago, 1988
3. Subramanian V., The Factories Act, 1948, with Tamil Nadu Factories Rules , 1950, Madras
4. Environmental Pollution Control Act, 1986
5. BOCW Act,1996, Madras Book agency, Chennai-1
6. Explosive Act, 1884, Eastern Book Company, Lucknow -266 001.

22OBT01 BIOFUELS**3 0 0 3****Course Objectives**

- To understand and explore the scope of biofuels the most efficient renewable source of energy.
- To develop the expertise in the technology pertaining to their generation and employment in order to surrogate the existing conventional fuels and hence strives towards sustainable development
- To give way to the bolster green technology and incline towards more eco-friendly options.

Course Outcomes (COs)

1. Apply the bio resources that can be used for the production of biofuels.
2. Analyze the physical and chemical properties of the biodiesel.
3. Analyze the mechanisms of improvising the quality and performance of engines using biofuels
4. Analyze the bio-fuel conversion technologies and their environmental attributes
5. Evaluate the designing aspects of major unit processes/operations of an integrated bio-refinery

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1		2				3								1
2	2						1								3
3	1						3								2
4	2						3								3
5	1						1								

UNIT I**9 Hours****CLASSIFICATION AND RESOURCES**

Introduction, biofuel as a renewable energy, classification of biofuels - First, second, third and fourth generation biofuels, different plant sources as biofuel feed stocks, Biogases, physical and chemical characteristics of vegetable oils - iodine number, hydroxyl, acid values, rancidity, hydrogenolysis and hydrolysis, Food vs energy.

UNIT II**9 Hours****BIODIESEL**

Definition, basics and chemistry of biodiesel, vegetable oils in biodiesel production, Trans esterification: Chemical methods, enzymatic methods and types of catalysts, separation and purification, physical properties and characterization of biodiesel - Cloud point, pour point, cold filter plugging point, flash point, viscosity and cetane number.

UNIT III

9 Hours

QUALITY BIODIESEL AND ENVIRONMENT

Producing Quality Biodiesel, quality control, test methods, ASTM specifications. Oxidative and thermal stability, estimation of mono, di, triglycerides and free glycerol, engine performance test, blending of ethanol with biodiesel, blending of biodiesel with high speed diesel (HSD) and their combustion properties.

UNIT IV

9 Hours

BIOETHANOL AND BIOGASES

Ethanol as a fuel, microbial and enzymatic production of ethanol from biomass - lignocellulose, sugarcane, sugar beet, corn, wheat starch, and purification - wet and dry milling processes, saccharification-chemical and enzymatic. Production of bio methane and bio hydrogen.

UNIT V

9 Hours

BIOREFINERIES

Definition and types of biorefineries, co-products of biorefineries-oil cake and glycerol, purification of glycerol obtained in biodiesel plant; anaerobic and thermal gasification of biomass, economics of biorefineries.

Total: 45 Hours

Reference(s)

1. Caye Drapcho, John Nghiem and Terry Walker, Biofuels Engineering process technology, McGraw Hill Professional, 2008.
2. Mousdale, Biofuels, CRC Press, 2008
3. Ahindra Nag, Biofuels Refining and Performance, McGraw-Hill Professional, 2007.
4. Lisbeth Olsson, Biofuels (Advances in Biochemical Engineering/ Biotechnology), Springer, 2007

22OFD01 TRADITIONAL FOODS**3 0 0 3****Course Objectives**

- Understand the importance of traditional foods and food habits
- Know the traditional processing of snack, sweet and dairy food products
- Infer the wide diversity and common features of traditional Indian foods and meal patterns.

Course Outcomes (COs)

1. Justify the processing methods of traditional foods in terms of its health benefits
2. Assess the production methods of traditional sweets, snacks and dairy products
3. Differentiate Traditional fermented foods products based on its raw material
4. Implement a large scale production of tradition foods for its increased consumption
5. Compare the health aspects of traditional foods with modern foods

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													
2		1												
3	2	1	1											
4								2						
5								2						

UNIT I**9 Hours****TRADITIONAL METHODS OF FOOD PROCESSING**

Introduction - food culture -geographical features and food. Traditional methods of milling grains - rice, wheat and corn - equipment and processes as compared to modern methods. Equipment and processes for edible oil extraction- comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation - sun-drying, osmotic drying, brining, pickling and smoking.

UNIT II**9 Hours****TRADITIONAL SWEETS, SNACKS AND DAIRY PRODUCTS**

Production, formulation, preparation and processing of Indian traditional sweet and snack food products:-Rasgolla, Gulab jamun; formulation and preparation of namkeen, potato chips, banana chips. Acid coagulated and fermented dairy products- paneer, dahi, shrikhand, lassi - processing conditions, defects etc. Fat rich products- Butter, ghee and its processing.

UNIT III

9 Hours

TRADITIONAL FERMENTED FOOD PRODUCTS

Idli, Soya sauce, fish pickle, dry fish, meat and vegetable fermented products. Various alcohol based products. Ways to increase nutritional quality of food such as enrichment, fortification, fermentation and mutual supplementation. Best cooking and processing methods to retain nutrients

UNIT IV

10 Hours

COMMERCIAL PRODUCTION OF TRADITIONAL FOODS

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods -types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods - ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters

UNIT V

8 Hours

HEALTH ASPECTS OF TRADITIONAL FOODS

Comparison of traditional foods with typical fast foods / junk foods - cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

Total: 45 Hours

Reference(s)

1. Sen and Colleen Taylor, Food Culture in India, Greenwood Press, 2005.
2. Davidar, Ruth N. "Indian Food Science: A Health and Nutrition Guide to Traditional Recipes:" East West Books, 2001.
3. Steinkrus.K.H. Handbook of Indigenous Fermented Foods, CRC press, 1995.
4. Aneja. R.P, Mathur.BN, R.C. Chandan,and Banerjee.A.K. Technology of Indian Milk Products. Dairy India Year Book, 2009.

22OFD02 FOOD LAWS AND REGULATIONS**3 0 0 3****Course Objectives**

- Introduce the concept of food hygiene, importance of safe food and laws governing it
- Learn common causes of food borne illness - viz. physical, chemical and biological and identification through food analysis
- Understand food inspection procedures employed in maintaining food quality

Course Outcomes (COs)

1. Analyse the food safety strategies and nutritional quality of the food
2. Check the food regulatory mechanism and mandatory laws for food products
3. Determine the national and international regulatory agencies
4. Understand and apply the voluntary regulatory standards
5. Assess the implementation of food safety for a food processing industry

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1											
2		1				1	2	1						
3		1												
4	1	2												
5	1	2												

UNIT I**10 Hours****INTRODUCTION**

Introduction, concept of food safety and standards, food safety strategies. Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical hazards. Preventive food safety systems - monitoring of safety, wholesomeness and nutritional quality of food. Prevention and control of physical, chemical and microbiological hazards. Principles of food safety - Establishment: design and facilities - emergency preparedness - Maintenance cleaning and sanitation - personal hygiene - packaging and labelling - transportation - traceability - recall procedure - visitor policy. Adulteration: Intentional and unintentional - Preservatives - antioxidants, sweeteners, flavours, colours, vitamins, stabilizers - indirect additives - organic residues - inorganic residues and contaminants.

UNIT II**10 Hours****FOOD LAWS**

Indian and Food Regulatory Regime (Existing and new), PFA Act and Rules, Food Safety and Quality Requirements, Additives, Contaminants and Pesticide Residue. Food Safety and Standards Act, 2006, FSSAI roles and responsibilities, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR)

WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.

UNIT III

10 Hours

REGULATIONS

Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Role of Agricultural and Processed Food Products Export Development Authority (APEDA), Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK. Nutritional Labelling, Health claims.

UNIT IV

10 Hours

STANDARDS

Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices ISO 9000, ISO 22000, ISO 14000, ISO 17025, PAS 22000, FSSC 22000, BRC, BRCIOP, IFS, SQF 1000, SQF 2000. Role of NABL, CFLS.

UNIT V

5 Hours

IMPLEMENTATION AND RISK ASSESSMENT

Implementation of food safety for a desired food processing industry. Risk assessment studies: Risk management, risk characterization and communication.

