INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM-CHENNAI
ACCREDITED BY NAAC WITH 'A++' GRADE

UNDERGRADUATE DEGREE PROGRAMME

BCA Three Years

/

BCA (Hons)Four Years

CURRICULUM & SYLLABUS

REGULATION 2024

Choice Based Credit System (CBCS)

&

Learning Outcomes Based Curriculum Framework (LOCF)

Effective from the Academic Year

2024 -2025

Department of Computer Applications (UG)

School of Computing Sciences

VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM-CHENNAI
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DEPARTMENT OF COMPUTER APPLICATIONS (UG)

VISION OF THE DEPARTMENT
To produce globally competent graduates, skilled intellectual professionals and a successful entrepreneur in the field of Computer Science and Information Technology to meet the current challenges in the fast-growing IT industry.

MISSION OF THE DEPARTMENT	
M1	To provide a strong theoretical and practical knowledge to the students in computer science discipline.
M2	To equip our students to attain skill set imperative to harness the opportunities present in this dynamic environment.
M3	To provide technical & skill-based quality training to the students in the field of Information Technology.
M4	To empower the Youth in rural communities with computer knowledge.
M5	To inculcate knowledge about socio-economic duties & responsibilities, human & ethical values to become an optimistic global citizen and a life-long learner.
M6	To provide environmental education to empower knowledge on ecological issues and to protect and conserve invaluable natural resources for healthy and sustainable livelihoods.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)	
PEO1	**Global Competence**: Develop into globally competent computer professionals capable of excelling in diverse, multidisciplinary domains. This includes mastering technical skills while also cultivating adaptability, cultural awareness, and effective communication across international contexts.
PEO2	**Social Commitment and Ethical Values:** Excel as individuals dedicated to upholding social responsibility, ethical values, and empathy for addressing societal needs. This commitment involves integrating ethical considerations and contributing positively to communities through thoughtful and compassionate actions.
PEO3	**Entrepreneurship and Leadership**: Become entrepreneurs with robust leadership skills, adept at delivering innovative solutions and developing software products. This entails fostering creativity, managing teams effectively, and navigating challenges to bring impactful software solutions to market.
PEO4	**Lifelong Learning**: Engage in lifelong learning to continuously update knowledge and skills in the rapidly advancing fields of computer applications and emerging technologies. This commitment ensures staying current with the latest advancements and enhancing expertise to meet evolving industry demands.
PEO5	**Quality Technical Training**: Deliver high-quality technical and skill-based training to students in the field of information technology, focusing on imparting comprehensive knowledge, practical skills, and preparing them for professional challenges in the industry.

PROGRAMME OUTCOMES (PO)	
PO1	**Understanding Comprehensive and Coherent Knowledge:** Understand your area of study within a broad multidisciplinary context by staying informed about current and emerging developments in the field. This approach allows for a comprehensive view, integrating knowledge from various disciplines to enhance expertise and adaptability.

PO2	**Problem-Solving Ability:** Apply learning skills to real-life situations by analysing and solving various problems. Tackle complex issues by developing solutions with appropriate computational techniques and tools.
PO3	**Analytical and Logical Reasoning:** Apply analytical thought by identifying relevant implications and using them to formulate coherent arguments. Systematically evaluate evidence to draw logical conclusions and construct persuasive reasoning.
PO4	**Critical Thinking:** Apply analytical thought by identifying relevant implications and using them to formulate coherent arguments. Systematically evaluate evidence to draw logical conclusions and construct persuasive reasoning.
PO5	**Creativity:** To create, perform, and think in diverse ways, develop creative thinking and problem-solving skills through techniques like brainstorming, design thinking, and empathy mapping. Challenge assumptions and use analogies to foster out-of-the-box thinking. Collaborate with diverse teams to gain multiple perspectives and generate innovative solutions to complex problems.
PO6	**Professional and Ethical Responsibility:** Recognize and adhere to ethical standards and professional responsibilities by engaging in courses that include group discussions and debates on ethical practices and human values. These activities sensitize students on interacting with customers and colleagues within the organization. Demonstrate awareness of ethical and legal issues related to information technology and consistently adhere to professional codes of conduct.
PO7	**Communication Skills:** Proficiently convey ideas in English by effectively communicating with both technical and non-technical stakeholders. This includes delivering clear oral presentations, writing precise technical documentation, and creating comprehensive project reports.
PO8	**Engage in lifelong and self-learning:** Acquiring new knowledge and skills, including learning how to learn techniques, essential for continuous personal development and achieving economic, social, and cultural objectives. Continuously update your knowledge and skills in the rapidly evolving field of computer applications and information technology through self-paced and self-directed learning.

PO9	**Leadership and Team-Based Projects:** Students undertake team projects to foster collaborative work and synergy. This involves formulating an inspiring vision, building cohesive teams aligned with that vision, and motivating members to actively engage. Utilizing management skills, leaders guide their teams effectively toward achieving shared goals and milestones.
PO10	**Research Related Skills:** Acquire an understanding of basic research ethics and develop skills to apply ethical principles in personal research regardless of the funding source or field of study. This involves adhering to ethical guidelines and ensuring integrity in conducting research activities.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1	**Fundamental Computer Concepts:** Gain a robust understanding of fundamental computer concepts through both theoretical learning and practical application across diverse fields. This involves acquiring knowledge that spans foundational principles and hands-on experience, ensuring proficiency in various aspects of computing.
PSO2	**Interdisciplinary Knowledge Application:** Effectively apply knowledge of mathematics, computer science, and management in practical applications. This involves integrating theoretical understanding with real-world scenarios to solve complex problems and make informed decisions in diverse contexts.
PSO3	**Problem Solving with Latest Technologies:** Analyse and leverage the latest technologies to effectively address challenges within computer applications. This entails staying abreast of advancements, assessing their applicability, and implementing innovative solutions to enhance performance and functionality.
PSO4	**Software Development Skills:** Develop software applications and tools by employing both quantitative and qualitative techniques. Design computing systems that fulfil specific requirements while adhering to practical constraints such as safety, security, and usability. This approach ensures the creation of robust solutions that effectively meet user needs and operational objectives.

PSO5	**Practical Skills for Industry Solutions:** Develop practical skills aimed at providing innovative solutions to challenges in industry, society, and business. This involves honing technical expertise, fostering creativity, and applying problem-solving methodologies to address real-world issues effectively and sustainably.
PSO6	**Communication and Collaboration:** Communicate effectively and collaborate within multidisciplinary teams to achieve shared goals in software development projects. This involves fostering clear communication channels, leveraging diverse perspectives, and coordinating efforts to deliver high-quality solutions that meet project objectives efficiently.
PSO7	**Professionalism and Ethics:** Demonstrate awareness of ethical and legal issues in information technology, adhering to professional codes of conduct. Continuously update skills and knowledge in the dynamic field of computer applications and information technology to stay current with industry advancements and best practices.
PSO8	**Practical Application and Project Management:** Apply theoretical knowledge to practical applications through internships, capstone projects, or industrial training. Manage software development projects by overseeing project planning, scheduling, budgeting, and implementing risk management practices. This hands-on experience ensures effective application of skills and prepares for real-world challenges in the field.

BOARD OF STUDIES

List of Members Department of Computer Applications (UG)

S. No	Name & Designation	Address	Role
1.	Dr.R.Sivakumar	Dean, School of Computing Sciences, VISTAS	
2.	Dr.P.Magesh Kumar	Director, School of Computing Sciences, VISTAS.	
3.	Dr.Ananthapadmanaban	Professor & Dean, FSH, SRM Institute of Science & Technology, Chennai.	Academic Expert (External Member)
4.	Dr.D.Ethiraj	Director I /C, C-DAC,Chennai	External Member (Industry Expert)
5	Dr.P.Sujatha	Professor & Head, Department of BCA, VISTAS.	Internal Member
6	Dr R.Priya Anand	Professor & Head, Department of Computer Applications-PG VISTAS	Internal Member
7	Dr.T.Kamalakannan	Professor, Department of Information Technology, VISTAS	Internal Member
8	Dr.S.Prasanna	Professor, Department of Computer Applications-PG VISTAS	Internal Member
9	Dr.Y.Kalpana	Professor, Department of Information Technology, VISTAS	Internal Member
10	Dr.R.Devi	Professor, Department of Information Technology, VISTAS	Internal Member
11	Dr. K.Rohini	Professor, Department of Information Technology, VISTAS	Internal Member
12	Dr.J.Jebathangam	Professor, Department of Information Technology, VISTAS	Internal Member
13	Dr.S.Kamalakannan	Professor, Department of Information Technology, VISTAS	Internal Member
14	Dr.K.Dharmarajan	Professor, Department of Information Technology, VISTAS	Internal Member
15	Dr.K.Sharmila	Professor, Department of Information Technology, VISTAS	Internal Member
16	Dr.V.Sumalatha	Professor, Department of Computer Applications-PG VISTAS	Internal Member
17	Dr.S.Jeyalakshmi	Professor, Department of Information Technology, VISTAS	Internal Member
18	Dr.B.Booba	Professor, Department of Information Technology, VISTAS	Internal Member
19	Dr.K.Kasturi	Professor, Department of Information Technology, VISTAS	Internal Member
20	Dr. C.Meenakshi	Associate Professor, Department of Computer Applications-PG VISTAS	Internal Member

21	Dr.A.Vidhya	Assistant Professor, Department of Information Technology, VISTAS	Internal Member
22	Dr.S.Nagasundaram	Asst. Professor, Department of Computer Applications-PG VISTAS	Internal Member
23	Vishnu.P.V	Chief Innovation officer, Xerago, Digital Impact Consulting &Services, Chennai.	Alumni Member

CREDIT DISTRIBUTION

BCA (Hons)

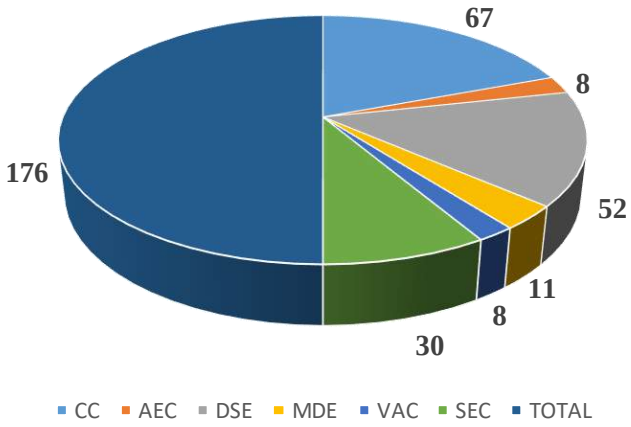
Minimum credits to be earned: 176

BCA

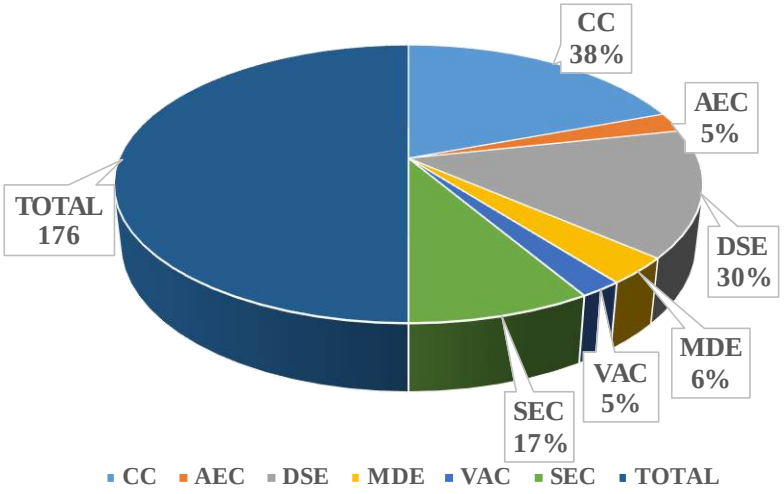
Minimum credits to be earned: 132

Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	3 Yrs. Total Credits	VII Sem	VIII Sem	4 Yrs Total Credits
CORE COURSE(CC)	11	12	13	15	6	5	62	5	-	67
ABILITY ENHANCEMENT COURSE(AEC)	4	4	-	-	-	-	8	-	-	8
DISCIPLINE SPECIFIC ELECTIVE(DSE)	-	-	3	3	10	12	28	10	14	52
MULTI - DISCIPLINARY ELECTIVE (MDE)	3	3	2	-	-	-	8	3	-	11
VALUE ADDED COURSE (VAC)	3	1	2	2	-	-	8	-	-	8
SKILL ENHANCEMENT COURSE(SEC)	2	2	2	2	6	4	18	4	8	30
TOTAL CREDIT	23	22	22	22	22	21	132	22	22	176

CREDIT DISTRIBUTION



CREDIT PERCENTAGE DISTRIBUTION



ABBREVIATIONS

CC	CORE COURSE
AEC	ABILITY ENHANCEMENT COURSE
DSE	DISCIPLINARY SPECIFIC ELECTIVE
MDE	MULTI -DISCIPLINARY ELECTIVE
VAC	VALUE ADDED COURSE
SEC	SKILL ENHANCEMENT COURSE

CURRICULUM STRUCTURE

BCA (Hons) - Four Years

/

BCA - Three Years

Total number of Credits: 176

	BCA (Hons) Minimum Credits to be earned :176 **BCA Minimum Credits to be earned: 132**									
	SEMESTER 1									
			Hours/Week					**Maximum Marks**		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
AEC	24LTAM11 / 24LHIN11/ 24LFRE11	Tamil I / Hindi I/ French I	2	0	0	1	2	40	60	100
AEC	24LENG11	English I	2	0	0	1	2	40	60	100
CC	24CBCA11	Problem Solving Techniques using C	3	0	0	2	3	40	60	100
CC	24CBCA12	Data Structures	3	0	0	2	3	40	60	100
CC	24CBCA13	Digital Logic and Computer Architecture	3	0	0	2	3	40	60	100
MDE	24BMA001	Mathematics- I	2	1	0	2	3	40	60	100
CC LAB	24PBCA11	Problem Solving Techniques using C LAB	0	0	2	1	1	40	60	100
CC LAB	24PBCA12	Data structures using C lab	0	0	2	1	1	40	60	100
VAC	24DVCA12	Web Programming	0	0	2	1	1	40	60	100
VAC	24DVAC11	Communication Skills	2	0	0	0	2	40	60	100
SEC	24SSKU11	Soft Skills I	2	0	0	1	2	40	60	100

SEC	Orientation programme /Industrial Visit	-	-	-	-	-	-	-	-
TOTAL		**19**	**1**	**6**	**-**	**23**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 2										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
AEC	24LTAM21/ 24LHIN21/ 24LFRE21	Tamil II / Hindi II / French II	2	0	0	2	2	40	60	100
AEC	24LENG21	English II	2	0	0	2	2	40	60	100
CC	24CBCA21	Object Oriented Programming using C++	3	0	0	2	3	40	60	100
CC	24CBCA22	Open Source Technologies	3	0	0	2	3	40	60	100
MDE	24BMA002	Mathematics – II	3	1	0	2	3	40	60	100
CC LAB	24PBCA21	Object Oriented Programming lab using C++	0	0	3	1	1	40	60	100
CC LAB	24PBCA22	Open Source Technologies Lab	0	0	3	1	1	40	60	100
VAC	24DVAC21	Universal Human Values	1	0	0	1	1	40	60	100
CC	24CBCA23	Computer Graphics and Multimedia	4	0	0	2	4	40	60	100
SEC	24SSKU21	Soft Skills II	2	0	0	1	2	40	60	100
			20	**-**	**6**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 3										
			Hours/Week					Maximum Marks		
Category	Code	Course	L	T	P	O	C	CIA	SEE	Total
CC	24CBCA31	Programming in Java	4	0	0	2	4	40	60	100
CC	24CBCA32	Data Base Management System	3	0	0	2	3	40	60	100
CC	24CBCA33	Probability and Statistics	3	0	0	2	3	40	60	100
DSE	24DBCA34	Discipline Specific Elective I	3	0	0	2	3	40	60	100
CC LAB	24PBCA31	Programming in Java Lab	0	0	4	1	2	40	60	100
CC LAB	24PBCA32	Relational Data Base Management System Lab	0	0	4	1	2	40	60	100
VAC	24DVAC31	Yoga/Sports/NCC /NSS/Disaster Management	0	0	4	1	2	40	60	100
MDE		Indian Knowledge System	2	0	0	1	2	40	60	100
SEC	24SSKU32	Soft skills III	1	1	0	1	2	-	100	100
TOTAL			15	3	12	-	23	-	-	