Total: 45 Hours

Reference(s)

1. Singal RS (1997). Handbook of indices of food quality and authenticity. Woodhead Publ. Cambridge, UK.
2. Shapton DA (1994). Principles and practices of safe processing of foods. Butterworth Publication, London. Winton AL (1999) Techniques of food analysis, Allied Science Publications New Delhi.
3. Pomeranze Y (2004). Food analysis - Theory and Practice CBS Publications, New Delhi.
4. Jacob MB (1999). The chemical analysis of foods and food products. CBS Publ. New Delhi

**22OFD03 POST HARVEST TECHNOLOGY OF
FRUITS AND VEGETABLES**

3 0 0 3

Course Objectives

- To understand the importance and different methods of post-harvest handling and storage of fruits and vegetables.
- To gain knowledge on different preservation methods of fruits and vegetables
- To familiarize with the value added products from fruits and vegetables

Course Outcomes (COs)

1. Implement the different post-harvest handling practices for the storage of fruits and vegetables
2. Analyze the suitable preservation method (sugar, salt or dehydration) to produce value added products from fruits and vegetables
3. Evaluate the requirement of low temperature and irradiation methods to preserve specific fruits and vegetables
4. Apply the concentration and fermentation methods to preserve fruits and vegetables
5. Implement the canning method to preserve fruits and vegetables

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	2	1			1							
2	1	1												
3	1	2												
4	1		1											
5	2	1	1											

UNIT I

9 Hours

POST-HARVEST PRACTICES AND PROCESSING

Maturity indices for harvesting; pathological spoilage's during storage, ripening and control measures, Post-harvest handling, sorting & grading, packaging, storage, transportation, Methods of pre-cooling, post-harvest treatments to hasten and delay ripening; Methods of storage at farm level - cold storage, controlled/modified atmosphere storage, Quality management, export requirements, Nutritive value, nutraceutical properties

UNIT II

9 Hours

PRESERVATION AND VALUE ADDITION

General principles and methods of fruit and vegetable preservation. Preservation using sugar: Principle and Preparation of jam, jelly, marmalade, squash, RTS, carbonated beverages, crush, nectar, cordial, fruit bar, preserves, candies and carbonated fruit beverages. Processing using salt: Principle - Brining - Preparation of pickles, chutney and sauces, ketchup.

UNIT III

9 Hours

PRESERVATION BY LOW TEMPERATURE AND IRRADIATION

Preservation by low temperature: definition, principle, methods - Refrigeration, freezing. Methods of freezing- changes during freezing. Preparation of frozen foods. Minimal Processing of Fruits and Vegetables - techniques involved - Preservation by irradiation: definition-principle, application, irradiation unit.

UNIT IV

9 Hours

PRESERVATION BY DRYING

Machineries involved in processing of fruits and vegetables products. Drying and dehydration: definition, principle, Types of driers: Solar, cabinet, spray drier, drum drier, fluidized bed drier. Preparation of product for dehydration. Dehydration principles and equipment. Preparation of fruits - powder production. Problems related to storage of dehydrated products.

UNIT V

9 Hours

PRESERVATION BY CANNING

Canning: principles, Types of cans, packing of canned products-preparation of canned products - general considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit- spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations.

Total: 45 Hours

Reference(s)

1. S.Ranganna, HandBook of Analysis and Quality Control for Fruit and Vegetable Products, McGraw Hill Education (India) Private Limited, Chennai, 2017
2. N.W. Desrosier, the Technology of Food Preservation, CBS Publisher & Distributions, New Delhi, 1987.
3. R.P. Srivastava and S. Kumar, Fruit and Vegetable Preservation: Principles and Practices, Second Edition, International Book Distribution Co., Lucknow, 1998.
4. G. Lal, G. Siddappa and G.L. Tondon, Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi, 1986.
5. Chakraverty, A.S. Mujumdar, G.S.V. Raghavan and H.S. Ramaswamy, Handbook of Post-harvest Technology, Marcel Dekker Press, USA, 2001.
6. D.K. Salunkhe, and S.S. Kadam, Handbook of Fruit Science and Technology: Production, Composition and Processing, Marcel Dekker, New York, 1995.

**22OFD04 CEREAL, PULSES AND OILSEED
TECHNOLOGY**

3 0 0 3

Course Objectives

- Understand the application of scientific principles in the processing technologies specific to the materials
- Understand the storage methods and handling techniques followed for cereals, pulses and oil seeds
- Develop the knowledge in the area of Cereals, pulses and oil seed processing and technology

Course Outcomes (COs)

1. Identify the specific processing technologies employed for cereals
2. Analyse the composition of millets and their nutritional importance
3. Relate the compositional changes and processing methods of pulses and legumes
4. Create the competence in processing of oilseeds technology
5. Relate the storage processing of food grains with quality aspects

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		2		2								
2	1	2		2		1								
3	2	2		1		2								
4	2	3		2		2								2
5	2	2		2		3								

UNIT I

9 Hours

CEREALS

Cereal Grains- Basic agricultural aspects, structure and composition; Storage, Insect control; Processing: Wheat- milling, (Atta and maida), quality aspects of flour, wheat proteins and their function, rheology of flour; wheat based baked products - Bread, Biscuit, Cakes, Extruded products, Pizza, Chapatis, malting and malt products; Rice-Milling, Parboiling, Quick cooking rice, Traditional Indian Products- Puffed Rice, flaked rice, Idli/Dosa/vada mixes and other savouries; Corn- Wet and dry milling, Corn Products - Corn flakes, Corn starch, canned corn products, puffed product; Oats-Milling, Oat Products - Steel cut, rolled oats, quick cooking; Traditional and Fermented cereal products.

UNIT II

9 Hours

OTHER CEREALS AND MILLETS

Sorghum, Pearl Millet, Finger millet, Foxtail Kodo Millet - Basic agricultural millet, aspects, structure and composition; storage, insect control; processing - pearling, Milling, Malting, Malt based

foods, flaked and fermented products; Traditional and Nutritional products based on finger millet.

UNIT III **9 Hours**

PULSES AND LEGUMES

Basic agricultural aspects, structure, composition, storage, insect control, processing Milling/splitting, dhal milling, products - puffed, flakes, flour, legume-based traditional products, flour based Indian sweets and savouries, soya milk, soya protein Isolate, soya paneer

UNIT IV **9 Hours**

OIL SEEDS AND NUTS

Basic agricultural aspects structure, composition, Storage, Insect control; processing: traditional and modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation; oil blends; applications of different oils and fats in food processing & products.

UNIT V **9 Hours**

STORAGE AND HANDLING

Bag Storage - Advantages and Disadvantages, Cover Plinth Storage Structures, CAP storage (Cover and Plinth Storage). Protection against Rodents, Fungi, Pests and Mites. Fumigation Processes for bag storage piles. Bulk Storage in silos and large Bins. Conveyors and Elevators for feeding and discharging.

Total: 45 Hours

Reference(s)

1. Chakraverty, A.: Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Co, Calcutta, 1995.
2. Delcour, Jan A. and R. Carl Hosney., Principles of Cereal Science and Technology, 3rd Edition, American Association of Cereal Chemists, 2010.
3. Karl Kulp, Handbook of Cereal Science and Technology, 2nd Rev. Edition, CRC Press, 2000.
4. N.L.Kent and A.D.Evans, Technology of Cereals (4th Edition) Elsevier Science (Pergaman),Oxford, UK, 1994.
5. Matz, Samuel A., The Chemistry and Technology of Cereals as Food and Feed, 2nd Edition,CBS, 1996.
6. Morris, Peter C. and J.H. Bryce., Cereal Biotechnology, CRC/Wood head publishing, 2004.

22OFT01 FASHION CRAFTSMANSHIP**3 0 0 3****Course Objectives**

- To impart theoretical and practical knowledge about various handi-craft techniques
- To enhance innovative skills on hand crafts.
- To build confidence on doing handicrafts.

Course Outcomes (COs)

1. Outline the classification, techniques and criteria for selecting raw materials for making various handicraft materials and produce textile based handicrafts. Produce various decorative and appealing products
2. Design and construct various wall hangings and fashion accessories.
3. Design and construct toys and accessories
4. Design and construct head accessories, home furnishings and paintings
5. Design and construct various decorative and appealing products for interiors

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	3				2		2	2		2	2	
2	3	2	3				1		2	3		2	2	
3	3	2	3				2		2	3		2	2	
4	3	2	3				2		2	3		2	2	
5	3	2	3				2		2	3		2	2	

UNIT I**9 Hours****TECHNIQUES OF HANDICRAFT MATERIALS**

Definition of Handicraft, Classification: Reusable, Non reusable, Raw materials used in various craft materials: printed, embroidered, stitched and handmade, Criteria for selection of raw materials: material types and end uses.

UNIT II**9 Hours****DECORATIVE AND APPEALING PRODUCTS - INTERIORS**

Designing and Construction procedures for following various decorative and appealing products: Wall hangings - String Art on plywood, Pressed Flower Art frames.

UNIT III**9 Hours****DECORATIVE AND APPEALING PRODUCTS - ACCESSORIES**

Designing and Construction procedures for following various decorative and appealing products: Handbags, Hats, footwear.

UNIT IV

9 Hours

DECORATIVE AND APPEALING PRODUCTS - ORNAMENTS

Designing and Construction procedures for following various decorative and appealing products: Stone necklace using Macrame Technique, Tribal Jewellery using woollen threads, Floral Jewellery using Resin Technique, Fabric Jewellery using Tie and Dye Technique.

UNIT V

9 Hours

DECORATIVE AND APPEALING PRODUCTS - FANCY ITEMS

Designing and Construction procedures for following various decorative and appealing products: Jewellery Box, Utility Holder, Gift items. Lampshade decors from cardboard, Driftwood Frames for pictures and Mirrors.

Total: 45 Hours

Reference(s)

1. Handmade in India: A Geographic Encyclopaedia of India Handicrafts. Abbeville press; 1 edition (October 20,2009)
2. Encyclopaedia of Card making Techniques (Crafts), Search Press Ltd, illustrated edition, 2007
3. All about Techniques in Illustration, Barron Educational Series, 2001
4. Printing by Hand: A Modern Guide to printing with Handmade stamps, Stencils and Silk Screens, STC Craft/A Melanie Falick Book, 2008
5. Materials & Techniques in the Decorative Arts: An Illustrated Dictionary, University of Chicago Press, 2000
6. <https://www.marthastewart.com/274411/fashion-crafts>

22OFT02 INTERIOR DESIGN IN FASHION**3 0 0 3****Course Objectives**

- To impart knowledge on interior design.
- To improve the design skills, sustainable with socially-conscious designs

Course Outcomes (COs)

1. Interpret the elements of interior design concepts and resolve the personality requirements
2. Develop graphical representations of interior design concepts
3. Resolve the space planning requirements of residential home as per CPWD guidelines
4. Determine the aesthetic requirements of interior design components.
5. Appraise the roles and responsibilities of interior designer.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3		-	1							2	
2	3	2	3		2	3		2					3	
3	3	3	3		2	2		2					2	
4	3	3	3		2	3		2					2	
5	3	2			2			3					3	

UNIT I**9 Hours****INTRODUCTION**

Interior designing - definition, importance, requirements and types - Structural design, Decorative Design -Designing interiors, Good taste; Design themes, types and application. Personality of the Home - Art elements - Line: types, characteristics and importance; form: size and shape, characteristics; Colour - sources, qualities, emotional effects, colour wheel and schemes.

UNIT II**9 Hours****GRAPHICAL PRESENTATIONS**

3D composition; Isometric and Axonometric- Still life- Furniture Sketching- Object Drawing with color rendering - Interior elements, Lighting, plants. Perspective, Axonometric Isometric drawing. Orthographic Projection - Lifts and escalators.

UNIT III**9 Hours****SPACE PLANNING**

Space planning concepts- interiors, circulation. Definition, application of ergonomic principals in interiors. Residential house space planning case study- CPWD guidelines. Lighting for different locations and activities, measurement, ventilation and indoor air quality, noise control methods.

UNIT IV

9 Hours

INTERIOR COMPONENTS

Application of colour in interiors; Texture - types and significance; Pattern: types and effects; Light - importance. Importance of Furniture Design for Interiors- Ancient Age / Middle Age / Contemporary. Doors, Windows, Staircase designs, False Ceiling, Partitions, Wall Panelling, Comics, Mosaic, Cladding- Flooring and Wall Cladding

UNIT V

9 Hours

ROLES AND RESPONSIBILITIES OF INTERIOR DESIGNER

Role of an Interior Designer- Responsibility towards society and need of an Interior Designer to better the environment- Ethics and Code of Conduct- Responsibility towards client, contractor and supplier, Estimation. Professional Fees- Work of an Interior Designer- Making of portfolio, JD Annual Design Awards.

Total: 45 Hours

Reference(s)

1. Joanna Gaines, *Homebody: A guide to creating spaces you never want to leave*, Harper design, 2018.
2. Erin gates, *Elements of Style: Designing a Home and a life*, Simon and Schuster, 2014.
3. Simon Dodsworth, *The Fundamentals of Interior Design*, AVA publishing, 2009.
4. V. Mary. Knackstedt, *The Interior Design Business Handbook: A Complete Guide to Profitability*, Wiley, New Jersey; 2006.
5. M. G. Shah, C. M. Kale, and S.Y. Patki, *Building Drawing with an Integrated Approach to Build Environment*, Tata McGraw Hill, 2002.
6. <https://eclectictrends.com>

22OFT03 SURFACE ORNAMENTATION**3 0 0 3****Course Objectives**

- To familiarize the students about the various techniques of surface embellishment with relevance to garment embellishments.
- To aware of various types of embroidery and methods of producing it.
- To make the students confident about doing surface embellishment work

Course Outcomes (COs)

1. Analyze the raw material requirements for surface ornamentation and its application
2. Implement hand embroidery stitches on fabric and show the stitch development procedure in diagrammatic representations
3. Apply the machine and computerized embroidery stitches
4. Analyze the surface embellishment techniques and its application
5. Assess the quality maintenance parameters of all embroidered products and analyze the 6 traditional embroidery techniques

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2					1						
2	2	3	2						2				2	2
3	2	3	2		3								2	2
4	2	2	2						2				2	2
5	2	2	2						2					2

UNIT I**9 Hours****INTRODUCTION TO SURFACE ORNAMENTATION**

Introduction, Definition, Need, Types, Raw materials, Importance of surface ornamentation, Selection of needle, thread and fabric for hand embroidery and machine embroidery. various methods of surface embellishment- embroidery and surface ornamentation.

UNIT II**9 Hours****HAND EMBROIDERY**

General rules for hand embroidery. Types of hand embroidery stitches-Running, Couching, Button hole, Satin, Long & Short, Wheat, Chain, Stem, Herringbone, Cross stitch, Knotted stitches, Fish bone, Fly stitch, Braids, Back, Hem, Seed, Needle weaving, Whip stitches.

UNIT III**9 Hours****MACHINE EMBROIDERY**

General rules for machine embroidery. Types of frames and methods of transferring the designs. Attachments to sewing machines for embroidery, Types of machine embroidery stitches- Eyelet work, Cut work, patch work, Mirror work, Applique, Shaded embroidery, Shadow work, Bead and Sequins work, Vermicelli, Zigzag, Granite stitch. Computerized

embroidery machine- Concept of design and development, software used in embroidery machines, process of designing, method and types of stitch application, punching and digitizing.

UNIT IV **9 Hours**

EMBELLISHMENT TECHNIQUES

Materials used and Applications. Types of embellishment techniques- fabric painting-hand, Stencil-dabbing and Spraying. Dyeing and printing-advanced tie and dye techniques, batik and block printing. Trimmings and decorations-Laces, Pompons, Fringes, Tassels, Tucks, Show buttons, Crocheting.

UNIT V **9 Hours**

TRADITIONAL EMBROIDERIES OF INDIA AND CARE

Care and maintenance of embroidered articles-care and maintenance methods for embroidered apparel, pressing. Traditional Embroideries of India-Phulkari, Kasuti, Kashmiri embroidery, Kutch work, Chikkankari, Kantha.