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 4										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
CC	24CBCA41	Python Programming	4	0	0	2	4	40	60	100
CC	24CBCA42	Artificial Intelligence	3	0	0	2	3	40	60	100
CC	24CBCA43	Design and Analysis of Algorithm	3	0	0	2	3	40	60	100
CC	24CBCA44	Computer Networks	3	0	0	2	3	40	60	100
DSE	24DBCA45	Discipline Specific Elective II	3	0	0	2	3	40	60	100
CC LAB	24PBCA41	Python Programming Lab	0	0	2	1	1	40	60	100
CC LAB	24PBCA42	Artificial Intelligence using Python Lab	0	0	2	1	1	40	60	100
VAC	24DVAC41	EVS	2	1	0	1	2	40	60	100
SEC	24SSKU41	Design Thinking and Innovation	1	1	0	1	2	-	100	100
TOTAL			**17**	**2**	**8**	**-**	**22**	-	-	-

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 5										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
CC	24CBCA51	Natural Language Processing	3	1	0	2	4	40	60	100
DSE	24DBCA52	Discipline Specific Electives III	3	0	0	2	3	40	60	100
DSE	24DBCA53	Discipline Specific Electives IV	3	2	0	2	5	40	60	100
CC LAB	24PBCA51	Natural Language Processing Lab	0	0	4	1	2	40	60	100
DSE LAB	24PBCA52	Discipline Specific Electives III Lab	0	0	4	1	2	40	60	100
SEC	24SSKU51	Quantitative Techniques	0	2	0	1	2	-	100	100
SEC	24SSKU52	Internship – 1	0	0	8	2	4	-	100	100
SEC		Major Project [evaluation in sixth semester]	-	-	-	-	0	-	-	-
TOTAL			**9**	**5**	**16**	-	**22**	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 6										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
CC	24CBCA61	Generative AI	4	1	0	2	5	40	60	100
DSE	24DBCA62	Discipline Specific Electives – V	3	2	0	2	5	40	60	100
DSE	24DBCA63	Discipline Specific Electives – VI	3	2	0	2	5	40	60	100
DSE LAB	24PBCA62	Discipline Specific Electives – V Lab	0	0	4	1	2	40	60	100
SEC	24SSKU61	Major Project [Initiated in 5th Semester]	0	0	8	2	4	40	60	100
TOTAL			**10**	**4**	**12**	**-**	**21**	**-**	**-**	-

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 7										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
MDE	24MDE71	Advanced Statistical methods for Data Science	3	0	0	2	3	40	60	100
CC	24CBCA71	Python for Data Science	3	2	0	2	5	40	60	100
DSE	24DBCA72	Discipline Specific Electives – VII	3	2	0	2	5	40	60	100
DSE	24DBCA73	Discipline Specific Electives – VIII	3	2	0	2	5	40	60	100
SEC		Dissertation work [evaluation in Eight semester]	-	-	-	-	-	-	-	-
SEC	24SSKU72	Internship – 2	0	0	8	2	4	40	60	100
TOTAL			**12**	**6**	**8**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 8										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSE	24DBCA81	Discipline Specific Electives –I X	3	2	0	2	5	40	60	100
DSE	24DBCA82	Discipline Specific Electives – X	3	2	0	2	5	40	60	100
DSE	24DBCA83	Discipline Specific Electives – XI	3	1	0	2	4	40	60	100
SEC	24SSKU81	Dissertation Work	0	0	16	2	8	40	60	100
TOTAL			**9**	**5**	**16**	**-**	**22**	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

CORE COURSES

Category	Course	L	T	P	O	C
CC	Problem solving Techniques using C	3	0	0	2	3
CC	Data Structures	3	0	0	2	3
CC	Digital Logic and Computer Architecture	3	0	0	2	3
CC	Problem solving Technique using C lab	0	0	2	1	1
CC	Data Structures using C lab	0	0	2	1	1
CC	Object oriented programming using C++	3	0	0	2	4
CC	Open Source Technologies	3	0	0	2	3
CC	Object oriented programming lab using C++	0	0	2	1	1
CC	Open Source Technologies	0	0	2	1	1
CC	Computer Graphics and Multimedia	4	0	0	2	4
CC	Programming in Java	4	0	0	2	4
CC	Database Management System	3	0	0	2	3
CC	Programming in Java lab	0	0	4	1	2
CC	Relational Database Management System lab	0	0	4	1	2
CC	Python Programming	4	0	0	2	4
CC	Artificial Intelligence	3	0	0	2	3
CC	Design and Analysis of Algorithm	3	0	0	2	3
CC	Computer Networks	3	0	0	2	3
CC	Python Programming lab	0	0	2	1	1
CC	Artificial Intelligence using Python lab	0	0	2	1	1

CC	Natural Language Processing	3	1	0	2	4
CC	Natural Language Processing lab	0	0	4	1	2
CC	Generative AI	4	1	0	2	5
CC	Python for Data science	3	2	0	2	5

DISCIPLINE SPECIFIC ELECTIVE COURSES

Category	Course	L	T	P	O	C
DSE –I	Software Engineering	3	0	0	2	3
	Grid Computing	3	0	0	2	3
DSE -II	Operating System	3	0	0	2	3
	Ethical Hacking	3	0	0	2	3
DSE -III	Introduction to ML	3	0	0	2	3
	Cloud Technology	3	0	0	2	3
DSE III LAB	Machine learning lab	0	0	4	1	2
DSE III LAB	Cloud Technology lab	0	0	4	1	2
DSE -IV	Cryptographic Fundamentals	3	2	0	2	5
	UI and UX design	3	2	0	2	5
DSE -V	Big data Analytics	3	2	0	2	5
	Advanced Data Visualization	3	2	0	2	5
DSE –V LAB	Big data Analytics lab	0	0	4	1	2
	Data Visualization lab	0	0	4	1	2
DSE -VI	Exploratory Data Analysis	3	2	0	2	5
	Edge Computing	3	2	0	2	5

DSE -VII	Business Intelligence and Analytics	3	2	0	2	5
	Data Warehousing and Data Mining	3	2	0	2	5
DSE -VIII	Predictive Analysis	3	2	0	2	5
	Deep learning	3	2	0	2	5
DSE -IX	Cloud Computing for Data Analysis	3	2	0	2	5
	Neural Network	3	2	0	2	5
DSE -X	Introduction to Data Science	3	1	0	2	4
	Network Security	3	1	0	2	4
DSE -XI	Time Series Analysis	3	1	0	2	4
	Full Stack Web development	3	1	0	2	4

ABILITY ENHANCEMENT COURSE

Category	Course	L	T	P	O	C
AEC	Tamil I / Hindi I/ French I	2	0	0	1	2
AEC	English I	2	0	0	1	2
AEC	Tamil II / Hindi II / French II	2	0	0	2	2
AEC	English II	2	0	0	2	2

MULTIDISCIPLINARY ELECTIVE

Category	Course	L	T	P	O	C
MDE	Mathematics- I	2	1	0	2	3
MDE	Mathematics – II	2	1	0	2	3
MDE	Indian Knowledge System	2	0	0	1	2
MDE	Advanced Statistical methods for Data Science	3	0	0	2	3

VALUE ADDED COURSES

Category	Course	L	T	P	O	C
VAC	Web Programming	0	0	2	1	1
VAC	Communication Skills	2	0	0	0	2
VAC	Universal Human Values	1	0	0	1	1
VAC	Yoga Education / NSS / NCC	0	0	4	1	2
VAC	Environmental Studies	2	1	0	1	2

SKILL ENHANCEMENT COURSES

Category	Course	L	T	P	O	C
SEC	Soft Skills I	2	0	0	1	2
SEC	Orientation Programme / Industrial Visit	-	-	-	-	-
SEC	Soft Skills II	2	0	0	1	2
SEC	Soft Skills III	1	1	0	1	2
SEC	Design Thinking and Innovation	1	1	0	1	2
SEC	Quantitative Techniques	0	2	0	1	2
SEC	Internship – 1	0	0	8	2	4

SEC	Major Project	0	0	8	2	4
SEC	Internship -2	0	0	8	2	4
SEC	Dissertation work	0	0	16	2	8

SEMESTER I

L	T	P	O	C
2	0	0	1	2

பாடக் குறியீட்டு எண்: 24LTAM11

பருவம்-1, தமிழ்மொழிப்பாடம்-1, பகுதி-1, தகுதிப்புள்ளி: 2, வாரப் பாட நேரம்: 2.

தாள்-1

மொழிவரலாறு – சங்க இலக்கியம் – அற இலக்கியம் – மொழித்திறன்

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், தற்கால தமிழ் இலக்கிய வகைமைகளான மரபுக்கவிதை, புதுக்கவிதை, உரைநடை ஆகியவற்றை அறிமுகப்படுத்துதல், தமிழர்தம் வாழ்வியல் நெறிகளையும் பண்பாட்டுச் செழுமைகளையும் இன்றைய தலைமுறையினர் அறியச் செய்தல், மாணவர்களுக்குத் தமிழைத் தவறின்றி எழுதுவதற்குத் தேவையான பயிற்சி அளித்து அவர்களின் மொழித்திறனை மேம்படுத்துதல், செய்யுளின் நலத்தைப் பாராட்டும் முறைமையை அறியச் செய்து அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களுக்கு வேலைவாய்ப்பை உருவாக்குவதும் இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு- 1: தமிழ் மொழி வரலாறு **8மணி நேரம்**

மொழிக்குடும்பம் - இந்திய மொழிக்குடும்பங்கள் - இந்திய ஆட்சி மொழிகள் - திராவிட மொழிக்குடும்பங்கள் - திராவிட மொழிகளின் வகைகள் –திராவிட மொழிகளின் சிறப்புகள் - திராவிட மொழிகளின் வழங்கிடங்கள் - திராவிட மொழிகளுள் தமிழின் இடம் - தமிழ்மொழியின் சிறப்புகள் - தமிழ் பிறமொழித் தொடர்புகள்.

அலகு -2 **8 மணி நேரம்**

புறநானூறு- பாடல் எண்: , 182, 183, – இரண்டு பாடல்கள்.

குறுந்தொகை- பாடல் எண்: 2, 167, - இரண்டு பாடல்கள்

பரிபாடல் - முருகன். வையை - இரண்டு பாடல்கள்

அலகு - 3 அற இலக்கியங்கள் **07 மணி நேரம்**

திருக்குறள்- வான்சிறப்பு (அறம்), பெருமை (பொருள்), பிரிவாற்றாமை (இன்பம்),. மூன்று அதிகாரங்கள் முழுமையும்

1. நாலடியார் - இரண்டு பாடல்கள். (2, 3)
2. மூதுரை - இரண்டு பாடல்கள். (2, 8)

அலகு 4 மொழி **07 மணி நேரம்**

பிழை நீக்கி எழுதுதல் - ஒற்றுப்பிழை நீக்கி எழுதுதல் - தொடர்பிழை நீக்கி எழுதுதல் - ஒற்று மிகும் இடங்கள் - ஒற்று மிகா இடங்கள் - பிற மொழிச் சொற்களை நீக்கி எழுதுதல் – பயிற்சிகள்.

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

1. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
2. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. **பாடநூல் தேடலுக்கான இணையம் -** https://archive.org/

L	T	P	O	C
2	0	0	1	2

24LHIN11 **HINDI I**

COURSE OBJECTIVES:

- To enable the students to develop communication Skills.
- To train students in official language.
- To enrich their knowledge in Hindi Literature.
- To teach them human values & create awareness towards importance of tourism.
- To share the knowledge of their native place.
- To teach them to use Azhagi (Prose, Letter Writing & Functional Words**).**

UNIT 1: 'Smruti' (Kahani) by Pandit Sriram Sharma. **6**

UNIT 2: 'Athiti tum kab jaaoge' (Vyangy) by Harishankar Parsayi. **6**

UNIT 3: 'Atatho Ghumakkad Jigyasa' (Yatra Vruthanth) by Rahul Sanskrityayan. **6**

UNIT 4: Functional Hindi-Phrases use in Letter Writing. Skill development **6**

- Bhav Ek Bhasha Anek.

UNIT 5: Letter Writing- Intro. & Types & 3 Personal Letters. **6**

Introduction to Azhagi, Azhagi + fonts.

Total Hours : 30 ,

COURSE OUTCOMES:

At the end of this course Students will be able to,

CO1: Gain knowledge about the olden system of communication, the olden living style existed in the villages, human values, giving due respect to other living beings, thriller style of storytelling.

CO2: Understand to maintain their limits among their familiar circle and social responsibility.

CO3: Understand importance of exposure to various culture, human values and develop goodcharacter.

CO4: Know the Functional words in Hindi, various culture and languages of India.

CO5: Gain knowledge in drafting personal letters, equip themselves to Hindi typing thereby creatingself-employment.

TEXT BOOKS / REFERENCE BOOKS / WEB SOURCES:

1. Pandit Sriram Sharma ka kahani: https://www.evidyarthi.in
2. Harishankar parasayi ka Vyangy: http://gadyakosh.org
3. Rahul Sanskrityayan ka yatravruttant: https://www.hindwi.org
4. Prayojanmoolak Hindi:https://hi.mwikipedia.org
5. https://www.azhagi.com/hnd/helphtml/Introduction.html

L	T	P	O	C
2	0	0	1	2

24LFRE11 **FRENCH I**

COURSE OBJECTIVES:

The lessons are being chosen:

- To Greet, To Express Excuse And To Introduce Oneself
- To Introduce Another Person
- To Express His/Her Ideas, Opinions And Weekend Projects
- To Request Someone To Do Something, Polite Manners
- To Accept, Refuse, Enquire And Indicate The Time And Date
- To Express Himself / Herself In Positive And Negative Manner

UNIT 1:Salut **4**

les nombres, Les jours de la semaine et du mois, La nationalité

UNIT 2:Enchanté **6**

Les verbes Etre, Avoir, Aller, Regular ER verbes, Present tense.

UNIT 3:J'Adore **4**

La negation, l'adjectif possessif, le futur proche

UNIT 4:Tu veux bien **7**

Les articles de finis/indéfinis, Les pronoms après une préposition (avec lui, chez moi), Le passé composé

UNIT 5: On se voit quand **5**

Les pronoms compléments directs me, te, nous, vous, L'interrogation avec est-ce que, L'heure et la date.

UNIT 6:Bonne idée **4**

Les articles partitifs, Le masculin et le féminin des adjectifs, Les pronoms compléments directs le, la, les, La négation : ne… pas de.

Total Hours-:30

COURSE OUTCOMES:

At the end of this course Students will be able to

CO1: The students would be able to greet, to excuse and to introduce himself

CO2: The students would be able to introduce someone

CO3: The students would be able to express his ideas, opinions and weekend projects

CO4: The students would be able to ask someone to do something, polite manner

CO5: The students would be able to accept, refuse enquire and indicate the time and date

CO6: The students would be able to express himself in positive and negative manner

TEXT / REFERENCE BOOK:

1. Prescribed book: LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau
2. Reference book: SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, CatherineHoussa,ÉmilieKasazian

L	T	P	O	C
2	0	0	1	2

24LENG11 **ENGLISH I**

COURSE OBJECTIVES:

- To enable students to develop their communication skills effectively.
- To make students familiar with usage skills in the English Language.
- To enrich their vocabulary in English.
- To develop communicative competence.

UNIT 1: PROSE **6**

Dangers of drug abuse - Hardin B.Jones

Tight corners - E.V.Lucas

UNIT 2: POETRY **6**

Ecology - A.K.Ramanujan

The owl and the chimpanzee - Jo Camacho

UNIT 3: SHORT STORY **6**

The Dear Departed - Stanley Houghton

The Fool's Paradise- Isaac Bashevis Singer

UNIT 4: GRAMMAR **6**

Parts of speech, Articles

UNIT 5: GRAMMAR **6**

One-word substitution, prefix, suffix, synonym, antonym.

Total Hours: 30

COURSE OUTCOMES:

On completion of this course, Students can able to;

CO1: Understand the characteristic features of the language used in the text.

CO2: Strengthen their knowledge of basic grammar

CO3: Improve narrative skills after studying diverse prose and play.

CO4: Understand to classify parts of speech and articles.

CO5: Develop critical writing skills in the textual content of the syllabus.

REFERENCE BOOKS:

1. English for Communication Enrichment: by Jeya Santhi June 2015.
2. Dr. M. Narayana Rao and Dr. B. G.Barki–Anu's Current English for Communication (AnuChitra). June 2012.
3. Dr. Ananthan, R. Effective Communication. Ed. Chennai: Anu Chithra Pub.2010.

24CBCA11 **PROBLEM SOLVING TECHNIQUES USING C**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- Define and describe fundamental concepts of computers, algorithms, flowcharts and
- problem solving techniques.
- Illustrate basic knowledge of mathematical factoring methods to model an algorithm, flowchartand able to solve given problem
- To create flowcharts and express algorithms in a language-independent way.
- To instruct students in writing readable, modular, and efficient C programs.
- To teach the creation and utilization of C data type arrays.
- To explain how to use functions and recursive functions to create programme modules in C.
- To show how to create derived data types and handle file operations.

UNIT- I INTRODUCTION TO PROBLEM SOLVING 9

Understand the **Problem-Solving approach** using algorithms, flowcharts, and pseudocode - Programs andalgorithm - The Role of Algorithms in Computing - Algorithms as a technology - analyzing algorithms, Designing algorithms - Growth of Functions. Explore the concept of time complexity to analyze and evaluate algorithm efficiency.Study various algorithms - their design - analysis and implementation in C programming.Design flowcharts and write pseudocode to represent algorithmic solutions systematically.

UNIT- II INTRODUCTION TO C PROGRAMMIMG 9

Overview of C: C History and Background - C Program Structure - . **Constants,Variables & Data Types:** Character Set - C Tokens: Keywords and Identifiers - Constants - Variables - .Declaring data Variables - Variable Types - Format of Variable declaration - Intialization of Variables, Assigning Values to Variables - Constans and its types.- Defining Symbolic Constants -**Operators and Expression :**Arithmetic Operators, Logical - Relational - Assignment - Increment & Decrement - Conditional - Special Operators - Bit wise & Shift Operators-Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associativity.

UNIT-III CONTROL STRUCTURES & ARRAY 9

Input and Output: Standard input and output - Formatted output- Printf, variable length argument list- Formatted input-Scanf - **Simple C Programs** - **Conditional Satements :** If Statement -Simple IF- Evaluation of Multiple Statements - The IF Else Statement - The ELSE IF Ladder - Nested IF**.**

Looping Statements: The While Statement - The Do -While Statement - For Statement - Nested For - **S**witchStatement - Break and Continue - The Comma Operator & Goto Statement- **Array :** Declaration of Array- Initialization of Array - Single Dimensional & Two Dimensional-Examples.

UNIT-IV FUNCTIONS & POINTERS 9

User-defined Functions: Need for functions - Elements of User-defined Functions - Definition of Functions,Return Values and their Types - Function Calls - Function Declaration - Category of Functions - No Arguments and no Return Values - Arguments but no Return values - Arguments with Return Values - No Arguments but Returns a Value - Passing Arrays to Functions - Recursion, The Scope, Visibility and Lifetimeof variables. **Pointers:** Introduction, Declaring Pointer Variables, Initialization of Pointer variables, accessinga Variable through its Pointer, Pointer Expressions - Pointer Increments and Scale Factor.

UNIT– V STRUCTURES AND FILE MANAGEMENT 9

Structures: Introduction, Defining a structure, declaring structure variables, accessing structure members, structure initialization, array of structures.

File Management in C: Introduction, Defining and opening a file, closing a file, Input/output and Error Handling on Files.

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Understand the fundamental of Problem Solving techniques., algorithms, flowcharts and pseudo code.

CO3: Develop, compile, and debug programmes in the C language.

CO4: Describe the Fundamentals, Strcuture & History of C.

CO5: Write User defined functions and apply concept of recursion to solve problems.

CO6: Create programmes using Functions, arrays, loops, and decision structures.

TEXT BOOKS:

1. **Ray Dowson ,"Programming in ANSI C", 3rd Edition ,** Loughborough University InstitutionalRepository , ISBN 1-874152-10-1
2. **E. Balaguruswamy, "Programming in ANSI C"**, 8th Edition, 2019, McGraw HillEducation, ISBN: 978-93-5316-513-0

REFERENCE BOOK:

1. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, 2018, OxfordUniversity Press, ISBN: 978-01-9949-147-6.
2. Kernighan B.W and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.
3. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978-93-8728- 449-
4. Jacqueline A Jones and Keith Harrow, "Problem Solving with C", Pearson Education. ISBN: 978-93-325-3800-9.
5. Dr. Guruprasad Nagraj, "C Programming for Problem Solving", Himalaya Publishing House. ISBN-978-93-5299-361-1.

WEBSITES:

1. **www.w3schools.com**
1. www.tutorialspoint.com
2. www.javapoint.com
3. www.geeksforgeeks.org

WEB SOURCES:

1. https://www.vssut.ac.in/lecture_notes/lecture1424354156.pdf
2. https://www.unf.edu/~wkloster/2220/ppts/cprogramming_tutorial.pdf
3. http://mars.tekkom.dk/w/images/4/42/6272_cnote.pdf
4. https://www.slideshare.net/gauravjuneja11/c-language-ppt
5. https://www.electronicshub.org/basics-of-embedded-c-program/
6. https://www.mygreatlearning.com/blog/embedded-c

24CBCA12 DATA STRUCTURES

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

This course introduces the core principles and techniques for Data structures. Students will gain experience in how to keep a data in an ordered fashion in the computer. Students can improve their programming skills using Data Structures Concepts through C. Exploring basic data structures such as stacks and queues. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs. Introduces sorting and pattern matching algorithms.

UNIT I: INTRODUCTION TO DATA STRUCTURES 7

Introduction and Overview: Definition, Elementary data organization, Data Structures, data Structures operations, Abstract data types, algorithms complexity, time-space trade off. Preliminaries: Mathematical notations and functions, Algorithmic notations, control structures, Complexity of algorithms, asymptotic notations for complexity of algorithms. Arrays: Definition, Linear arrays, arrays as ADT, Representation of Linear Arrays in Memory,Traversing Linear arrays, Inserting and deleting, .

UNIT II : LINKED LIST 8

Linked list: Definition, Representation of Singly Linked List in memory,Traversing a Singly linked list, Searching in a Singly linked list, Memory allocation, Garbage collection, Insertion into a singly linked list, Deletion from a singly linked list; Doubly linked list, Header linked list, Circular linked list.

UNIT III : STACK & QUEUE 8

Stacks: Representation of Stack - Stack Operations - Applications - Recursion. Queues: Operations on Queues- Application & Representation - Circular Queues, Dequeue, Priority Queues.

UNIT IV : TREES & GRAPHS 10

Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees, Types of Tree, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Binary Search Trees and Operations, AVL Trees, Heap, B-Trees, B+ Trees. **Graph :**Definitions and Basic Terminologies, Representation of Graphs, Graph Traversals, Operations on Graphs, Shortest Path Problem (Warshall's Algorithm and Dijkstra's Algorithm), Minimum Spanning Tree (Prim's and Kruskal's Algorithm)

UNIT V : SORTING , SEARCHING & HASHING 12

Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Linear and Binary Searcht.Hashing: Hash functions, Collision Resolution, Implementation using Linear and Quadratic Probing, Chaining using C.

Total Hours: 45

COURSE OUTCOMES:

On Completion of the course, students will able to,

CO1: Understand and apply linear data structures-List, Stack and Queue.

CO2: Able to analyze the efficiency of algorithm.

CO3: Ability to select the data structures that efficiently model the information in a problem.

CO4: Apply data structures and algorithms in real time applications

CO5: Design programs using a variety of data structures, including hash tables, binary andgeneral tree structures, search trees, tries, heaps, graphs, and AVL-trees.

TEXT BOOKS:

1. Fundamentals of Data Structures in C, 2 nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed,Universities Press.
2. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.
3. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, andClifford Stein.

REFERENCE BOOK:

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, R. F. Gilberg and B.A.Forouzan,Cengage Learning.

WEB SOURCES:

http://www.suite101.com/reference/data_structure_tutorial

http://warrior-101.tripod.com/dstut/dstut.htm

http://www.cplusplus.com/doc/tutorial/structures/

http://www.theparticle.com/javadata2.html

24CBCA13 DIGITAL LOGIC & COMPUTER ARCHITECTURE

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- This course introduces the concepts of digital logic. Digital number systems and basic logic gates are covered.
- It includes the functionality of logic gates, simplifying Digital Circuits, Boolean Expression, combinational and sequential circuits.
- Emphasis is placed on providing a foundation for the application of digital logic to use of digital applications such as programmable logic converters.
- The objective of this course is to study computer architecture design by examining architectural Concepts with consideration of performance,usability, reliability, and power management etc.
- This course covers a number of issues involved in the design and utilization of high performance computing systems.

UNIT – I: NUMBER SYSTEM 10

Digital Systems, Binary Numbers, Number base conversions, Octal, Hexadecimal and other base numbers, complements, signed binary numbers, Floating point number representation, binary codes, Error detection and correction, binary storage and registers, binary logic, Boolean algebra and logic gates , Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Digital Logic Gates.

UNIT – II: K MAP & LOGIC GATES 10

The K-Map Method, Three-Variable Map, Four Variable Map, Five-Variable Map, sum of products, product of sums simplification, Don't care conditions , NAND and NOR implementation and other two level implementations, Exclusive-OR function.

UNIT – III: COMBINATIONAL LOGIC CIRCUIT 8

Combinational circuit: Binary Adder, Subtractor, Decimal Adder, Decoders, Encoders, Multiplexers, De-multiplexers .

UNIT – IV: SEQUENTIAL CIRCUIT 7

Sequential Circuit: Latches, Flip-flops, analysis of clocked sequential circuits, Registers, Shift registers, Ripple counters, Synchronous counters, other counters

UNIT – V: BASIC COMPUTER DESIGN 10

Basic Model of a Computer, Computer Components, Register transfer and Microoperations: Register Transfer Language ,Register Transfer , Bus and Memory Transfers, Arithmetic Microoperations , Logic Microoperations , Shift Microoperations , Arithmetic Logic and Shift Unit. Instruction codes, Computer registers, Computer Instruction, Timing and control, Instruction cycle, Memory reference instructions, Input output and Interrupt, Design of basic computer, Design of Accumulator logic.

Total Hours: 45

COURSE OUTCOMES:

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

CO1. Demonstrate the relation between various number systems and model basic functions based on Boolean algebra and logic gates

CO2. Analyze logic function using K-maps ad tabular method and develop basic combinational digital systems.

CO3. Characterize sequential circuits and design clock based registers and counters.

CO4. Design synchronous and asynchronous finite state machines.

CO5. Compare various digital logic families based on power, speed and interfacing characteristics. Analyze working of logic families and logic gates and design the simple circuits using various gates for a given problem.

TEXT BOOKS:

1. Digital Design, M. Morris Mano, M.D.Ciletti, 5th edition, Pearson.(Units I, II, III, IV, Part of Unit V)

2. Computer System Architecture, M.Morris Mano, 3rd edition, Pearson.(Part of Unit V)

REFERENCE BOOKS:

1. Switching and Finite Automata Theory, Z. Kohavi, Tata McGraw Hill.

2. Stalling, Williams. Computer Organization and Architecture, 7th Edition,2010

2. Fundamentals of Logic Design, C. H. Roth, L. L. Kinney, 7th edition, Cengage Learning.

3. Fundamentals of Digital Logic & Micro Computer Design, 5TH Edition, M.

WEB SOURCES:

https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

24PBCA11 PROBLEM SOLVING TECHNIQUES USING C LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

- To make the student learn a programming language.
- Develop C programs using operators
- Write C programs using conditional structures
- Write C programs using iterative structure arrays and strings
- Inscribe C programs that use Pointers to and functions
- Develop a c program for implementing user defined types and file processing

LIST OF PROGRAMS:

1) Write a C program to find sum and average of three numbers.
2) Write a C program to find the sum of individual digits of a given positive integer.
3) Write a C program to generate the first n terms of the Fibonacci sequence.
4) Write a C program to generate prime numbers between 1 to n.
5) Write a C program to Check whether given number is Armstrong Number or Not.
6) Write a C program to evaluate algebraic expression (ax+b)/(ax-b).
7) Write a C program to check whether given number is perfect number or Not.
8) Write a C program to check whether given number is strong number or not.
9) Write a C program to find the roots of a quadratic equation.
10) Write a C program perform arithmetic operations using switch statement.
11) Write a C program to perform addition and Multiplication of two matrices.
12) Write a C program using user defined functions to determine whether the given string is palindrome or not.
13) Write a C program to count the number of lines, words and characters in a given text.
14) Write a C program to find the length of the string using Pointer.
15) Write a C Program to Calculate Total and Percentage marks of a student using structure.
16) Write a C program to copy the contents of one file to another.

Total Hours : 30

COURSE OUTCOMES:

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

CO1: Understand the fundamental of Problem Solving techniques. Algorithms, flowcharts and pseudo code.

CO2: Develop, compile, and debug programmes in the C language.

CO3: Write User defined functions and apply concept of recursion to solve problems.

CO4: Create programmes using Functions, arrays, loops, and decision structures.

CO5: Diffentiate Call by Value and Call by Reference and describe the concept of Pointers and Structures.

TEXT BOOKS:

3. **Ray Dowson ,"Programming in ANSI C", 3rd Edition ,** Loughborough UniversityInstitutional Repository , ISBN 1-874152-10-1

4. **E. Balaguruswamy, "Programming in ANSI C"**, 8th Edition, 2019, McGraw HillEducation, ISBN: 978-93-5316-513-0

REFERENCE BOOKS:

1. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, 2018, Oxford UniversityPress, ISBN: 978-01-9949-147-6.

5. Kernighan B.W and Dennis M. Ritchie, "The C Programming Language", 2ndEdition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.

6. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978-93-8728-449-4.

7. Jacqueline A Jones and Keith Harrow, "Problem Solving with C", PearsonEducation. ISBN: 978-93-325-3800-9.

8. Dr. Guruprasad Nagraj, "C Programming for Problem Solving", HimalayaPublishing House. ISBN-978-93-5299-361-

WEB SOURCES:

1. www.w3schools.com
2. www.tutorialspoint.com
3. www.javapoint.com
4. www.geeksforgeeks.org

24PBCA12 **DATA STRUCTRES LAB**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

This course introduces the core principles and techniques for Data structures. Students will gain experience in how to keep a data in an ordered fashion in the computer.Students can improve their programming skills using Data Structures Concepts through C. Exploring basic data structures such as stacks and queues. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs. Introduces sorting and pattern matching algorithms.

1. Given {2,8,3,7,1,4,6,9,0,5} find the location of 9using Linear search and also display its first occurrence.
2. Given {2,8,3,7,1,4,6,9,0,5} find the location of 9 using Binary search and also display its first occurrence.
3. Write a program to push 5,12,34,78,20,11,15,2 into stack and pop 3 times from the stack, also display the popped numbers.
4. Write a program to insert the elements {61,16,8,27} into linear queue and delete three elements from the list. Display your list after each insertion and deletion.
5. Perform the Insertion and Selection Sort on the input {92,7,1,16,48,7,3,0}.
6. Perform Bubble sort for the elements 5,3,1,6,0,2,4.
7. Write a program to insert the elements {61,16,8,27} into singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.
8. Write a program to evaluate a postfix expression 5 3+8 2 - *.
9. Write a program to create binary search tree with the elements {2,5,1,3,9,0,6} and perform inorder, preorder and post order traversal.
10. Write a program to Sort the following elements using heap sort {9.16,32,8,4,1,5,8,0} Quick Sort.