Total: 45 Hours

Reference(s)

1. Ruth Chandler, Modern Hand Stitching-Dozens of stitches with creative free-form variations,2014
2. Sophie Long, Mastering the Art of Embroidery: Traditional Techniques and Contemporary Applications for Hand and Machine Embroidery, Heritage Publishers, London, 2013
3. Christen Brown ,Embroidered & Embellished, C&T Publishing, 2013
4. Sheila Paine, Embroidered Textiles, Thames and Hudson Publisher, UK, 1990.
5. Gail Lawther, Inspirational Ideas for Embroidery on Clothes & Accessories, Search Press Ltd, UK, 1993.
6. <http://www.needlenthread.com/tag/hand-embroidery-stitches>

22OPH01 NANOMATERIALS SCIENCE**3 0 0 3****Course Objectives**

- Impart knowledge on Nanoscience
- Explore different techniques of producing nanomaterials
- Create expertise on the applications of nanomaterials in various fields

Course Outcomes (COs)

1. Summarize the origin and advance of nanomaterials and its classification
2. Compare the different types of methods adopted for synthesizing nanomaterials
3. Analyze the characterization techniques for analyzing nanomaterials
4. Explain the physical properties exhibited by nanomaterials
5. Organize the nanomaterials developed for advanced technological applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1												
2	2	2												
3	3	1												
4	1	1												
5	2	3												

UNIT I**9 Hours****NANO SCALE MATERIALS**

Introduction-Feynman's vision-national nanotechnology initiative (NNI) - past, present, future -classification of nanostructures, nanoscale architecture - effects of the nanometer length scale - changes to the system total energy, and the system structures- effect of nanoscale dimensions on various properties -differences between bulk and nanomaterials and their physical properties.

UNIT II**9 Hours****NANOMATERIALS SYNTHESIS METHODS**

Top down processes - mechanical milling, nanolithography and types based on radiations - Bottom up process physical method: physical vapour deposition, RF sputtering, CVD- chemical method: colloidal and sol-gel methods - template based growth of nanomaterials - ordering of nanosystems, self-assembly and self-organization.

UNIT III

9 Hours

CHARACTERIZATION TECHNIQUES

General classification of characterization methods - analytical and imaging techniques - microscopy techniques - electron microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy - diffraction techniques - X-ray spectroscopy - thermogravimetric analysis of nanomaterials.

UNIT IV

9 Hours

SEMICONDUCTOR NANOSTRUCTURES

Quantum confinement in semiconductor nanostructures - quantum wells, quantum wires, quantum dots, super lattices-epitaxial growth of nanostructures-MBE, metal organic VPE, LPE - carbon nano tubes- structure, synthesis and electrical properties -applications- quantum well laser- quantum efficiency of semiconductor nanomaterials

UNIT V

9 Hours

NANOMACHINES AND NANODEVICES

Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS)- fabrication, actuators-organic FET- principle, description, requirements, integrated circuits- single electron transistor - - organic photovoltaic cells- spintronics

Total: 45 Hours

Reference(s)

1. Willam A. Goddard, Donald W. Brenner, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, 2012
2. Charles P. Poole Jr and. Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2007
3. Guozhong Cao, Y. Wang, "Nanostructures and Nanomaterials-Synthesis, Properties & Applications", Imperials College Press, 2011.
4. T. Pradeep, "NANO: The Essentials Understanding Nanoscience and Nanotechnology", McGraw - Hill Education (India) Ltd, 2012
5. Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley and Sons Ltd, 2006
6. Viswanathan B, AuliceScibioh M, "Fuel cells: Principles and Applications", University Press, 2009.

22OPH02 SEMICONDUCTOR PHYSICS AND DEVICES

3 0 0 3

Course Objectives

- Impart knowledge in physical properties of semiconducting materials
- Analyze the factors affecting the operation of semiconductor devices
- Apply the physics of semiconductors to develop semiconductor devices

Course Outcomes (COs)

1. Exemplify the band gap, drift and diffusion current densities due to carrier transport in semiconductors
2. Analyze the energy band diagram in thermal equilibrium and space charge width of PN junction
3. Illustrate the operation of Bipolar Junction transistor at different modes and different configurations
4. Illustrate the operation of metal oxide field effect transistor and their memory devices
5. Represent the working mechanism of opto-electronic devices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

UNIT I

9 Hours

ENERGY BANDS AND CARRIER TRANSPORT PROPERTIES

Energy Bands: Formation of energy bands - doping effects - energy levels - electron and hole concept in semiconductor. Carrier transport: Carrier drift-current density - conductivity-diffusion current density - total current density

UNIT II

9 Hours

P-N JUNCTION

Basic structure and fabrication process of p-n junction - current - voltage characteristics - energy band diagram - equilibrium Fermi levels - depletion region - junction breakdown phenomena - zener - avalanche breakdown.

UNIT III

9 Hours

BIPOLAR JUNCTION TRANSISTOR

The basic transistor action - operation in the active mode - current gain - static characteristics - carrier distribution in emitter, base and collector region - modes of operation - current - voltage characteristics of common base and emitter configuration - frequency response and switching of bipolar transistor

UNIT IV

9 Hours

MOSFET

The ideal MOS diode - basic fundamentals and characteristics - types - CMOS and BiCMOS - CMOS inverter - MOSFET on insulator - thin film transistor (TFT) - silicon on insulators (SOI) devices - MOS Memory structures - DRAM and SRAM

UNIT V

9 Hours

PHOTONIC DEVICES

Radiative transitions and optical absorption-light emitting diodes-organic LED - infrared LED - semiconductor laser - temperature effect - photo detector - photo diode - silicon and compound semiconductor solar cells - efficiency

Total: 45 Hours

Reference(s)

1. Donald A Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, 2012
2. S. M. Sze and M. K. Lee, "Semiconductor Devices, Physics and Technology", John-Wiley & Sons, 2015
3. Ben. G. Streetman and S. K. Banerjee , "Solid State Electronic Devices", Pearson Education Ltd, 2015
4. C. Kittel, "Introduction to Solid State Physics", John-Wiley & Sons, 2012
5. J. Millman and C. Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, 2010
6. Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006

22OPH03 APPLIED LASER SCIENCE**3 0 0 3****Course Objectives**

- Impart knowledge on laser science
- Explore different strategies for producing lasers
- Create expertise on the applications of lasers in various fields

Course Outcomes (COs)

1. Illustrate the transition mechanisms and the components of a laser system
2. Compare the different types of lasers based on pumping method, active medium and energy levels
3. Compute the rotation of earth, velocity and distance using lasers and apply the same for day today applications
4. Analyze the role of lasers in surgical and endoscopy applications
5. Apply the laser techniques in industrial applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	1												
4	2	1												
5	1	2												

UNIT I**9 Hours****LASER FUNDAMENTALS**

Introduction - principle - absorption and emission of light - thermal equilibrium - Einstein's prediction - Einstein's relations - A and B coefficients - condition for large stimulated emission - spontaneous and stimulated emission in optical region - light amplification - condition for light amplification - population inversion- Components of lasers - pumping methods - pumping mechanisms - optical resonator

UNIT II**9 Hours****LASER BEAM CHARACTERISTICS AND TYPES**

Characteristics of laser - Classification of lasers - principle, construction, working, energy level diagram and applications of molecular gas laser (CO₂ laser) - liquid laser (dye laser) - excimer laser - Solid state laser (Nd:YAG laser) - semiconductor laser (homojunction laser).

UNIT III

9 Hours

LASERS IN SCIENCE

Introduction - Harmonic generation (SHG) - Stimulated Raman emission - lasers in chemistry - laser in nuclear energy - lasers and gravitational waves - rotation of the earth - measurement of distance - Light detection And Ranging (LIDER) - velocity measurement - holography

UNIT IV

9 Hours

LASERS IN MEDICINE AND SURGERY

Light induced biological hazards: Eye and skin - Eye laser surgery - photocoagulations - homeostasis - dentistry - laser angioplasty - different laser therapies - advantages & disadvantages - laser endoscopy.