Total Hours : 30

TEXT BOOKS:

1. Fundamentals of Data Structures in C, 2 nd Edition, (2000) E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education(1996)
3. Data Structures: A Pseudocode Approach with C, 2 nd Edition, R. F. Gilberg and B.A.Forouzan, Cengage Learning.

SEMESTER II

L	T	P	O	C
2	0	0	2	2

பாடக் குறியீட்டு எண்: 24LTAM21

பருவம்-2, தமிழ்மொழிப்பாடம்-2, பகுதி-1, தகுதிப்புள்ளி: 2, வாரப் பாட நேரம்: 2.

தாள்-2

காப்பியம், பக்தி இலக்கியம், கலைகள், நாகரிகம்-பண்பாடு

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், அற இலக்கியங்கள், சிற்றிலக்கியம், சிறுகதை ஆகியவற்றை அறிமுகப்படுத்துதல், தற்காலப் பேச்சுத் தமிழ் எழுத்துத்தமிழ் ஆகியவற்றின் வளர்நிலைகளை மாணவர்களை அறியச் செய்தல், அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களின் மொழித் திறனை மேம்படுத்த அவர்களுக்குக் கடிதம் எழுதும் கலையைக் கற்றுக்கொடுத்தல், அணி இலக்கணத்தை அறியச் செய்தல் என்பன இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு 1காப்பியங்கள் **8மணி நேரம்**

சிலப்பதிகாரம்- கனாத்திறம் உரைத்தக் காதை முழுவதும்.

மணிமேகலை- மலர்வனம் புக்க காதை முழுவதும்.

கம்பராமாயணம் - குகப் படலம் (தேர்ந்தெடுக்கப்பட்ட ஒன்பது பாடல்கள்)

அலகு 2: பக்தி இலக்கியம் **8 மணி நேரம்**

1. மாணிக்கவாசகர் - திருவாசகம் – மூன்று பாடல்கள்
   - ✓ புல்லாகி பூடாகி (சிவபுராணம்)
   - ✓ எல்லாப் பிறப்பும் (சிவபுராணம்)
   - ✓ உற்றாரை யான் வேண்டேன் (திருப்புலம்பல்)
2. ஆண்டாள் - திருப்பாவை – மூன்று பாடல்கள் (1, 3, 4)
   - ✓ மார்கழித் திங்கள் ... (பாசுரம் 1)
   - ✓ ஓங்கி உலகளந்த... (பாசுரம் 3)
   - ✓ ஆழிமழைக் கண்ணா... (பாசுரம் 4)
3. வீரமாமுனிவர் - தேம்பாவணி – வளன் சினித்தப் படலம்
4. சீறாப்புராணம்- மானுக்கு பிணை நின்ற படலம்

அலகு 3 கலைகள் **07 மணி நேரம்**

சிற்பம் - ஓவியம் - இசை - கூத்து - ஒப்பனை - ஆடை அணிகலன்கள்.

அலகு 4 நாகரிகம், பண்பாடு **7மணி நேரம்**

சொற்பொருள் விளக்கம் - பண்டைத் தமிழர் வாழ்வியல் - அகம் - களவு - கற்பு - குடும்பம் - விருந்தோம்பல் - உறவு முறைகள் - சடங்குகள் - நம்பிக்கைகள் - பொழுதுபோக்கு - புறம் - போர் முறைகள் - நடுகல் வழிபாடு - கொடைப்பண்பு.

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

1. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
2. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. **பாடநூல் தேடலுக்கான இணையம் -** https://archive.org/

L	T	P	O	C
2	0	0	2	2

24LHIN21 HINDI II
Prose, Official Letter Writing & Functional Hindi

COURSE OBJECTIVES :

- To train students in translation
- To develop reading & writing skills
- To create interest towards reading different types of literature
- To understand the value of Senior citizen
- To understand the importance of hard work
- To understand the patriotism and women empowerment
- To introduce the usage of Inscript keyboard

UNIT I: 'Boodee kaki" (Kahani) by Munshi Premchand **6**

UNIT II: 'Puraskar' (Kahani) by Prasad **6**

UNIT III: 'Main Narak Se Bhol Raha Hun' (Vyangy) by Harishankar Parsayi, **6**

UNIT IV: Functional Hindi- Technical & Designation & Department Names-50., Bhav Ek Bhasha Anek **6**

UNIT V : Functional Hindi-Letter Writing- 3 Official Letters.Inscript Keyboard Knowledge. **6**

Total Hours: 30

COURSE OUTCOMES:

At the end of this course Students will be able to

CO1 Know to the value senior citizen , their love and affection towards the family members

CO2 Know the importance of patriotism and women empowerment in the society

CO3 Know the value of hardwork in human life

CO4 Gain fair knowledge of Functional Hindi and fluency in speaking Hindi

CO5 Equip themselves in writing official letters in Hindi importance of translation of technical words and equip knowledge in using inscript keyboard thereby improving their Employability

TEXT/REFERENCE BOOK/WSOURCES:

1. Munshi Premchand, Manasarovar, 2007, http://gadyakosh.org
2. Jaishankar Prasad/ http://gadyakosh.org
3. Harishankar Parsai/ https://hindikahani.hindi-kavita.com
4. Prayojanmoolak Hindi:https://hi.mwikipedia.org
5. https://rajbhasha.gov.in/en/introduction

24LFRE21 **FRENCH – II**

L	T	P	O	C
2	0	0	2	2

COURSE OBJECTIVES:

The lessons are being chosen:

- To express his / her where abouts and to ask seek direction
- To express obligation and restriction
- To describe a place
- To narrate and to question To describe someone
- To express his desire and to speak about the future

UNIT I **C'est où** **6**

L'impératif, Les articles contractés au, à la…, Le passé composé et l'accord du participe passé avec être.

UNIT II **N'oubliez pas** **6**

Le pronom relatif Qui, que, où, Les pronoms compléments indirects (me, te, lui, leur…)

UNIT III: **Belle vue sur la mer --** **6**

Les adjectifs démonstratifs, Y- pronom complément.

UNIT IV: **Quel beau voyage!** **6**

Les verbes pronominaux, En- pronom complément.

UNIT V: **Oh ! joli** **6**

L'imparfait, L'imparfait ou le passé composé.

Total Hours: 30 Hrs

COURSE OUTCOMES:

At the end of this course, the students would have learn to

CO1 The students would be able to express his/her where about and to ask direction

CO2 The students would be able to express obligation and restriction

CO3 The students would be able to describe a place

CO4 The students would be able to narrate and to question

CO5 The students would be able to describe someone

CO6 The students would be able to express his desire and to speak about the future

TEXT /REFERENCE BOOKS :

- Prescribed book: LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau
- Reference book: SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

24LENG21 **ENGLISH – II**

COURSE OBJECTIVES:

CO1: To read and understand different typ es of prose, poetry, and fiction.
CO2: To think critically about texts and express ideas clearly.
CO3: To recognize and discuss key themes and styles in literary works.
CO4: To learn and use grammar rules correctly in writing and speaking.
CO5: To write more effectively by applying grammar and literary techniques.

UNIT I -PROSE *6*

- If you are wrong, admit it- Dale Garnegie
- Words of Wisdom- Chetan Bhaghat

UNIT II - POETRY *6*

- La Belle Dame Sans Merci - John Keats
- Ozymandias- P.B.Shelley

UNIT III - FICTION *6*

- The School for Empathy - E.V. Lucas
- The Lamb to the Slaughter-Roald Dahl

UNIT IV - GRAMMAR *6*

- Types of sentences, Concord

UNIT V - GRAMMAR *6*

- Tenses, Voices

Total Hours:30

COURSE OUTCOMES:

At the end of this course, the students would have learnt to

CO1: Identify poetic expressions in the course of daily speech
CO2: Students will develop skills that enable them to communicate effectively in writing.
CO3: Students will develop skills that enable them to communicate effectively in writing.
CO4: Discriminate against different sensibilities in approaching life.
CO5: Strengthen the ability to solve life's problems, as highlighted in the selection

REFERENCE BOOKS:

- Dr. M. Narayana Rao and Dr. B. G. Barki–Anu's Current English for Communication (AnuChitra). June 2012.
- General English for competitive examinations by V.Rajagopalan (Mcgraw Hill Education) -2010.

1. General English for competitive examinations by V.Rajagopalan (Mcgraw Hill Education) -2010.

24CBCA21 OBJECT ORIENTED PROGRAMMING WITH C++

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- This course introduces basic objectives c++ and learning the difference b/w structured programming and programming and OOPs concepts.
- Creating C++ programs using Tokens, expressions and control structures in C++.
- Arranging same data systematically with arrays. How to handle Classes and objects in C++.
- Knowledge about the functions, Constructors and destructors Inheritance and Overloadings in C++.
- Files management and inheritance in C++. Handling exceptions to control errors.

UNIT I INTRODUCTION 9

Introduction to C++ - key concepts of Object-Oriented Programming –Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements : If ..else, jump, goto, break, continue, Switch case statements - Loops in C++ : for, while, do - functions in C++ - inline functions – Function Overloading.

UNIT II CLASSES & OBJECTS 9

Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructors with static members.

UNIT III INHERITANCE 9

Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchical, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.

UNIT IV POINTERS 9

Pointers – Declaration – Pointer to Class, Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models new and delete operators – dynamicobject – Binding, Polymorphism and Virtual Functions.

UNIT V FILES **9**

Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous function

Total Hours: 45

COURSE OUTCOMES:

On Completion of this course, the students can able to

CO1: Develop bottom up Programming using classes & objects and identify the basic concepts of Object Oriented Programming

CO2: Recite the concepts to control the flow of data

CO3:. Apply the Concepts of Inline Function & Friend Function.

CO4: Analyze the role of inheritance and overloading concepts to building reusable code.

CO5: Develop the file handling and file operations.

TEXT BOOKS:

1. E.BalaGurusamy "Object Oriented Programming with C++", Tata MC Graw Hill Education.
2. YashwantKanetkar-"Let Us C++", 2nd edition,McGraw HillEducation,2000.

REFERENCE BOOKS:

1. Herbert Schildt "The Complete Reference C++", 4th edition,McGraw Hill Education,2017
2. D.Ravichandran-"Oriented Programming with C++", 2nd edition, TMH.

WEBSOURCES:

1. www.w3schools.com
2. www.tutorialspoint.com
3. www.javapoint.com
4. www.geeksforgeeks.org

5. https://www.tutorialspoint.com/cplusplus/cpp_tutorial.pdf

6. https://www.cplusplus.com/files/tutorial.pdf

7. https://www.slideshare.net/aloknie/oop-cclassfinalppt
8. https://www.slideshare.net/adisesha12/basic-concept-of-oops
9. https://www.slideserve.com/joan-craft/object-oriented-programming-

24CBCA22 **OPEN SOURCE TECHNOLOGIES**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- To explore open-source software licenses, open-source project structure.
- To analyse model requirements and constraints for the purpose of designing and implementing software systems using open-source tools.
- To provide an exposure to develop various real time applications using Perl and Python

UNIT I INTRODUCTION 9

Introduction – Why Open Source – Open Source –Principles, Standards Requirements - Successes – Free Software – FOSS – Internet Application Projects.

UNIT II LINUX ENVIRONMENT 9

What is Linux and Open Source? -Linux Distributions and Installation- Getting Familiar with the Linux Command Line-Basic File Operations in Linux-User and Group Management in Linux.

UNIT III PERL 9

Introduction- Syntax Overview- Data Types- Variables- Array- If-Else-Loops-Operators-Functions -File I/O.

UNIT IV PHP 9

PHP – variables, operations- constants- control structures arrays- functions- classes – handling files. E-mailing with PHP – sending an email – multipart message – storing images– getting confirmation- Session tracking using PHP-cookies.

UNIT V MYSQL 9

Introduction – Setting up account –Starting, terminating and writing your own SQL programs - Record selection Technology-Working with strings- –Date and Time – Sorting Query Results – Generating Summary – Working with metadata – Using sequences –MySQL and Web

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Be familiar with fundamentals of Linux operating system.

CO2: To learn the concepts of files and file organization.

CO3: To learn the mechanisms involved in ownership of files and file attributes

CO4. To gain the knowledge on vi editor and regular expressions

CO5. To know the techniques of shell programming**.**

TEXT BOOK:

1. Kailash Vadera, Bhavyesh Gandhi, "Open-Source Technology", Laxmi Publications Pvt Ltd2012, 1st Edition.

REFERENCE BOOK:

1. Fadi P. Deek and James A. M. McHugh, "Open Source: Technology and Policy",Cambridge Universities Press 2007.

WEB SOURCES:

1. https://tavaana.org/sites/default/files/introduction_to_opensource.pdf
2. http://www.gov.pe.ca/photos/original/IPEI_ebiz_oss.pdf
3. https://www.tutorialspoint.com/php/php_tutorial.pdf
4. https://www.tutorialspoint.com/mysql/mysql_tutorial.pdf

L	T	P	O	C
0	0	2	1	1

24PBCA21 OBJECT ORIENTED PROGRAMMING LAB USING C++

COURSE OBJECTIVES:

This course introduces basic objectives C++ learning is to learn about programming and OOPs concepts.

- Creating C++ programs using Tokens, expressions and control structures in C++.
- Arranging same data systematically with arrays. How to handle Classes and objects in C++.
- Knowledge about the functions, Constructors and destructors in C++.
- Files management and inheritance in C++. Handling exceptions to control errors.

LIST OF EXPERIMENTS:

1. Write a C++ program to demonstrate Control Structures
2. Write a C++ program to calculate Simple interest using class and Object
3. Write a C++ program to sort given numbers in Ascending Order using Bubble sort
4. Write a C++ program to manipulate a given string
5. Write a C++ program to demonstrate function overloading
6. Write a C++ program to demonstrate Inline and friend function
7. Write a C++ program to demonstrate Swap using call-by-value
8. Write a C++ program to demonstrate Mathematical functions
9. Write a C++ program to demonstrate Constructor and Destructor
10. Write a C++ program to demonstrate Operator Overloading
11. Write a C++ program to demonstrate Single Inheritance
12. Write a C++ program to demonstrate Multi level Inheritance
13. Write a C++ program to demonstrate Multiple Inheritance
14. Write a C++ program to demonstrate virtual function
15. Write a C++ program to demonstrate Exception handling

Total Hours: 30

COURSE OUTCOMES:

On Completion of this course, the students can able to

CO1: Develop the Virtual Functions and File handling operations

CO2: Write C++ Programs using Classes & objects.

CO3: Build programs on Constructors, Destructors and Overloading concepts using programs.

CO4: Manipulate the role of inheritance in building reusable code and I/O operations.

CO5: State the OOP's concepts in writing simple C++ Programs.

TEXT BOOKS:

1) E.BalaGurusamy "Object Oriented Programming with C++", Tata MC Graw Hill Education.
2) YashwantKanetkar-"Let Us C++", 2nd edition,McGraw HillEducation,2000.

REFERENCE BOOKS:

1. Herbert Schildt "The Complete Reference C++", 4th edition,McGraw Hill Education,2017
2. D.Ravichandran-"Oriented Programming with C++", 2nd edition, TMH.

WEBSITES

1. www.w3schools.com
2. www.tutorialspoint.com
3. www.javapoint.com
4. www.geeksforgeeks.org

WEB SOURCES

1. https://www.tutorialspoint.com/cplusplus/cpp_tutorial.pdf
2. https://www.cplusplus.com/files/tutorial.pdf
3. https://www.slideshare.net/aloknie/oop-cclassfinalppt
4. https://www.slideshare.net/adisesha12/basic-concept-of-oops
5. https://www.slideserve.com/joan-craft/object-oriented-programming-with-c

24PBCA22 OPEN SOURCE TECHNOLOGIES LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

- Understand the difference between open-source software and commercial software.
- Familiarity with Linux operating system.
- Understanding and development of web applications using open-source web
- technologies like Apache, MySql and PHP

LIST OF PROGRAMS

1. Write a Shell script that accepts a filename, starting and ending line numbers as arguments and displays all the lines between the given line numbers?
2. Write a Shell script to list all of the directory files in a directory.
3. Write a Shell script to find factorial of a given integer?
4. Write a awk script to find the number of characters, words and lines in a file?
5. Installation Apache
6. Creating TABLE using My SQL.
7. Data Manipulation Commands
8. Joining Database Tables
9. Palindrome or not in PHP
10. Connect PHP with My SQL
11. Create Login page with help of PHP and My SQL

Total Hours: 30

COURSE OUTCOMES:

On completion of this course, the students can be able to:

CO1: Write session control PHP code for a website

CO2: Develop web applications using LAMP.

CO3: Identify, install and run open source technologies like PHP MySql , Apache

CO4: Develop a database connectivity among PHP to MySql .

CO5: Develop simple applications using PHP.

TEXT BOOKS:

1. James Lee and Brent Ware ,"Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", , Dorling Kindersley(India) Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. Eric Rosebrock, Eric Filson ,"Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.

WEBSITES

1. www.w3schools.com
2. www.tutorialspoint.com
3. www.javapoint.com
4. www.geeksforgeeks.org

WEB SOURCES:

1. https://tavaana.org/sites/default/files/introduction_to_opensource.pdf
2. http://www.gov.pe.ca/photos/original/IPEI_ebiz_oss.pdf
3. https://www.tutorialspoint.com/php/php_tutorial.pdf
4. https://www.tutorialspoint.com/mysql/mysql_tutorial.pdf

24CBCA23 COMPUTER GRAPHICS AND MULTIMEDIA

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

- To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- To become familiar with various software programs used in the creation and implementation of multi-media
- To appreciate the importance of technical ability and creativity within design practice.
- To gain knowledge about graphics hardware devices and software used.
- To understand the two-dimensional and three-dimensional graphics and their transformations.
- To appreciate illumination and colour models
- To become familiar with understand clipping techniques
- To become familiar with Blender Graphics

UNIT I BASIC CONCEPTS 12

Introduction, Definition of Computer Graphics, Area of Computer Graphics, Design and Drawing, GRAPHIC DEVICES- Cathode Ray Tube, Quality of Phosphors, CRTs for Color Display, Beam PenetrationCRT, The Shadow - Mask CRT, Direct View Storage Tube, Tablets, The light Pen, C Graphics Basics Graphics programming, initializing the graphics, C Graphical functions, simple programs.

UNIT II 3D GRAPHICS 12

2D Transformations – Clipping – Window – View Prot Mapping – Graphical User Interfaces and Interactive Input Methods – Picture Construction Techniques – Virtual Reality Environment.3D Transformation – 3D Viewing – Visible Surface Detection – Back Face Detection – Depth Buffer Method – Scan Line Method.

UNIT III MULTIMEDIA BASICS 12

Introduction to Multimedia – Components – Hypermedia – Authoring – Authoring tools – File formats – Color models – Digital Audio representation – Transmission – Audio signal processing – Digital music making – MIDI – Digital video – Video compression techniques – Video performance measurements – Multimedia Databases – Animation – Key frames and twining techniques – Principles of animation – Virtual

reality – Multimedia for portable devices.

UNIT IV MULTIMEDIA COMMUNICATION **12**

Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions -Media Synchronization – Models for Temporal Specifications – Streaming of Audio and Video –Recovering from packet loss – RTSP — Multimedia Communication Standards –RTP/RTCP – SIP and H.263- Real time streaming and On-demand streaming.

UNIT V MULTIMEDIA APPLICATION DEVELOPMENT **12**

Design, Development and evaluation of multimedia a system - The development of user interface design - Design Process - Multimedia & the Internet - Multimedia conferencing - Multimedia file sharing – Multimedia broadcasting - Multimedia Development Issues - Multimedia project – Structured Multimedia development - Multimedia project timing - Sample project.

Total Hours: 60

COURSE OUTCOMES

At the end of this course, the students would have learnt to

CO1: Design two-dimensional graphics.

CO2: Apply two dimensional transformations

CO3: Design three- dimensional graphics.

CO4: Apply three dimensional transformations.

CO5: Apply Illumination and colour models and apply clipping techniques to graphics.

CO7: Understood Different types of Multimedia File Format

CO8: Design Basic 3d Scenes using Blender

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, New Delhi, 2007 [UNIT I – III]

2. Andleigh, P. K and KiranThakrar, ―Multimedia Systems and Design‖, PHI, 2003. [UNIT IV,V]

REFERENCES:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics in C Version", Second Edition, PearsonEducation

2. Tom McReynolds – David Blythe " Advanced Graphics Programming Using OpenGL" , Elsevier,2010
3. Parag Havaldar and Gerard Medioni, "Multimedia Systems-Algorithms, Standards and Industry Practices", Course Technology, Cengage Learning, 2010.John F. Koegel Bufend , "Multimedia systems", Pearson Education, Delhi, 2002
4. Ralf Steinmetz and Klara "Multimedia Computing, Communications and Applications", Pearson Education,2004.
5. Kurose and Ross, 'Computer Networks : A top down Approach', Pearson Education, 2002
6. Mohammad Dastbaz, Desgning Interactive Multimedia Systems
7. Multimedia – Technology and applications David Hillman Galgotia Publications, Delhi
8. Ralf Steinmetz and Klara Nahrstedt "Multimedia Applications", Springer, 2007.

SEMESTER III

24CBCA31 **PROGRAMMING IN JAVA**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE

1. To introduce the object oriented programming system concepts.
2. To introduce syntax and semantics of Java programming language.
3. To develop modular programs using Java.
4. To setup JDK environment to create, debug and run Java programs.
5. To develop skills in creating custom exceptions.

UNIT I: FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING 9

Basic Concepts of Object Oriented Programming (OOP), Benefits and Applications of OOP. **Java Evolution:** Java Features, Difference between Java, C and C++, Java and Internet, Java Environment. **Overview of Java Language:** Introduction to Simple Java Program, Use of Comments and Math function, Application of two classes, Java Program Structure, Java Tokens and statements, Implementing Java program and JVM, Command Line Arguments.

UNIT II: CONSTANTS, VARIABLES AND DATA TYPES 9

Constants, Variables, Data Types, Declaration of Variables, Giving values to Variables, Symbolic Constants, Typecasting. **Operators & Expressions:** Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, conditional operators, Bitwise operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence & Associativity. **Decision Making, Branching & Looping:** Decision Making with Control Statements, Looping statements, Jump in loops, Labelled loops.

UNIT III: CLASSES, OBJECTS AND METHODS 9

Defining Class, Methods Declaration, Constructors, Methods Overloading, Overriding Methods, Inheritance**. Arrays, Strings and Vectors:** 1D arrays, Creating an Array, 2D arrays, Strings, Vectors, Wrapper Classes, Enumerated Types**. Inheritance:** Defining, extending classes, and Implementing Interfaces. Multiple inheritance and polymorphism.

UNIT IV: PACKAGES 9

Basics of packages, System packages, Creating and accessing packages, creating user defined packages, Adding class to a package.

UNIT V: EXCEPTION HANDLING 9

Using the main keywords of exception handling: try, catch, throw, throws and finally; Nested try, multiple catch statements, creating user defined exceptions**.**

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Understand and apply the core concepts of Object-Oriented Programming (OOP) such as classes, objects, inheritance, and polymorphism in Java.

CO2: Write, compile, and debug Java programs using the Java Development Kit (JDK), understanding the role of the Java Virtual Machine (JVM).

CO3: Develop modular, reusable code by leveraging Java's object-oriented features such as classes, methods, constructors, and method overloading/overriding.

CO4: Implement control structures, operators, and decision-making processes to create logical and efficient programs.

CO5: Work with Java's built-in data structures including arrays, strings, and vectors, as well as wrapper classes and enumerated types.

CO6: Handle exceptions effectively in Java, using try-catch blocks, throws, throw, and custom exception handling to ensure program robustness.

TEXT BOOKS:

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition.McGraw-Hill Education.

REFERENCE BOOKS:

1. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson,2008.
4. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, OxfordUniversity Press, 2014.
5. Learning Java, 6th Edition By Marc Loy, Patrick Niemeyer and Daniel Leuck O'Reilly Media, Inc.August 2023

WEB RESOURCES

1. https://www.w3schools.com/java/.
2. http://www.java2s.com/.
3. https://onlinecourses.nptel.ac.in/noc22_cs47/pre

24CBCA32 DATA BASE MANAGEMENT SYSTEM

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

1. Understanding Core Concepts of DBMS
2. Proficiency in Database Design and SQL
3. Application of Advanced Database Techniques
4. Basic knowledge of Set Theory.
5. To enhance advanced data privacy.

UNIT I: INTRODUCTION TO DATABASES 9

Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators**. Data Models:** Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS**. Database Design**:Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key,Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model,Entities and Entity Sets, Attributes and Relationships,ER Diagrams,Key Constraints and Weak Entity Sets, Extended ER Features,Introduction to the Relational Model and Relational Schema.

UNIT II: RELATIONAL ALGEBRA AND CALCULUS 9

Introduction to Relational Algebra, Operations: Selection, Projection, Set Operations, Join Operations, Division,Tuple and Domain Relational Calculus. **Structured Query Language (SQL):** SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses(Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join. **Normalization and Database Design**: Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.

UNIT III: TRANSACTION MANAGEMENT 9

ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL,Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlocks. **Database Storage and Indexing**: Data on External Storage, File Organizations and

Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection.

UNIT IV: NOSQL DATABASES AND BIG DATA **9**

Introduction to NoSQL, Data Models: Document, Key value, Column family, Graph. Uses and Features of NO/SQL document databases. CAP theorem, BASE vs ACID, CRUD operations, MongoDB operators, Overview of Big Data Technologies: Hadoop, MongoDB, and Cassandra.

UNIT V: ADVANCED SQL **9**

Analytical queries, Hierarchical queries, Recursive queries, Views, Cursors, Stored Procedures and Functions, Packages, Triggers, Dynamic SQL. **Database Security and Advanced Topics:** Introduction to Database Security, Access Control, Discretionary Access Control, Introduction to Data Warehousing, OLAP, And Data Mining.

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Understand the core concepts and fundamentals of Database Management Systems (DBMS).

CO2: Gain proficiency in database design and the usage of Structured Query Language (SQL).

CO3: Apply advanced database techniques such as normalization, transaction management, and indexing.

CO4: Develop a basic understanding of Set Theory, particularly its application in DBMS.

TEXT BOOKS

1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", third edition, McGraw – Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015
3. Brad Dayley, "NoSQL with MongoDB in 24 Hours", 1st edition, Sams Publishing, 2024

REFERENCE BOOKS

1. Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.(2019).

2. R.P. Mahapatra, Govind Verma, “Database Management Systems”, Khanna Publishing House, 2024.

WEB RESOURCES

1. https://oracle-base.com/articles
2. https://forums.oracle.com/ords/apexds/domain/dev-community/category/sql_and_pl_sql
3. https://asktom.oracle.com/ords/f?p=10

24PBCA31 **PROGRAMMING IN JAVA LAB**

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

1. To introduce the object oriented programming system concepts.
2. To introduce syntax and semantics of Java programming language.
3. To develop modular programs using Java.
4. To setup JDK environment to create, debug and run Java programs.
5. To develop skills in creating custom exceptions

LIST OF EXPERIMENTS:

1. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student.
2. Write a java program to find the largest number out of n natural numbers.
3. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non-recursive functions.
4. Write a Java program to perform mathematical Operations
5. Write a Java program that displays the number of characters, lines and wordsin a text.
6. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea(). Create a subclass called Circle that overrides the getPerimeter() and getArea() methods to calculate the area and perimeter of a circle.
7. Write a Java program to create a class Employee with a method called calculateSalary(). Create two subclasses Manager and Programmer. In each subclass, override the calculateSalary() method to calculate and return the salary based on their specific roles.
8. Write a Java package program for the class book and then import the data from the package and display the result.
9. Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results.

10. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.

Total Hours: 30

COURSE OUTCOMES:

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

CO1: Understand and apply the core concepts of Object-Oriented Programming (OOP) such as classes, objects, inheritance, and polymorphism in Java.

CO2: Write, compile, and debug Java programs using the Java Development Kit (JDK), understanding the role of the Java Virtual Machine (JVM).

CO3: Develop modular, reusable code by leveraging Java's object-oriented features such as classes, methods, constructors, and method overloading/overriding.

CO4: Implement control structures, operators, and decision-making processes to create logical and efficient programs.

CO5: Work with Java's built-in data structures including arrays, strings, and vectors, as well as wrapper classes and enumerated types.

CO6: Handle exceptions effectively in Java, using try-catch blocks, throws, throw, and custom exception handling to ensure program robustness.

TEXT BOOKS:

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition.McGraw-Hill Education.

REFERENCE BOOKS:

1. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson,2008.
4. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, OxfordUniversity Press, 2014.

WEB RESOURCES:

1. https://www.w3schools.com/java/.
2. http://www.java2s.com/.
3. https://onlinecourses.nptel.ac.in/noc22_cs47/pre

L	T	P	O	C
0	0	4	1	2

24PBCA32 RELATIONAL DATA BASE MANAGEMENT SYSTEMS LAB

COURSE OBJECTIVES:

1. To provide foundational knowledge of relational databases, data models, and database management systems.
2. To equip students with skills to design efficient databases, use normalization techniques, and structure data effectively.
3. To develop proficiency in Structured Query Language (SQL) for data definition, manipulation, and control within relational databases.
4. To develop basic database administration tasks, including data integrity, backup, recovery, and security protocols.

LIST OF EXPERIMENTS:

1. **DDL Commands**

Create the table to;

- ✓ Add a new attribute state in supplier table
- ✓ Remove attribute city from supplier table
- ✓ Modify the data type of phone attribute
- ✓ Change the name of attribute city to address
- ✓ Change a table's name, supplier to sup
- ✓ Use truncate to delete the contents of supplies table
- ✓ Remove the part table from database

2. **DML Commands**

Create the table to;

- ✓ Insert at least 10 records in table's supplier, part and supplies.
- ✓ Show the contents in table's supplier, part and supplies.
- ✓ Find the name and city of all suppliers.
- ✓ Find the name and phone no of all suppliers who stay in 'Delhi'.
- ✓ Find all distinct branches of suppliers.
- ✓ Delete the record of the supplier whose SID is 204001.
- ✓ Delete all records of supplier table.

- ✓ Delete all records of suppliers whose city starts with capital A.
- ✓ Find the supplier names which have 'lk' in any position.
- ✓ Find the supplier name where 'R' is in the second position.
- ✓ Find the name of supplier whose name starts with 'V' and ends with 'A'.
- ✓ Change the city of all suppliers to 'BOMBAY'.
- ✓ Change the city of supplier 'Vandana' to 'Goa'.

3. Queries with Constraints

- ✓ Create the supplier table with Primary Key Constraint.
- ✓ Create supplies table with Foreign key Constraint.
- ✓ Create a part table with UNIQUE Constraint.
- ✓ Create supplier Table with Check Constraints.
- ✓ Create Supplier table with Default Constraint.

4. Aggregate Functions

- ✓ Find the minimum, maximum, average and sum of costs of parts.
- ✓ Count the total number of parts present.
- ✓ Retrieve the average cost of all parts.

Total Hours: 30

COURSE OUTCOMES:

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

CO1: Understand the core concepts and fundamentals of Database Management Systems (DBMS).

CO2: Gain proficiency in database design and the usage of Structured Query Language (SQL).

CO3: Apply advanced database techniques such as normalization, transaction management, and indexing.