UNIT V

9 Hours

LASERS IN INDUSTRY

Applications in material processing: laser welding - hole drilling - laser cutting - Lasers in electronics industry: information storage - bar code scanner- Lasers in defence: laser based military weapons - laser walls.

Total: 45 Hours

Reference(s)

1. K. Thiyagarajan and A. K. Ghatak, "LASERS: Fundamentals and Applications", Springer, USA, 2015
2. M. N. Avadhanulu, "An Introduction to Lasers Theory and Applications", S. Chand Publisher, 2013
3. W. Koechner, M. Bass, "Solid State Lasers: a graduate text", Springer Verlag, New York, 2006
4. K. P. R. Nair, "Atoms, Molecules and Lasers", Narosa Publishing House, 2009
5. K. R. Nambiar, "Lasers: Principles Types and Applications", New Age International Publications, 2006
6. A. Sennaroglu, "Solid-State Lasers and Applications", CRC Press, 2006

22OPH04 BIO-PHOTONICS**3 0 0 3****Course Objective:**

- To understand the light-matter interaction in biological cells or tissues by using the principles of optics and lasers.
- To apply the properties of biological cells or tissues in biomedical applications by various optical imaging, sensing and activation techniques.
- To analyze the concepts of Modern optical measurement techniques and devices in early detection of disease and cure them.

Course Outcomes (COs)

1. Infer the laws of optics and lasers to interpret the biological cells and tissues.
2. Identify the properties of different optical instruments in biological systems to represent their behavior in structure and design of detection engineering instruments.
3. Use laser tweezers techniques to infer the activities of cells (tissues) and explain the single molecule detection processes in medical diagnosis.
4. Outline the properties of ultra short laser pulses and tissue engineering to rectify the affecting factors in biological cells.
5. Compare the various types of bio-imaging methods to detect the infected cells and molecules in biological science.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	3	2												
3	3	2							3					
4	3	2							3					
5	3	2												

UNIT I**9****Hours****INTRODUCTION TO BIOPHOTONICS**

Light as Photon Particles – Coherence of light - lasers – classification of lasers – Mechanisms of Non-linear Optics (NLO) processes associated with Biophotonics - Light scattering mechanisms: Rayleigh scattering, Miescattering, Brillouin Scattering, Raman Scattering - Different light sources – Quantitative description of light: Radiometry

UNIT II **9 Hours**

PHOTOBIOLOGY

Interaction of light with cells and tissues – Light – Tissue Interaction Variables – Light – Tissue Interaction Theory: Radiative Transport Theory – Photo process in biopolymers – In Vivo Photoexcitation – photo-induced physical, chemical, thermal and mechanical effects in biological systems – Optical biopsy – Single molecule detection

UNIT III **9 Hours**

BIO-NANO-PHOTONICS

Laser Microtools, Semiconductor quantum dots for bioimaging, Metallic nanoparticles and nanorods for biosensing – Optical biosensors: Fibre-Optic, evanescent wave, surface Plasmon resonance (SPR) based biosensors – biomaterials for photonics – Principle and design of laser tweezers – laser trapping and dissection for biological manipulation.

UNIT IV **9 Hours**

TISSUE ENGINEERING WITH LIGHT

Basics of tissue optics: Light absorption and scattering in tissues, Wavelength effects and spectra– the therapeutic window, Light penetration in tissues – Absorbing agents in tissues and blood –Skinoptics, response to the UV radiation, Optical parameters of tissues – tissue welding – tissue contouring – tissue regeneration – Femto laser surgery – low level light therapy and photo dynamic therapy

UNIT V **9 Hours**

BIO-IMAGING TECHNIQUES AND ITS APPLICATIONS

An overview of optical imaging – Fluorescence Microscopy – Scanning Microscopy – In vivo Confocal Microscopy – Multi photon Microscopy – Optical Coherence Tomography (OCT) – Fluorescence Resonance Energy Transfer (FRET) imaging – fluorescence lifetime imaging Microscopy (FLIM) – Nonlinear optical imaging – Coherent Anti-stokes Raman Scattering – Bioimaging Applications.

Total: 45 Hours

Reference(s)

1. Introduction to Biophotonics, ParasN.Prasad, WileyInter-science, AJohnWiley & Sons, Inc., Publication (Class notes are developed mainly based on this book.)
2. Introduction to Biomedical Imaging, Andrew G.Webb, 2002, IEEE Press.
3. Biomedical Optics: Principles and Imaging, Lihong.V.Wang, Hsin.-I.Wu, 2007, Wiley Interscience 2007. & "An Introduction to Biomedical Optics", R.Splinterand B.A.Hooper, Taylor & Francis
4. Bioimaging Current Concepts in Light and Electron Microscopy, DouglasE.Chandler & Robert W.Roberson, Jones and Bartlett publishers.
5. Optical Imaging and Microscopy : Techniques and Advanced Systems, Peter Török and Fu-JenKao, 2004, Springer.

22OPH05 PHYSICS OF SOFT MATTER**3 0 0 3****Course Objectives**

- To recognize the properties of soft matter and hard matter
- To understand the fundamental interactions of colloids and gels
- To explain the structure and phase behavior of liquid crystals and supramolecules
- To summarize the soft matter properties of structures and components of life

Course Outcomes (COs)

1. Identify the salient features of soft matter and hard matter
2. Exemplify the fundamental interactions and stability of colloids and gels
3. Illustrate the structure and properties of liquid crystals
4. Outline the aggregation and phase behavior of surfactants, polymers, copolymers and block copolymers
5. Analyze the soft matter behavior of nucleic acids, proteins, polysaccharides and membranes

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	2												
4	2	2												
5	2	2												

UNIT I**9 Hours****CONDENSED MATTER**

Intermolecular forces-Condensation and freezing-mechanical response: Hookean solid-Newtonian liquid-viscoelasticity. Glasses: relaxation time-viscosity- glass forming liquids. Soft matter: length scales-fluctuations and Brownian motion

UNIT II**9 Hours****COLLOIDAL DISPERSIONS & GELS**

Forces between colloidal particles: vander Waals forces-electrostatic double layer forces-steric hindrance-depletion interactions. Stability and phase behaviour: Crystallisation-strong colloids-weak colloids.Physical and chemical gels-classical theory of gelation-elasticity of gels

UNIT III **9 Hours**

LIQUID CRYSTALS

Liquid crystal phases-distortions and topological defects-electrical and magnetic properties-polymer liquid crystals-Fredricks transition and liquid crystal displays

UNIT IV **9 Hours**

SUPRAMOLECULAR SELF ASSEMBLY

Aggragation and phase separation-types of micelles- bilayers and vesicles. Phase behaviour of concentrated surfactant solutions-phase separation in polymers, copolymers and block copolymers

UNIT V **9 Hours**

SOFT MATTER IN NATURE

Components and structures of life-Nucleic acids-proteins-interaction between proteins-polysaccharides-membranes

Total: 45 Hours

REFERENCES

1. Richard A L Jones, *Soft Condensd Matter*, Oxford University Press, UK, 2002
2. Masao Doi, *Soft Matter Physics*, Oxford University Press, UK, 2013.
3. Ian W. Hamley, *Introduction to Soft Matter*, John Wiley & Sons, 2007
4. A. Fernandez-Nieves, A M Puertas, *Fluids, Colloids and Soft materials: An Introduction to Soft Matter Physics*, John Wiley & Sons, 2016
5. Maurice Kleman, Oleg D. Lavrentovich, *Soft Matter Physics: An Introduction*, Springer-Verlag, New York, 2003.