CO4: Develop a basic understanding of Set Theory, particularly its application in DBMS.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

2. Pal Nabendu and Sarkar Sahadeb, Statistics: Concepts and Applications, Second Edition, PHI, 2013

3. Montgomery Douglas and Runger George C., Applied Statistics and Probability for Engineers, Wiley, 2016.

4. Reena Garg, Engineering Mathematics, Khanna Publishing House, 2024.

REFERENCE BOOKS:

1. Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.(2019)

2. R.P. Mahapatra, Govind Verma, "Database Management Systems", Khanna Publishing House, 2025.

WEB LINKS:

1. https://nptel.ac.in/courses/111106112

2. https://nptel.ac.in/courses/111105041

3. https://nptel.ac.in/courses/111105090

4. https://nptel.ac.in/courses/111105041

5. https://onlinecourses.nptel.ac.in/noc21_ma74/preview

WEB SOURCES:

1. https://oracle-base.com/articles
2. https://forums.oracle.com/ords/apexds/domain/devcommunity/category/sql_and_pl_sql
3. https://asktom.oracle.com/ords/f?p=100:1:0

24CBCA33 PROBABILITY AND STATISTICS

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

CO1: To make the students identify randomness scientifically using theory of probabaility.

CO2: To make students represent the statistical data in a systematic way and analyze it to gain meaningful information.

CO3:To make the students apply statistical and probabilistic concepts in real life situation.

UNIT I: Basic Statistics 09

Basic concepts of Statistics Qualitative and quantitative data, classification of data , construction of frequency distribution, diagrammatic representation of data.

Measures of Central tendency: Mean, Median and Mode

Measure of Dispersion - Range, Mean deviation - Standard Deviation and coefficient of variation.

UNIT II: Correlation and Regression Analysis 09

Correlation: Types of Correlation - Methods of studying correlation - Scatter diagram method, Karl Pearson's Coefficient of correlation, Spearman's Rank Correlation Coefficient.

Regression: Regression Lines and Regression equations - simple problems.

UNIT III: Basic Probability and Standard Distributions 09

Introduction to Probability - Conditional probability - Baye's Theorem - Random Variables-Discrete random variables - Continuous Random Variables - Probability mass function-Probability density function.

Introduction to theoretical distribution - Discrete Distributions - Binomial, Poisson, Geometric Distributions.Continuous Distribution - Uniform, Normal, Exponential and Gamma distribution – Properties.

UNIT IV: Sampling Theory 09

Introduction to small sample – t-test-Single mean, difference of means, and Paired t-test, F-test- Chi square test for goodness of fit and independence of attributes.

TEXT BOOKS:

1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing Company, 2010 (AICTE Recommended Textbook)

2. Das N. G., Statistical Methods, Combined Edition, Tata McGraw Hill, 2010.

3. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.

4. Miller Irwin and Miller Marylees, Mathematical Statistics with Applications, Seventh Edition, Pearson Education, 2005

SEMESTER IV

24CBCA41 PYTHON PROGRAMMING

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

1. To develop modular Python programs.
2. To apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.
3. To understand basic Data visualization and File handling in Python.

UNIT I: INTRODUCTION 10

History and Application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/output statements. **Strings**: Creating and Storing Strings, Built-in functions for strings; string operators, String Control Flow Statements: Conditional Flow statements; Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit.

UNIT II: FUNCTIONS 15

Built-In Functions, Function Definition and call; Scope and Lifetime of Variables, Default Parameters, Command Line Arguments; Lambda Functions; Assert statement; Importing User defined module.

UNIT III: MUTABLE AND IMMUTABLE OBJECTS 15

Lists, Tuples and Dictionaries; commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists, tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays.

UNIT IV: EXCEPTION HANDLING 10

Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions. Data visualization: Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves

.

UNIT V: FILES 10

Types of Files; Creating, Reading and writing on Text and Binary Files; The Pickle Module, Reading and Writing CSV Files. Reading and writing of csv and JSON files.

Total Hours: 60

COURSE OUTCOMES:

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

CO1: Develop modular Python programs.

CO2: Apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.

CO3: Understand basic Data visualization and File handling in Python..

TEXT BOOKS:

1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
2. Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023.
3. Sheetal Taneja & Naveen kumar: Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications, Pearson, 2017.

REFERENCE BOOKS:

1. ThinkPython, by Allen Downey, 2 nd edition, 2015, O'Reilly.
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
3. Introduction to Computation and Programming using Python, by John Guttag, 2 nd edition, 2016, PHI India.

WEB SOURCES:

1. https://www.learnpython.org/
2. https://www.w3schools.com/python/default.asp

24CBCA42 **ARTIFICIAL INTELLIGENCE**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

1. To develop semantic-based and context-aware systems to acquire, organize process, share and use the Knowledge embedded in multimedia content.
2. Aim to maximize automation of the complete knowledge lifecycle.
3. Aim to achieve semantic interoperability between Web resources and services.

UNIT I: INTRODUCTION TO AL 9

What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents. Knowledge-Based Agents: Introduction to Knowledge-Based Agents, The Wumpus World as an Example World. Problem-solving: Problem-solving agents.

UNIT II: ADVANCED SEARCH TECHNIQUES 9

Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search. Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha- Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP. Evolutionary Search Techniques: Introduction to evolutionary algorithms, Genetic algorithms, Applications of evolutionary search in AI.

UNIT III: LOGICAL REASONING AND UNCERTAINTY 9

Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting. Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems.

UNIT IV: INTRODUCTION TO PLANNING 9

Blocks World problem, Strips; Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Introduction to Fuzzy set theory.

UNIT V: DOMAINS AND APPLICATIONS OF AI 9

Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks, and their Applications. Expert Systems: The architecture and role of expert systems include two case studies. Legal and Ethical Issues: Concerns related to AI.

Total Hours: 60

COURSE OUTCOMES:

CO1: Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents.

CO2: Gain insights about Uninformed and Heuristic search techniques and apply them to solve search applications.

CO3: Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.

CO4: Obtain insights about Planning and handling uncertainty through probabilistic reasoning and fuzzy sets.

CO5: Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI.

TEXT BOOKS:

1. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J, Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Dan W Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning 2010.
4. Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.

REFERENCE BOOKS:

1. M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
2. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd edition, Prentice Hall
3. Van Hirtum, A. & Kolski, C. (2020). Constraint Satisfaction Problems: Algorithms and Applications. Springer
4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024.

WEB SOURCES:

1.https://www.javatpoint.com/agents-in-ai

2.https://artificialintelligence.readthedocs.io/en/

3.https://www.geeksforgeeks.org/search-algorithms-in-ai

24CBCA43 DESIGN AND ANALYSIS OF ALGORITHM

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

1. To analyze performance of algorithms.
2. To understand and choose the appropriate algorithm design technique for a specified application.
3. To solve problems using algorithm design techniques such as the greedy method, divide and conquer, dynamic programming, backtracking and branch and bound.
4. To analyze the impact of algorithm design techniques on each application solved.

UNIT I: INTRODUCTION 9

What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity. Asymptotic notations (O, Ω, Θ) to measure growth of a function and application to measure complexity of algorithms. Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication. Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.

UNIT II: THE DIVIDE & CONQUER DESIGN TECHNIQUE 9

The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication. Lower bound for comparison-based sorting.

UNIT III: THE GREEDY DESIGN TECHNIQUE 9

The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.

UNIT IV: THE DYNAMIC PROGRAMMING DESIGN TECHNIQUE 9

The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem. Algorithms on Graphs: Breadth First Search, Depth First Search, finding connected components, depth first search of a directed graph, topological sorting.

UNIT V: LIMITATIONS OF ALGORITHMIC POWER 9

Backtracking Method: n-Queen problem; sum of subsets problem/ Hamiltonian circuit problem/vertex cover problem. Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.

Total Hours: 45

COURSE OUTCOMES:

CO1: Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents.

CO2: Gain insights about Uninformed and Heuristic search techniques and apply them to solve search applications.

CO3: Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.

CO4: Obtain insights about Planning and handling uncertainty through probabilistic reasoning and fuzzy sets.

CO5: Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI

TEXT BOOKS:

1. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House (AICTE Recommended Textbook)

2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.

3. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.

4. Levitin Anany, Introduction to Design and Analysis of Algorithms, 3 rd Edition, Pearson, 2012.

REFERENCE BOOKS:

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of Computer Algorithms, Addison Wesley Publications, Boston, 1983.

2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

WEB SOURCES:

1. https://nptel.ac.in/courses/106101060

2. https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf

24CBCA44 **COMPUTER NETWORKS**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

1. Understand the fundamental concepts of Computer Networks and their applications.
2. Develop problem-solving skills related to network design, implementation, and troubleshooting.
3. Implement network protocols and configure network devices.

UNIT I: INTRODUCTION TO COMPUTER NETWORKS 9

Overview of Computer Networks: Definition and Objectives, Applications and Examples Network Components and Architecture. **Network Models:** OSI Model: Layers and Functions, TCP/IP Model: Layers and Functions. Comparison between OSI and TCP/IP Models. **Network Topologies:** Physical vs. Logical Topologies, Common Topologies: Star, Ring, Bus, Mesh, Hybrid, Advantages and Disadvantages of Each Topology. **Data Transmission:** Analog vs. Digital Signals, Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Bandwidth and Latency. **Networking Devices:** Routers, Switches,Hubs, Bridges, Gateways,Functions and Configurations of Each Device.

UNIT II: DATA LINK LAYER AND NETWORKING PROTOCOLS 9

Data Link Layer Fundamentals: Functions of the Data Link Layer, Framing, Error Detection, and Error Correction, Flow Control Mechanisms. **Ethernet:** Ethernet Standards and Frame Structure, MAC Addressing and ARP, Ethernet Switching: Basic Concepts and Methods. **Network Protocols:** Introduction to TCP/IP Protocol Suite, IP Addressing: IPv4 and IPv6 Subnetting and CIDR Notation. **Address Resolution Protocol (ARP):** ARP Operation and Table, ARP Spoofing and Security Considerations. **Virtual LANs (VLANs):** Concept of VLANs, VLAN Tagging and Configuration, Benefits and Use Cases.

UNIT III: NETWORK LAYER AND TRANSPORT LAYER 9

Network Layer: IP Routing: Static vs. Dynamic Routing,Routing Protocols: RIP, OSPF, BGP, Network Address Translation (NAT). **Transport Layer:** TCP vs. UDP: Characteristics and Use Cases, TCP Handshake and Connection Management, Flow Control and Congestion Control in TCP. **Congestion Control Algorithms:** Techniques: Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery, TCP Variants: TCP Reno, TCP Vegas.

Quality of Service (QoS): QoS Principles and Mechanisms, Differentiated Services (DiffServ) and Integrated Services (IntServ). **Network Security Fundamentals:** Threats and Vulnerabilities, Basic Security Mechanisms: Firewalls, VPNs, Encryption

UNIT IV: APPLICATION LAYER AND EMERGING TECHNOLOGIES 9

Application Layer Protocols: HTTP/HTTPS: Structure and Operation, FTP, SMTP, POP3, IMAP: Protocols and Uses, DNS: Domain Name System and Resolution. **Network Applications:** Web Browsing, Email Communication, File Transfer, Voice over IP (VoIP) and Streaming.

UNIT V: EMERGING TECHNOLOGIES 9

Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT) and Its Impact on Networking. **Network Management:** SNMP: Simple Network Management Protocol, Network Monitoring Tools and Techniques. **Future Trends in Networking:** 5G and Beyond, Network Automation and Artificial Intelligence in Networking.

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Demonstrate a comprehensive understanding of fundamental networking concepts, including the OSI and TCP/IP models, data transmission methods, and networking devices.

CO2: Apply knowledge of various network topologies, protocols, and layers to design and analyze network architectures and understand their performance characteristics.

CO3: Utilize essential networking protocols, including Ethernet, IP, ARP, and TCP/UDP, to solve problems related to network communication and configuration.

CO4: Implement IP addressing, subnetting, and routing techniques, and perform network management tasks like configuring VLANs and network security measures.

CO5: Analyze and troubleshoot common networking issues, including packet loss, congestion, and security threats, using standard diagnostic tools and methodologies.

CO6: Understand the principles of Quality of Service (QoS) and apply them in the design and optimization of networks to ensure efficient data transmission.

TEXT BOOKS:

1. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2019.
3. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2023.
4. Mastering PC Hardware & Networking, Khanna Publishing House, 2024.

WEB SOURCES:

1. Cisco Networking Academy - Online Courses and Resources
2. NetworkLessons.com - Tutorials on Various Networking To

24PBCA41 PYTHON PROGRAMMING LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

1. To develop modular Python programs.
2. To apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.
3. To understand basic Data visualization and File handling in Python.

LIST OF EXPERIMENTS:

1. Write a program to find whether a number is a prime number.
2. Write a program to print m raise to power n, where m and n are read from the user.
3. Write a program having a parameterized function that returns True or False depending on whether the parameter passed is even or odd.
4. Write a program to print the summation of the following series up to n terms:1-2+3-4+5- 6+7-….n
5. Write a menu driven program to perform the following operations on strings using string built in functions.
    a. Find the frequency of a character in a string.
    b. Replace a character by another character in a string.
    c. Remove the first occurrence of a character from a string.
    d. Remove all occurrences of a character from a string.
6. Write a program that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1
7. Using Numpy module write menu driven program to do following
    a. Create an array filled with 1's.
    b. Find maximum and minimum values from an array
    c. Dot product of 2 arrays.
    d. Reshape a 1-D array to 2-D array.

8. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.
9. Consider a tuple t1=(1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations:
    a. Print contents of t1 in 2 separate lines such that half values come on one line and other half in the next line.
    b. Print all even values of t1 as another tuple t2.
    c. Concatenate a tuple t2= (11, 13, 15) witht1.
    d. Return maximum and minimum value from t1.
10. Write a program that makes use of a function to display sine, cosine, polynomial and exponential curves.

Total Hours: 30

COURSE OUTCOMES:

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

CO1: Develop modular Python programs.

CO2: Apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.

CO3: Understand basic Data visualization and File handling in Python..

TEXT BOOKS:

1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
2. Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023.
3. Sheetal Taneja & Naveen kumar: Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications, Pearson, 2017.

REFERENCE BOOKS:

1. Think Python, by Allen Downey, 2 nd edition, 2015, O'Reilly.
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
3. Introduction to Computation and Programming using Python, by John Guttag, 2 nd edition, 2016, PHI India.

WEB SOURCES:

1. https://www.learnpython.org/
2. https://www.w3schools.com/python/default.asp

24PBCA42 ARTIFICIAL INTELLIGENCE LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

1. Understand the potential benefits of using AI in knowledge-sharing and management
2. Practice using AI tools to automate knowledge management tasks
3. Discover how AI can help in data analysis and decision-making
4. Explore ways to integrate AI applications into existing knowledge management systems

LIST OF EXPERIMENTS:

1. Demonstrate basic problem-solving using Breadth-First Search on a simple grid.

2. Implement Depth-First Search (DFS) on a small graph.

3. Solve the Water Jug Problem using Breadth First Search (BFS).

4. Implement a Hill Climbing search to find the peak in a numeric dataset.

5. Apply the A* Search algorithm to find the shortest path in a 4x4 grid.

6. Implement the Minimax search algorithm for 2-player games. You may use a game tree with 3 plies.

7. Solve the 4 – Queens Problem as a CSP backtracking problem.

8. Use constraint propagation to solve a Magic Square puzzle.

9. Apply optimization techniques to find the maximum value in a list.

10. Represent and evaluate propositional logic expressions.

11. Implement a basic rule-based expert system for weather classification.

12. Implement a basic AI agent with simple decision-making rules.

13. Implement a basic Rule-Based Chatbot.

14. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for text content.

a) Tokenizing

b) Filtering Stop Words

c) Stemming

d) Part of Speech tagging

e) Chunking

f) Named Entity Recognition (NER)

15. Perform Image classification for a given dataset using CNN. You may use Tensorflow /Keras.

COURSE OUTCOMES:

CO1: Apply Uninformed Search Algorithms and Implement Heuristic Search techniques

CO2: Analyze and Solve Constraint Satisfaction Problems

CO3: Develop Rule-Based Systems

CO4: Implement and Evaluate Optimization Techniques

CO5: Apply and illustrate the NLP concepts

SEMESTER V

24DBCA51 NATURAL LANGUAGE PROCESSING

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES:

1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To apply the NLP techniques to IR applications

UNIT I: INTRODUCTION **9**

History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing , Ambiguity in Natural language , stages in NLP, challenges of NLP ,Applications of NLP, Empirical laws.