22OCH01 CORROSION SCIENCE AND ENGINEERING

3 0 0 3

Course Objectives

- Analyse the loss incurred due to corrosion in different sectors and terminologies related to corrosion
- Identify forms and types of corrosion with suitable mechanism
- Apply various methods of corrosion control, corrosion testing and monitoring

Course Outcomes (COs)

1. Explain if corrosion can occur under specific operating conditions in a given equipment or construction and indicate regions of immunity, corrosion and passivity of a metal
2. Compare different corrosion types on metals when exposed to air, water and at high temperatures (> 100 C)
3. Identify the corrosion mechanism on steel, iron, zinc and copper metal surfaces
4. Calculate the rate of corrosion on metals using electrochemical methods of testing
5. Propose the correct materials, design and operation conditions to reduce the likelihood of corrosion in new equipment and constructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

UNIT I

9 Hours

CORROSION

Importance of corrosion - spontaneity of corrosion - units of corrosion rate (mdd and mpy) - direct and indirect damage by corrosion - importance of corrosion prevention in industries - Pilling Bedworth ratio and its significance - passivation - area relationship in both active and passive states of metals - Pourbaix diagrams of Mg, Al and Fe and their advantages and disadvantages

UNIT II

7 Hours

TYPES OF CORROSION

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion-Catastrophic oxidation corrosion

UNIT III

9 Hours

MECHANISM OF CORROSION

Hydrogen embrittlement - corrosion fatigue - filiform corrosion - fretting damage and microbes induced corrosion. Corrosion mechanism on steel, iron, zinc and copper metal surfaces

UNIT IV

10 Hours

CORROSION RATE AND ITS ESTIMATION

Rate of corrosion: Factors affecting corrosion. Electrochemical methods of polarization: Tafel extrapolation polarization and linear polarization. Weight loss method - testing for intergranular susceptibility and stress corrosion. Non-destructive testing methods: Visual testing - liquid penetrant testing - magnetic particle testing - Ultrasonic monitoring, and eddy current testing

UNIT V

10 Hours

CORROSION CONTROL METHODS

Fundamentals of cathodic protection - types of cathodic protection (sacrificial anodic and impressed current cathodic protection). Stray current corrosion, problems and its prevention. Protective coatings: Metal coatings: Hot dipping (galvanizing, tinning and metal cladding) - natural inhibitors. Selection of suitable design for corrosion control

Total: 45 Hours

Reference(s)

1. Mouafak A. Zaher, "Introduction to Corrosion Engineering", CreateSpace Independent Publishing Platform, 2016.
2. E.McCafferty, "Introduction to Corrosion Science", Springer; 2010 Edition, January 2010.
3. R. Winstone Revie and Herbert H. Uhlig, "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, John Wiley & Science, 2008.
4. Mars G. Fontana, "Corrosion Engineering", Tata McGraw Hill, Singapore, 2008
5. David E.J. Talbot (Author), James D.R. Talbot, "Corrosion Science and Technology", Second Edition (Materials Science & Technology), CRC Press; 2nd Edition, 2007.
6. <http://corrosion-doctors.org/Corrosion-History/Eight.html>

22OCH02 POLYMER SCIENCE**3 0 0 3****Course Objectives**

- Explain the properties of different polymers with its mechanism
- Select the appropriate polymerization techniques to synthesize the polymers
- Identify suitable polymers for various industrial applications

Course Outcomes (COs)

1. Illustrate the types of mechanism of polymerization reactions and analyze the natural and synthetic polymers
2. Identify the suitable polymerization techniques to synthesize the high quality polymers
3. Identify the structure, thermal, and mechanical properties of polymers for different applications
4. Apply the polymer processing methods to design polymer products
5. Analyze the polymers used in electronic and biomedical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	2												
4	1	1	2											
5	1	3	2											

UNIT I**10 Hours****POLYMERS AND ELASTOMERS**

Classification of polymers - Mechanism: Addition polymerization - free radical, cationic, anionic and co-ordination (Ziegler-Natta) polymerization - copolymerization - condensation polymerization (nylon-6,6) -ring opening polymerization (nylon-6). Elastomers: Natural rubber and synthetic rubber: styrene -butadiene rubber (SBR), butyl, neoprene, thiocol rubbers. High performance polymers: polyethers, polyether ether ketone (PEEK), polysulphones and polyimides

UNIT II**8 Hours****POLYMERIZATION TECHNIQUES**

Homogeneous and heterogeneous polymerization - bulk polymerization (PMMA, PVC) - solution polymerization - polyacrylic acid, suspension polymerization (ion-exchange resins) - emulsion polymerization (SBR) - advantages and disadvantages of bulk and emulsion polymerization. Melt solution and interfacial poly-condensation

UNIT III

8 Hours

CHARACTERIZATION AND TESTING

Characterization of polymers by Infrared Spectroscopy (IR) and Nuclear Magnetic Spectroscopy (NMR) - Thermal properties: TGA and DSC - Testing tensile strength - Izod impact - Compressive strength - Rockwell hardness - Vicot softening point - water absorption

UNIT IV

9 Hours

POLYMER PROCESSING

Moulding: Compression - injection - extrusion and blow mouldings. Film casting - calendering. Thermoforming and vacuum formed polystyrene - foamed polyurethanes. Fibre spinning: melt, dry and wet spinning. Fibre reinforced plastics fabrication: hand-layup - filament winding and pultrusion

UNIT V

10 Hours

SPECIALITY POLYMERS

Preparation and properties of heat resistant and flame retardant polymers. Polymers for electronic applications: liquid crystalline, conducting and photosensitive polymers – E waste management. Polymer for biomedical applications: artificial organs, controlled drug delivery, Scaffolds in tissue Engineering –waste management.

Total: 45 Hours

Reference(s)

1. V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International (P) Ltd., New Delhi, 2021
2. Joel R. Fried, "Polymer Science and Technology", Prentice Hall of India (P). Ltd., 2014
3. F. W. Billmeyer, "Text Book of Polymer Science", John Wiley & Sons, New York, 2008
4. Barbara H. Stuart, "Polymer Analysis", John Wiley & Sons, New York, 2008
5. George Odian , "Principles of Polymerization", John Wiley & Sons, New York, 2004
6. R. J. Young and P. A. Lovell, "Introduction to Polymers", CRC Press, New York, 2011
7. Common Biocompatible Polymeric Materials for Tissue Engineering and Regenerative Medicine (2019), Materials Chemistry and Physics <https://doi.org/10.1016/j>.

22OCH03 ENERGY STORING DEVICES**3 0 0 3****Course Objectives**

- Compare the energy density of commercialized primary and secondary batteries.
- Classify the fuel cells and compare their efficiency in different environmental conditions.
- Demonstrate the various energy storage devices and fuel cells.

Course Outcomes (COs)

1. Find the parameters required for operation of a cell to evaluate the capacity of energy storage devices.
2. Identify the electrodes, electrolyte and cell reactions of different types of primary, secondary batteries and infer the selection criteria for commercial battery systems with respect to commercial applications.
3. Differentiate fuel cells based on its construction, production of current and applications.
4. Compare different methods of storing hydrogen fuel and its environmental applications.
5. Classify the solar cell based on the materials used in it.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1												
2	2	3					1							
3	3	1												
4	2	2					1							
5	3	3					1							

UNIT I**6 Hours****BASICS OF CELLS AND BATTERIES**

Components - classification - operation of a cell - theoretical cell voltage - capacity - specific energy - energy density of lithium and lead acid battery - charge efficiency- charge rate - charge retention - closed circuit voltage - open circuit voltage current density - cycle life - discharge rate-over charge-over discharge

UNIT II**10 Hours****BATTERIES FOR PORTABLE DEVICES AND ELECTRIC VEHICLES**

Primary batteries: zinc-carbon - magnesium, and mercuric oxide - recycling/safe disposal of used cells. Secondary batteries: lead acid - nickel-cadmium - lithium ion batteries - rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide - lithium anode cell - photogalvanic cells. Battery specifications for cars and automobiles. Extraction of metals from battery materials.

UNIT III

10 Hours

TYPES OF FUEL CELLS

Importance and classification of fuel cells: Description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells - phosphoric acid - solid oxide - molten carbonate and direct methanol fuel cells

UNIT IV

10 Hours

HYDROGEN AS A FUEL

Sources and production of hydrogen: Electrolysis and photocatalytic water splitting. Methods of hydrogen storage: High pressurized gas - liquid hydrogen type - metal hydride. Hydrogen as engine fuel - features, application of hydrogen technologies in the future – limitations.

UNIT V

9 Hours

ENERGY AND ENVIRONMENT

Future prospects of renewable energy and efficiency of renewable fuels - economy of hydrogen energy. Solar Cells: First, second, third and fourth generation solar cell - photobiochemical conversion cell.

Total: 45 Hours

Reference(s)

1. N. Eliaz, E. Gileadi, Physical Electrochemistry, Fundamentals, Techniques and Applications, Wiley, 2019.
2. J. Garche, K. Brandt, Electrochemical Power sources: Fundamentals Systems and Applications, Elsevier, 2018
3. S.P. Jiang, Q. Li, Introduction to Fuel Cells, Springer, 2021.
4. A. Iulianelli, A. Basile, Advances in Hydrogen Production, Storage and Distribution, Elsevier, 2016.
5. M.M. Eboch, The Future of Energy, From Solar Cells to Flying Wind Farms, Capstone, 2020.

22OMA01 GRAPH THEORY AND COMBINATORICS

3 0 0 3

Course Objectives

- This course comprehends the graphs as a modeling and analysis tool in computer science & Engineering
- It introduces the structures such as graphs & trees and techniques of counting and combinations, which are needed in number theory based computing and network security studies in Computer Science.

Programme Outcomes (POs)

- Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Recognize the basic ideas of Graph and its characteristics.
2. Assess the characteristics of trees and its properties.
3. Predict the coloring of graphs and its applications in the respective areas of engineering.
4. Compute the permutations and combinations in the engineering field.
5. Demonstrate the types of generating functions and their applications in engineering.

Articulation Matrix

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	1	2													
2	1	3													
3	2	3													
4	2	3													
5	3	3													

UNIT I

9 Hours

INTRODUCTION

Graphs - Introduction - Isomorphism - Sub graphs - Walks, Paths, Circuits - Connectedness - Components - Euler graphs - Hamiltonian paths and circuits - Trees - Properties of trees - Distance and centers in tree - Rooted and binary trees.

UNIT II **9 Hours**

TREES, CONNECTIVITY

Spanning trees - Fundamental circuits - Spanning trees in a weighted graph - cut sets - Properties of cut set - All cut sets - Fundamental circuits and cut sets - Connectivity and separability - Network flows - 1-Isomorphism - 2-Isomorphism - Combinational and geometric graphs - Planer graphs - Different representation of a planer graph.

UNIT III **9 Hours**

MATRICES, COLOURING AND DIRECTED GRAPH

Chromatic number - Chromatic partitioning - Chromatic polynomial - Matching - Covering - Four color problem - Directed graphs - Types of directed graphs - Digraphs and binary relations - Directed paths and connectedness - Euler graphs.

UNIT IV **9 Hours**

PERMUTATIONS

Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.

UNIT V **9 Hours**

GENERATING FUNCTIONS

Generating functions - Partitions of integers - Exponential generating function - Summation operator - Recurrence relations - First order and second order - Non-homogeneous recurrence relations - Method of generating functions.

Total: 45 Hours

Reference(s)

1. Narsingh Deo, Graph Theory: With Application to Engineering and Computer Science, Prentice Hall of India, 2003
2. Grimaldi R.P., Discrete and Combinatorial Mathematics: An Applied Introduction, Addison Wesley, 1994.
3. Rosen K.H., Discrete Mathematics And Its Applications, McGraw Hil, 2007
4. Clark J. & Holton D.A., A First Look at Graph Theory, Allied Publishers, 1995.
5. Mott J.L., Kandel A. & Baker T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India, 1996.
6. Liu C.L., Elements of Discrete Mathematics, McGraw Hill, 1985.

21OGE01 PRINCIPLES OF MANAGEMENT

3 0 0 3

Course Objectives

- To develop cognizance about importance of management principles.
- Extract the functions and responsibilities of managers.
- To Study and understand the various HR related activities.
- Learn the application of the theories in an organization.
- Analyze the position of self and company goals towards business.

Course Outcomes (COs)

1. Students will be able to understand the basic concepts of Management.
2. Have some basic knowledge on planning process and its Tools & Techniques.
3. Ability to understand management concept of organizing and staffing.
4. Ability to understand management concept of directing.
5. Ability to understand management concept of controlling.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1									2		3				
2									2		2				
3									2		2				
4									3		2				
5									2		2				

UNIT I

9 Hours

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management Science or Art Manager Vs Entrepreneur-types of managers -Managerial roles and skills Evolution of Management Scientific, Human Relations, System and Contingency approaches Types of Business organization - Sole proprietorship, partnership, Company - public and private sector enterprises - Organization culture and Environment Current Trends and issues in Management.

UNIT II

9 Hours

PLANNING

Nature and purpose of planning - Planning process - Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III

9 Hours

ORGANISING

Nature and purpose – Formal and informal organization - Organization chart - Organization Structure Types - Line and staff authority – Departmentalization - Delegation of authority - Centralization and decentralization - Job Design - Human Resource – Management - HR

Planning, Recruitment, Selection, Training and Development, Performance Management, Career planning and management

UNIT IV **9 Hours**

DIRECTING

Foundations of individual and group behaviour – Motivation - Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership - types and theories of leadership – Communication - Process of communication - Barrier in communication Effective communication - Communication and IT.

UNIT V **9 Hours**

CONTROLLING

System and process of controlling - Budgetary and non - Budgetary control techniques - Use of Computers and IT in Management control - Productivity problems and management - Control and Performance-Direct and preventive control - Reporting.

Total: 45 Hours

Reference(s)

1. Robbins S, Management, (13th ed.), Pearson Education, New Delhi, 2017.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management, Pearson Education, 7th Edition, 2011.
3. Robert Kreitner and Mamata Mohapatra, Management, Biztantra, 2008.
4. L. M. Prasad, Principles and Practice of Management. 7th Edition, Sultan Chand & Sons, 2007.
5. P. C. Tripathi and P. N. Reddy, Principles of Management, Fourth Edition, Tata McGraw Hill, 2008.

**21OGE02 ENTREPRENEURSHIP
DEVELOPMENT I**

3 0 0 3

Course Objectives

- Learn the basics and scope of the Entrepreneurship
- Understand the generation of ideas of the Entrepreneurship
- Evolve the legal aspects of the business
- Learn to analyze the various business finance
- Learn the basics of the Operations Management

Course Outcomes (COs)

1. Analyze the role of entrepreneurship in economic development.
2. Explain the types of ideas that to be used for entrepreneurship development.
3. Examine the legal aspects of business and its association.
4. Examine the sources of business and its analysis.
5. Analyse the different modes of operation management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1						1	2		2						
2						1	2		2						
3						1	2		2						
4						1	2		2						
5						1	2		2						

UNIT I

9 Hours

BASICS OF ENTREPRENEURSHIP

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurship process. Role of entrepreneurship in economic development

UNIT II

9 Hours

GENERATION OF IDEAS

Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractional, Reversal Method, Brain Storming, Analogies

UNIT III

9 Hours

LEGAL ASPECTS OF BUSINESS

Contract act - Indian contract act, Essential elements of valid contract, classification of contracts, sale of goods act- Formation of contract of sale, negotiable instruments - promissory note, bills and cheques, partnership, limited liability partnership (LLP), companies act-kinds, formation, memorandum of association, articles of association.

UNIT IV **9 Hours**

BUSINESS FINANCE

Project evaluation and investment criteria (cases), sources of finance, financial statements, break even analysis, cash flow analysis.