UNIT II: WORD LEVEL ANALYSIS **9**

Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams - N-gram language model, N-gram for spelling correction.

UNIT III: SYNTAX ANALYSIS **9**

Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labelling: Hidden Markov Model (HMM), Maximum Entropy Self learning topics: Conditional Random Field (CRF).

UNIT IV: TEXT SUMMARIZATION, TEXT CLASSIFICATION **9**

Text summarization- LEXRANK, Optimization based approaches for summarization, Summarization evaluation, Text classification, NLKT, Naïve Bayes Theorem.

UNIT V: SENTIMENT ANALYSIS AND OPINION MINING **9**

Sentiment Analysis - Introduction, Sentiment Analysis - Affective lexicons, Learning affective lexicons, Computing with affective lexicons, Aspect based sentiment analysis, Named Entity Recognition.

Total Hours:45

COURSE OUTCOMES:

CO1: To tag a given text with basic Language features

CO2: To design an innovative application using NLP components

CO3: To implement a rule based system to tackle morphology/syntax of a language

CO4: To design a tag set to be used for statistical processing.

CO5: To compare and contrast the use of different statistical approachesor different types of NLP applications.

TEXT BOOKS:

1. "Speech and Language Processing" (3rd Edition) by Daniel Jurafsky and James H. Martin, Pearson, 2020.
2. "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit" (2nd Edition) by Steven Bird, Ewan Klein, and Edward Loper, O'Reilly Media, 2021.
3. "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schütze, MIT Press, 2020

REFERENCE BOOKS:

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.2.Richard M Reese, —Natural Language Processing with Java‖, O_Reilly Media, 2015.
2. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapmanand Hall/CRC Press, 2010.
3. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval‖, Oxford UniversityPress, 2008.

WEB SOURCES:

1. https://www.cl.cam.ac.uk/teaching/2002/NatLangProc/nlp1-4.pdf
2. https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing- NLP
3. https://www.cs.jhu.edu/~phi/ai/slides/lecture-natural-language-processing.pdf

L	T	P	O	C
0	0	4	1	2

24PBCA51 NATURAL LANGUAGE PROCESSING LAB

COURSE OBJECTIVES:

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques to IR applications

LIST OF EXPERIMENTS:

1. Implement Basic Commands To Access Text Data
2. Implement Text Pre-Processing (Tokenization, Stop Word Removal, Stemming And Lemmatization)
3. Perform Morphological Analysis
4. Implement N- Gram Model
5. Implement Bag Of Word And Tf-Idf Vectorization
6. Implement Part Of Speech Tagging
7. Perform Topic Modeling
8. Implement Sentiment Analysis Of A Dataset
9. Perform Named Entity Recognition Of A Text
10. Perform One Real Time Application Using Natural Language Processing.

COURSE OUTCOMES:

CO1: To tag a given text with basic Language features

CO2: To design an innovative application using NLP components

CO3: To implement a rule based system to tackle morphology/syntax of a language

CO4: To design a tag set to be used for statistical processing.

CO5: To compare and contrast the use of different statistical approaches or different types of NLP applications.

SEMESTER VI

24DBCA61 **GENERATIVE AI**

L	T	P	O	C
4	1	0	2	5

COURSE OBJECTIVES:

1. To introduce the fundamental concepts of Generative AI and its applications.
2. To explore modern generative models, including GANs, VAEs, Transformers, and diffusion models.
3. To develop skills in implementing generative models using popular frameworks.
4. To examine the ethical implications and real-world applications of Generative AI.
5. To foster creativity in solving problems using generative approaches.

UNIT 1: INTRODUCTION TO GENERATIVE AI 10

What is Generative AI? ,Overview of supervised vs. unsupervised learning. Applications: Text, image, video generation, and beyond, Key challenges in Generative AI.

UNIT 2: GENERATIVE MODELS - THEORY AND PRACTICE 15

Generative Adversarial Networks (GANs): Architecture and working. Variational Autoencoders (VAEs): Latent space and sampling. Transformers for generative tasks (e.g., GPT, DALL-E).

UNIT 3: ADVANCED GENERATIVE MODELS 15

Diffusion Models: How they work and applications in image synthesis, Neural Style Transfer , Techniques for improving generative models (e.g., loss functions, architecture tweaks).

UNIT 4: APPLICATIONS OF GENERATIVE AI 10

Text generation (e.g., chatbots, summarization), Image generation (e.g., image-to-image translation, super-resolution), Generative AI in games, music, and design, Case studies.

UNIT 5: ETHICS AND FUTURE DIRECTIONS IN GENERATIVE AI 10

Ethical concerns: Deepfakes, biases, copyright issues , Responsible AI development and use , Future trends in Generative AI , OpenAI, Meta, Google research initiatives.

TOTAL HOURS: 60

COURSE OUTCOMES:

Upon successful completion, students will:

CO1: Understand the principles and techniques underlying Generative AI.

CO2: Implement generative models for tasks like text generation, image synthesis, and more.

CO3: Evaluate the performance of generative models.

CO4: Recognize ethical challenges and responsibilities in Generative AI applications. **CO5:** Apply generative techniques to solve real-world problems innovatively.

REFERENCE BOOKS:

1. **Ian Goodfellow, Yoshua Bengio, Aaron Courville** - *Deep Learning* (MIT Press).
2. **François Chollet** - *Deep Learning with Python* (Manning Publications).
3. **Sebastian Raschka, Yuxi (Hayden) Liu, Vahid Mirjalili** - *Machine Learning with PyTorch and Scikit-Learn*

RECOMMENDED BOOKS:

1. **David Foster** - *Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play* (O'Reilly Media).
2. **Andreas Holzinger** - *Machine Learning for Health Informatics* (Springer).

WEB SOURCES:

1. OpenAI - For GPT, DALL-E, and ChatGPT resources.
2. TensorFlow - Tutorials and resources for building AI models.
3. PyTorch - Guides for deep learning implementation.
4. Coursera - Generative AI Courses - Online learning resources.

SEMESTER VII

24DBCA71 **PYTHON FOR DATA SCIENCE**

L	T	P	O	C
3	2	0	2	5

COURSE OBJECTIVES:

1. Develop programming skills relevant to data science.
2. Learn essential libraries: NumPy, Pandas, and Matplotlib.
3. Apply skills in data analysis for extracting insights.
4. Use data visualization techniques to present findings.
5. Explore NLP and ML for advanced data processing and prediction.

UNIT I: INTRODUCTION TO IPYTHON AND NUMPY 09

IPython Beyond Normal Python: Help and documentation in IPython, Keyboard Shortcuts in the IPython Shell, IPython Magic Commands, Input and Output History, IPython and Shell Commands, Errors and Debugging, Profiling and Timing Code. Introduction to NumPy: Understanding Data Types in Python, The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations.

UNIT II: WORKING WITH NUMPY, DATA MANIPULATION WITH PANDAS 09

Computation on Arrays: Broadcasting, Comparisons, Masks, and Boolean Logic, Fancy Indexing, Sorting Arrays, Structured Data. Data Manipulation with Pandas: Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data.

UNIT III : WORKING WITH DATASETS USING PANDAS 09

Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas -eval() and query().

UNIT IV: VISUALIZATION WITH MATPLOTLIB 09

General MatplotLib, Simple Line Plots, Simple Scatter Plots, Density and Contour Plot Histograms, Binnings, and Density, Customizing Plot Legends.

UNIT V: ADVANCED VISUALIZATION TECHNIQUES 09

Customizing Colorbars, Text and Annotation, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap, Visualization with Seaborn.

Total Hours:45

TEXTBOOK:

1. Python Data Science Handbook: Essential Tools for Working with Data, by Jake VanderPlas, O'reilly Media, 2017.

COURSE OUTCOMES:

CO1: To understand data types in python and to apply array concepts using NumPy.

CO2: Structuring data using NumPy and manipulating the data using Pandas.

CO3: Using Pandas to analyze and work with data sets.

CO4: Graphical visualization of data using Matplotlib

REFERENCE BOOKS:

1. Data Science From Scratch: First Principles with Python by Joel Grus, Second Edition, 2019, O'reilly Media.
2. Python for Data Science by Mohd. Abdul Hameed, May 2021, Wiley.
3. Python for Data Science: A Crash Course for Data Science and Analysis, Python Machine Learning and Big Data by Computer Science Academy.
4. Python for Data Science: The Ultimate Step-by-Step Guide to Python Programming by Daniel, March 2021, O'reilly.

WEB SOURCES:

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.coursera.org/professional-certificates/ibm-data-science.

MULTIDISCIPLINARY ELECTIVE (MDE)

24BMA001 **MATHEMATICS - I**

L	T	P	O	C
2	1	0	2	3

COURSE OBJECTIVES:

1. To learn various concept in matrix.
2. To apply the concept of Sets to promote critical thinking, problem-solving technique and inter disciplinary connections.
3. To analyse the relationships, decisions making and modeling complex systems using Partial Order Relations.

UNIT-I MATRICES & DETERMINANTS: 9

Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramer's Rule, Rank of Matrix Dependence of Vectors . **Determinants:** Definition, Minors, Cofactors, Properties of Determinants

UNIT-II: SETS 9

Sets: Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersectionand Complements of Sets, Cartesian product, Cardinality of Set, Simple Applications.

UNIT-III: RELATIONS & FUNCTIONS 9

Relations: Properties of Relations, Equivalence Relation. **Functions:** Partial Order Relation Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions,

UNIT-IV: PARTIAL ORDER RELATIONS 9

Partial Order Sets, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal Point, GLB, LUB.

UNIT-V: NUMBER SYSTEM AND CONVERSIONS 9

Number Systems: Binary Numbers, Octal Numbers, Decimal numbers, Hexa Decimal numbers. **Number base conversions**: Octal and Hexa Decimal Numbers - Complements - Signed Binary Numbers - Binary Arithmetic - Binary Codes - Decimal Code.

Total Hours : 45

COURSE OUTCOMES:

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

CO1 : Apply the concept of Matrix and solving simultaneous equations (k3).

CO2: Understand the ideas of Sets and its applications. (K2).

CO3: Identify the relations for various functions. (K3)

CO4 : Apply the concept of partial order relation for various sets. (K5)

CO5: Understand the conversion of various number system. (K3)

TEXTBOOK:

1. Kolman, Busby, Ross and Rehman, Discrete Mathematical Structures for Computer Science, Pearson Education, 5th Edition, 2003.

REFERENCE BOOKS:

1. D.S. Malik and M.K. Sen, Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.
2. Goodaire & Parmenter : Discrete Mathematics & Graph Theory, Pearson Education, 2000.
3. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw Hill, 5th Ed., 2004.
4. C.L. Liu, Elements of Discrete Mathematics, 2nd Edition, McGraw Hill, 1986.

WEB SOURCES:

1. https://www.geeksforgeeks.org/mathematics-partial-orders-lattices/
2. https://www.ipsgwalior.org/download/number%20system.pdf

24BMA002 **MATHEMATICS – II**

L	T	P	O	C
2	1	0	2	3

COURSE OBJECTIVES:

- To enable professional undergraduate students to understand the importance of Mathematics
- To provide basic knowledge of Discrete Mathematics and Probability.
- The main aim of this course is to help the students to read, classify and then interpret the data given to them and draw conclusions. Students understand the concepts like Logic, tautology and Probability.

UNIT 1: FUNDAMENTALS OF LOGIC 9

Fundamentals of logic: Introduction to logic, propositional logic, logical connectives and truth table, negation conjunction, disjunction.

UNIT 2: LOGIC AND TATUOLOGY 9

Conditional, bi-conditional or double implication, converse, inverse and contra positive, tautology and contradiction.

UNIT 3: PERMUTATIONS AND COMBINATIONS 9

Introduction -Fundamental Principle of Counting-Permutations: Problems on permutations – Combinations - Problems on combinations, Difference between permutations and combinations.

UNIT 4: BASICS OF PROBABILITY 9

Basics of probability: Basic Probability- Axioms of Probability- Addition and Multiplication theorem without proof-Conditional Probability-simple problems

UNIT 5: RANDOM VARIABLES 9

Random variable - Discrete random variables- Mean- Expectations- Variance- Independent random variables- simple problems, Continuous random variables- Mean- Expectations- Variance- simple problems.

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Apply the basic concepts of Mathematical reasoning.

CO2: Understands the types of logic

CO3: Understands the concept based on permutation and combinations.

CO4: Apply the concepts of Probability.

CO5: Understand the concepts of Random Variables

TEXT BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw Hill.
2. R A Johnson And C.B.Gupta., Probability and statistics for engineers (Erwin Miller AndJohn E.Freund), 7th edition, Pearson Education / PHI.

REFERENCE BOOKS:

1. R. P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education,Fifth Edition, 2007.
2. Thomas Koshy, "Discrete Mathematics with Applications", Academic Press, 2005.
3. S.I.Resnick, A Probability Path, Birhauser, Berlin,1999.

WEB SOURCES:

https://courses.umass.edu/phil110-gmh/text/c01.pdf

1. https://www.cuemath.com/data/permutations-and-combinations/

2. https://www.toppr.com/guides/maths/probability/introduction-to-probability/

INDIAN KNOWLEDGE SYSTEM

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

- To Gain an understanding of Indian Knowledge System.
- To Develop an ability to apply the Indian Knowledge System to societal challenges faced today in areas such asholistic health, governance, public administration and sustainable living.
- To Promote the youths to do research in the various fields of Indian knowledge system.

UNIT1: AN OVERVIEW OF INDIAN KNOWLEDGE SYSTEM 6

Introduction- Organization of Indian Knowledge System- The IKS corpus- A Classification framework- Historicity of Indian KnowledgeSystem -Some salient aspects of Indian Knowledge System

UNIT 2: PHILOSOPHICAL SYSTEM 6

Introduction to Philosophy- Development of Indian Philosophical system - Unique features of Indian Philosophical system- Introduction to Yoga.

UNIT 3 : GOVERNANCE AND PUBLIC ADMINISTRATION 6

Introduction - Understanding Governance from ancient to modern times- Relevance of Arthashastra- Glimpses of Nitishastra- Vidura Niti.

UNIT 4 : WISDOM THROUGH THE AGES 6

Gateways of ancestral wisdoms-Introduction to Purāṇa- The Purāṇic repository- Issues of interest in Purāṇas- Introduction to Itihāsas- Key messages in Itihāsa-Wisdom through Nīti-śāstra.

UNIT 5 MATHEMATICS 6

Introduction to Indian Mathematics- Unique aspects of Indian Mathematics- Indian Mathematicians and their Contributions.

Total Hours: 30

COURSE OUTCOMES:

CO1: Classify the key concepts of Indian Knowledge System and discuss the multi-faceted nature of knowledgecontained in the Traditional Systems of India.
CO2: Identify the rich heritage of governance in Indian Knowledge System.
CO3: Recognize the relevance of Arthashastra in public administration.
CO4: Identify the Wisdom through Ages through Ithihasas.
CO5: Knowledge of Indian Mathematicians and their contributions.

TEXT BOOKS:

1. Mahadevan B., Bhat V R, Nagendra Pavana R.N., Indian Knowledge SystemConcepts andApplication, PHI Learning Pvt. Ltd., 2022.
2. Kapoor Kapil, and Singh Avadesh Kumar, Indian Knowledge System Vol.1, DK PrintWorld,Ltd., 2005.

REFERENCE BOOKS:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan.
2. Histrory of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al.National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata

WEB SOURCES:

1. https://onlinecourses.swayam2.ac.in/imb23_mg54/preview
2. https://digest.iimb.ac.in/2022/04/book-indian-knowledge-systems-co-authored-dr-b-mahadevan/
3. https://www.summarize.tech/www.youtube.com/watch?v=jcV0LIp570A

ADVANCED STATISTICAL METHODS FOR DATASCIENCE

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

Statistics plays an important role in data analytics. The main aim of this course is to help the students to read, classify and then interpret the data given to them and draw conclusions.