UNIT V **9 Hours**

OPERATIONS MANAGEMENT

Importance - functions - deciding on the production system - facility decisions: plant location, plant layout (cases), capacity requirement planning - inventory management (cases) - lean manufacturing, Six sigma.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business

**21OGE03 ENTREPRENEURSHIP
DEVELOPMENT II**

3 0 0 3

Course Objectives

- Evolve the marketing mix for promotion the product / services
- Handle the human resources and taxation
- Learn to analyze the taxation
- Understand the Government industrial policies and supports
- Preparation of a business plan

Course Outcomes (COs)

1. Examine the strategies and plans in marketing management.
2. Analyse the cases involved in human resource management.
3. Classify the direct and indirect taxes in business.
4. Analyze the supports given by government for improving the business.
5. Examine the various steps involved in preparing the business plan.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1						1	2		2					
2						1	2		2					
3						1	2		2					
4						1	2		2					
5						1	2		2					

UNIT I

9 Hours

MARKETING MANAGEMENT

Marketing environment, Segmentation, Targeting and positioning, Formulating marketing strategies, marketing research, marketing plan, marketing mix (cases)

UNIT II

9 Hours

HUMAN RESOURCE MANAGEMENT

Human Resource Planning (Cases), Recruitment, Selection, Training and Development, HRIS, Factories Act 1948 (an over view)

UNIT III

9 Hours

BUSINESS TAXATION

Direct taxation, Income tax, Corporate tax, MAT, Tax holidays, Wealth tax, Professional tax (Cases). Indirect taxation, Excise duty, Customs, Sales and Service tax, VAT, Octroi, GST (Cases)

UNIT IV **9 Hours**

GOVERNMENT SUPPORT

Industrial policy of Central and State Government, National Institute-NIESBUD, IIE, EDI. State Level Institutions - TIIC, CED, MSME, Financial Institutions

UNIT V **9 Hours**

BUSINESS PLAN PREPARATION

Purpose of writing a business plan, Capital outlay, Technical feasibility, Production plan, HR plan, Market survey and Marketing plan, Financial plan and Viability, Government approvals, SWOT analysis.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Philip Kotler., Marketing Management, Prentice Hall of India, New Delhi: 2003
3. Aswathappa K, Human Resource and Personnel Management - Text and Cases, Tata McGraw Hill: 2007.
4. Jain P C., Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi: 2002.
5. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006.
6. <http://niesbud.nic.in/agencies.html>

**22OGE04 NATION BUILDING, LEADERSHIP
AND SOCIAL RESPONSIBILITY**

3 0 0 3

Course Objectives

- To understand the importance of National Integration, Patriotism and Communal Harmony
- To outline the basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality
- To analyze the different types of responsibility role of play for the improvement of society

Course Outcomes (COs)

1. Understand religio-cultural diversity of the country and its impact on the lives of the people and their beliefs
2. Acquire a sense of responsibility, smartness in appearance and improve self confidence
3. Develop the sense of self-less social service for better social & community life
4. Apply the importance of Physical and Mental health and structure of communication organization and various mode of communication
5. Acquire awareness about the various types of weapon systems in the Armed Forces.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1				1					3		
2	2		2				2					2		
3	2		1				1					2		
4	2		3				3					3		
5	2		1				1					2		

UNIT I**9 Hours****NATIONAL INTEGRATION**

Importance & Necessity, Factors Affecting National Integration, Unity in Diversity. Threats to National Security. Water Conservation and Rain Harvesting, Waste Management and Energy Conservation.

Leadership Capsule-Traits-Indicators-Motivation-Moral Values-Honor Code-Case Studies: Shivaji, Jhansiki Rani, Case Studies–APJ Abdul kalam, Deepa Malik, Maharana Pratap, N Narayan Murthy

Ratan Tata Rabindra Nath Tagore, role of NCC cadets in 1965 war.

UNIT II**9 Hours****PERSONALITY DEVELOPMENT AND LEADERSHIP**

Intra & Interpersonal skills - Self-Awareness- &Analysis, Empathy, Critical & creative thinking, Decision making and problem solving, Communication skills, Group Discussion – coping with stress and emotions, changing mindset, Public Speaking, Time Management, Social skills, Career counseling, SSB procedure and Interview skills.

UNIT III **9 Hours**
SOCIAL SERVICE, COMMUNITY DEVELOPMENT AND ENVIRONMENTAL AWARENESS

Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare. Protection of children & women safety, Road/ Rail Travel Safety, New initiatives, Cyber and mobile security awareness. Disaster management Capsule-Organization-Types of Disasters-Essential Services-Assistance-Civil Defence Organization

UNIT IV **9 Hours**
HEALTH, HYGIENE AND COMMUNICATION

Sanitation, First Aid in Common Medical Emergencies. Health, Treatment and Care of Wounds. Yoga- Introduction, Definition, Purpose, Benefits. Asanas-Padamsana, Siddhasana, Gyan Mudra, Surya Namaskar, Shavasana, Vajrasana, Dhanurasana, Chakrasana, Sarvaangasana, Halasanaetc. Obstacle Training Contact: Obstacle training - Intro, Safety measures, Benefits, Straight balance, Clear Jump, Gate Vault, ZigZagBalance, High Wall etc. COMMUNICATION: Basic Radio Telephony (RT) Procedure-Introduction, Advantages, Disadvantages, Need for standard- Procedures-Types of Radio Telephony Communication- Radio telephony procedure, Documentation.

UNIT V **9 Hours**
ARMED FORCES AND NCC GENERAL

Introduction to Digital Signal Processors- Basic Classification-Features TMS320C6713 Architecture-Functional Unit-Pipelining- Addressing Modes -Instruction set Simple Assembly Language Program.

Total: 45 Hours

Reference(s)

1. Director General NCC Website: <https://indiancc.nic.in/ncc-general-elective-subject-course-design/>
2. Grooming Tomorrow's Leaders, published by DG, NCC. <https://indiancc.nic.in/>
3. Youth in Action, published by DG, NCC. <https://indiancc.nic.in/>
4. The Cadet, Annual Journal of the NCC. <https://indiancc.nic.in/>
5. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material. <https://indiancc.nic.in/>

22IS0XA - HEALTHCARE ANALYTICS**1 0 0 1****Course Objective**

- To equip students with the skills to analyze diverse healthcare data sources, apply statistical methods and predictive modeling.
- To improve clinical decision-making and patient outcomes, address resource optimization challenges, and navigate ethical considerations in data privacy.

Course Outcome

1. Identify the benefits of using healthcare data analytics.
2. Apply phenotyping algorithms, prediction models, and pervasive health analysis techniques to solve real-world problems.

Articulation Matrix

CO No	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2
1		1			2									
2		2	2	2				1	1	1				

Course Syllabus

Introduction to Healthcare Data Analytics – Electronic Health Records – Phenotyping Algorithms – Challenges in Healthcare Data Analysis – Acquisition Challenges – Pre-processing – Transformation – Social Media Analytics for Healthcare. Advanced Data Analytics for Healthcare : Prediction Models – Statistical Prediction Models – Alternative Clinical Prediction Models – Survival Models – Predictive Models for Integrating Clinical and Genomic Data – Data Analytics for Pervasive Health – Fraud Detection in Healthcare – Pharmaceutical Discoveries and Clinical Decision Support Systems.

Total: 15 Hours**Text Books**

1. Chandan K. Reddy and Charu C Aggarwal, “Healthcare Data Analytics”, Taylor & Francis, 2015.
2. Hui Yang and Eva K. Lee, “Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016.
3. Vikas Kumar, “Healthcare Analytics Made Simple”, Packt Publishing, 2018.
4. Rafalski, Edward M., “Healthcare Analytics”, Taylor and Francis Ltd, 2022.

22IS0XB - AWS Cloud Services and Data management**1 0 0 1****Course Objectives:**

- To provide a foundational understanding of the AWS Cloud services.
- To learn about core data management of cloud services.

Course Outcome:

1. Understand Cloud Computing Concepts and core AWS services including compute, network, databases, and storage.
2. Identify an appropriate solution using AWS Cloud services with various use cases.

Articulation Matrix

CO No	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2
1	1	2	2											2
2		1	2	2										2

15 Hours

Introduction to Amazon Web Services - Benefits of AWS - Amazon CloudFront and Edge locations - layers of network security used in an IT strategy - VPC and subnet - Access Management (IAM) - Multi-factor authentication (MFA) - Amazon Elastic Compute Cloud (Amazon EC2) - concept of storage and databases - Amazon EBS - Simple Storage Service (S3) - Elastic File System (EFS) - Amazon Relational Database Service - Amazon DynamoDB - Amazon CloudWatch - AWS CloudTrail.

References:

- **AWS: The Most Complete Guide to Amazon Web Services from Beginner to Advanced Level, by Raoul Alongi.**
- **Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud, by Mark Wilkins (Author).**
- <https://aws.amazon.com/training/classroom/aws-cloud-practitioner-essentials/>
- <https://aws.amazon.com/>