UNIT I **12**

Data and Representation Introduction to Statistics, Collection of data, classification and tabulation of data, Types of data: Primary data, Secondary data, Presentation of data Diagrammatic and Graphical Representation: Histogram, frequency curve, frequency polygon, Ogive curves, stem and leaf chart.

UNIT II **12**

Measures of Central Tendency and Dispersion Arithmetic Mean (A.M.) Definition, Mode, Median, Partition Values: Quartiles, Deciles and Percentiles, Box Plot, Percentile ranks. Means of transformed data, Geometric Mean (G.M.) Definition, Harmonic Mean (H.M.), Weighted Mean : Weighted A.M., G.M. and H.M. Range, Mean deviation Mean square deviation, Variance and Standard Deviation, Combined variance (derivation for 2 groups), Combined standard deviation.

UNIT III **12**

Correlation and Regression Bivariate normal distribution, types, importance, methods of measuring correlation-scatter diagram, Karl Pearson's Coefficient of Correlation and Spearman's rank Correlation. Regression lines, Difference between regression and correlation, uses of Regression.

UNIT IV **12**

Sampling theory and tests of significance Methods of sampling (Description only): Simple random sampling with and without replacement (SRSWR and SRWOR)

UNIT V **12**

Stratified random sampling, systematic sampling. Tests of significance – z, t, chi-square and F.

Total Hours: 60

TEXT BOOKS:

Mood, A. M., Graybill, F. A. And Boes, D.C. : Introduction to the Theory of Statistics, McGraw Hill.
Biswas and Srivastava – A textbook, mathematical Statistics, Ist Edition, Narosa Publishing House, New Delhi.

Gupta, S.C. and V. K. Kapoor – Mathe mathical Statistics, Sultan Chand and sons. Hogg,R.V. and Craig, A.T: Introduction to Mathematical Statistics, McMillan. S. C. Gupta – Fundamentals of Statistics, Himalaya Publishing House.

VALUE ADDED COURSE (VAC)

24VBCA12 **WEB PROGRAMMING**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The purpose of this course is to provide comprehensive understanding to develop web applications with database systems. Started with web programming using HTML, CSS & JAVA SCRIPT.

LIST OF PROGRAMS:

1. Develop static pages usingHTML (Using Heading elements, Text Elements .
2. Logical Styles, Physical Styles,
3. Ordered, Unordered and Definition list
4. Hyper Links, Image Link, Link to page containing Images and Videos, FileLink
5. HTML Page usingFrames. (Navigation, Floating, Inline Frames , Frames to add Images and Videos
6. Add a Cascading Style sheet for designing the webpage
7. Create any catalog and display it using CSS.
8. Create a Static Web page using HTML & CSS
9. Design a dynamic web page with validation using JavaScript

Total Hours :30

COURSE OUTCOMES:

CO1: Install, configure, and interact with a database management system

CO2: Describe, define and apply the database components to database design

CO3: Analyze the design of a database schema and apply normalization techniques

CO4: Develop dynamic web pages to meet specified needs using HTML, CSS , JAVA SCRIPT

24DVAC11 **COMMUNICATION SKILLS**

L	T	P	C	C
2	0	0	0	2

COURSE OBJECTIVES:

CO1: To develop effective verbal and non-verbal communication techniques for various contexts.

CO2: To enhance listening skills for better comprehension and engagement in conversations.

CO3: To improve written communication abilities, focusing on clarity, coherence, and style.

CO4: To build confidence in public speaking through practice and constructive feedback.

CO5: To cultivate interpersonal skills for successful collaboration and professional interactions.

UNIT I –INTRODUCTION TO COMMUNICATION SKILLS 6

- Fundamentals of Communications
- Elements of Communication, Types of Communication

UNIT II - PRACTICAL ENGLISH 6

- Importance of the language - Word Usage and Jargon
- Tenses and the effectiveness - Basics of grammar (Noun/Verb/Adverb/Conjunction)

UNIT III - EFFECTIVE COMMUNICATION 6

- LSRW (Listening, Speaking, Reading & Writing)
- Pronunciation - Vocabulary Building
- Intonations & its importance

UNIT IV - WORKPLACE COMMUNICATION 6

- Basics of telephone etiquette
- E-Mail writing
- Presentation Skills
- Interpersonal Skills
- Business English

UNIT V - QUANTITATIVE ABILITY 6

- Verbal Ability - Verbal Analogy
- Debating Skills - Public Speaking

Total Hours:30

COURSE OUTCOMES:

At the end of this course, the students would have learnt to

CO1: enhance participants' business communication skills
CO2: enhance LSRW Skills (LSRW – Listening, Speaking, Reading & Writing)
CO3: express opinions at free will in social/ personal gathering
CO4: impact leadership qualities among participants
CO5: engage in conversation with others to exchange ideas

REFERENCE BOOKS:

- Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition,Pearson Education, 2011
- Personality development and soft skills, Barun K Mitra, 1 stEdition, Oxford Press,2011
- Elizabeth Harren, 7 April 2022, last updated: 16 November, 2023
- Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler (McGraw-Hill)
- Ethan Beute and Stephen Pacinelli (Greenleaf)
- Soft skills and professional communication, Francis Peters SJ, 1stEdition, McGraw Hill Education, 2011

24DVAC21 **UNIVERSAL HUMAN VALUES**

L	T	P	O	C
1	0	0	1	1

COURSE OBJECTIVES:

The candidates will be able to appreciate the complementarity between the values and skills for sustained happiness and prosperity. To influence the students to approach the life and profession with a holistic perspective towards a value-based living in a natural way. To highlight plausible implications of holistic understanding of ethical human conduct.

UNIT- I INTRODUCTION TO VALUE EDUCATION 5

Living a fulfilling life. Value education. Skill education. Complementarity of Values and Skills. Development of a holistic perspective. Right understanding, relationship and physical facility. Understanding the happiness and prosperity.

UNIT-II HARMONY AT MULTIPLE LEVELS 5

Human being as co-existence of the self and the human body. Understanding harmony in the self. Harmony in the family and understanding values in human-human relationships. Harmony in the society and understanding universal human order. Harmony in nature and understanding the interconnectedness, self-regulation and mutual fulfillment. Harmony in existence and understanding co-existence at various levels.

UNIT-III IMPLICATIONS OF THE RIGHT UNDERSTANDING 5

Ethical human conduct. Implications of value-based living. Right understanding of professional ethics. Humanistic education. Holistic technologies, production systems and management models. Strategies for transition towards value-based life and profession.

Total Hours: 15

COURSE OUTCOMES:

At the end of the course learners will be able to:

CO1: Develop qualities like responsibility and the ability to handle problems with sustainable solutions.

CO2: Appraise human values and the harmony at various levels.

CO3: Perceive a better critical ability.

CO4: Develop qualities pertaining to value-based living.

CO5: Apply what they have learnt to their own self in real life settings.

TEXT BOOKS:

R.R. Gaur, R. Asthana, G.P. Bagaria. (2023). A Foundation Course in Human Values and Professional Ethics. 3rd Revised Edition. Excel Books, New

REFERENCE BOOKS:

1. A. Nagaraj, Jeevan Vidya Prakashan, Amar Kantak. Jeevan Vidya: Ek Parichaya .
2. (1999). Rakesh Gupta. (2008). Jeevan Vidya: An Introduction (Introductory Book to Madhyasth Darshan-Coexistentialism). English Version.
3. A. N. Tripathi. (2004). Human Values. First Edition. New Age International Publishers, New Delhi.

24DVAC31 YOGA AND PHYSICAL FITNESS/SPORTS/NCC/NSS/DISASTER MANAGEMENT

L	T	P	O	C
0	0	4	1	2

YOGA

COURSE OBJECTIVES:

1. Understand yoga's significance and its practical applications for holistic well-being.
2. Explore subtle energy systems and their role in enhancing health through yogic practices.
3. Examine various paths of yoga to foster self-realization and spiritual growth.
4. Master the Eight Limbs of Yoga for physical, mental, and spiritual harmony.
5. Apply yogic principles to manage psycho-somatic ailments and promote resilience.

UNIT-I 06

- Yoga: Meaning and definition
- Importance of yoga in 21st century
- Introduction to Yogic Anatomy and Physiology
- Yoga & sports, Yoga for healthy lifestyle
- Types of Yoga: - Hatha yaga, laya yoga, mantra yoga, bhakti yoga, karma yoga, jnana yoga, raj yoga
- Study of Chakras, Koshas, Pranas, Nadis, Gunas, Vayus and its application in Yogic practices.
- Ashtang Yoga: - Yama, niyama, asana, pranayama, Pratyahar, dharna, dhyan, Samadhi: Benefits, Utilities & their psychological impact on body and mind. According to yoga concept of normality in modern psychology, concept of personality & its development, yogic management of psycho- somatic ailments: frustration, anxiety, depression.

UNIT- 2 06

- Sports for Physical Fitness: Meaning and definition
- Physical Activity – Concept, Benefits of Participation in Physical Activities

- Components and Significance of Physical Fitness -Health, Skill and Cosmetic Fitness
- Types of Physical Activities – Walking, Jogging, Running, Calisthenics, Rope Skipping, Cycling, Swimming, Circuit Training, Weight training, Adventure Sports
- Principles of Physical Fitness, Warming Up, Conditioning, Cooling Down, Methods to Develop and Measure Health and Skill related components of Physical Fitness
- Measurement of Health Related Physical Fitness (HRPF)

UNIT -3 **06**

- Physical Wellness: Concept, Components
- Types of wellness: psychological, social, emotional, and spiritual.
- Significance with reference to Positive Lifestyle 2.2

UNIT-4: **06**

Nutrition and Weight Management

- Concept of Nutrients, Nutrition, Balanced Diet, Dietary Aids and Gimmicks
- Energy and Activity- Calorie Intake, Energy Balance Equation

UNIT -5 **06**

- Obesity - Concept, Causes, Obesity Related Health Problems
- Weight Management through Behavioural Modifications
- Concepts of Quality of Life and Body Image
- Factors affecting Wellness
- Wellness Programmes

Total Hours: 30

COURSE OUTCOMES:

CO1: Gain a comprehensive understanding of yoga and its modern applications for holistic well-being.

CO2: Demonstrate proficiency in yogic anatomy and physiology, enhancing yoga practice and promoting physical and energetic balance.

CO3: Master the Eight Limbs of Yoga and comprehend their psychological impact, fostering personal growth and self-realization.

CO4: Integrate yoga principles into sports and physical fitness activities to enhance performance and prevent injuries.

CO5: Develop skills in wellness management and nutrition

TEXT BOOKS:

1. Anand O P. Yog Dawra Kaya Kalp. Sewasth Sahitya Perkashan. Kanpur.
2. Brown, J.E. Nutrition Now Thomson-Wadsworth.
3. Corbin et.al.Fitness & Wellness-Concepts. McGraw Hill. Publishers. New York.U.S.A
4. Corbin, C. B., G. J. Welk, W. R Corbin, K. A. Welk, Concepts of Physical Fitness: Active Lifestyle for Wellness. McGraw Hill, New York, USA.
5. Hoeger, W W K and S.A. Hoeger. Principles and Labs for Fitness and Wellness, Thomson Wadsworth, California, USA.

REFERENCE BOOKS:

1. Siedentop, D. Introduction to Physical Education, Fitness and Sport, McGraw Hill Companies Inc., New York, USA.
2. Sri Swami Ramas. Breathing. Sadhana Mandir Trust.Rishikesh.
3. Swami Ram Yoga & Married Life Sadhana Mandir Trust. Rishikesh

SPORTS MANAGEMENT

COURSE OBJECTIVES:

- Understand the fundamental principles and concepts of sports management, including its scope, organizational structure, and ethical considerations.
- Analyse the role of marketing and sponsorship in the sports industry, with a focus on branding, target audience segmentation, and event management.
- Develop proficiency in financial management techniques specific to the sports industry, including revenue generation, cost management, and investment strategies.
- Explore the application of analytics and technology in sports, including performance evaluation, strategic decision-making, and fan engagement.
- Apply theoretical knowledge to practical scenarios through case studies and projects, fostering critical thinking and problem-solving skills in sports management context

UNIT 1: INTRODUCTION TO SPORTS MANAGEMENT

- Definition and scope of sports management
- Significance of sports management in society and its evolution over time
- Organizational structure of sports: amateur, professional, and non-profit entities
- Roles and responsibilities of key personnel: managers, coaches, and agents
- Governance bodies in sports: FIFA, IOC, and NCAA
- Legal issues: contracts, negotiations, intellectual property rights
- Ethical considerations: fair play and doping

UNIT 2: SPORTS MARKETING AND SPONSORSHIP

- Unique aspects of sports marketing
- Fan engagement strategies
- Target audience identification and segmentation
- Branding strategies for sports teams and athletes
- Sponsorship and endorsement deals
- Negotiating and managing partnerships
- Event management: planning, organizing, and promoting sports events

UNIT 3: FINANCIAL MANAGEMENT IN SPORTS

- Revenue generation in sports: ticket sales, broadcasting rights, merchandise sales
- Financial models: budgeting and forecasting
- Cost management: player salaries, facility expenses, operational costs
- Investment opportunities in sports
- Risk management techniques specific to sports organizations

UNIT 4: SPORTS ANALYTICS AND TECHNOLOGY

- Introduction to sports analytics
- Evaluating player performance
- Devising game strategies

UNIT 5:

- Fan engagement through technology
- Analytical techniques: statistical analysis, data visualization, predictive modeling
- Key performance indicators (KPIs) in sports
- Applications of analytics: talent scouting, injury prevention, performance optimization.

COURSE OUTCOMES:

1. Demonstrate a comprehensive understanding of sports management principles, including organizational structures, legal issues, and ethical considerations.
2. Evaluate marketing strategies and sponsorship opportunities in the sports industry, devising effective branding and promotional campaigns.
3. Apply financial management techniques to analyze revenue streams, control costs, and make informed investment decisions in sports organizations.
4. Utilize sports analytics tools and technology to enhance performance evaluation, strategic planning, and fan engagement initiatives.
5. Synthesize course concepts through practical applications, demonstrating the ability to address real-world challenges in sports management scenarios

TEXT BOOKS:

1. Pedersen, P. M., Thibault, L., & Pedersen, P. M. (2019). Contemporary Sport Management. Human Kinetics.

2. Hoye, R., Smith, A. C. T., Nicholson, M., et al. (2021). Sports Management: Principles and Applications. Routledge.

3. Chelladurai, P., & Kerwin, S. (2017). Introduction to Sport Management: Theory and Practice. Human Kinetics.

REFERENCE BOOKS:

1. Hoye, R., Cuskelly, G., & Nicholson, M. (2019). Sports Governance: A Guide for Sport Organizations. Routledge.

2. Conrad, M. (2018). The Business of Sports: A Primer for Journalists. Routledge.

3. Shank, M. D. (2019). Sports Marketing: A Strategic Perspective. Pearson.

NATIONAL CADET CORPS (NCC)

COURSE OBJECTIVES:

1. Understand the foundational role of drill in fostering discipline and leadership within a group, enabling effective command towards achieving common goals.
2. Appreciate the importance of grace and dignity in executing foot drill movements, recognizing their significance in enhancing performance and teamwork.
3. Comprehend the criticality of weapon handling and detailed safety measures, emphasizing the importance of accident prevention through strict adherence to safety protocols.
4. Develop an awareness of diverse terrain types and their strategic significance in battle craft, enabling informed decision-making and effective utilization of terrain features for tactical advantage

UNIT 1:

Overview of NCC, its history, aims, objectives, and organizational structure, Incentives and duties associated with NCC cadetship; Maneuvers: Foot drill, Word of Command, Attention, and stand at ease, and Advanced maneuvers like turning and sizing; Parade formations: Parade line, open line, and closed line; Saluting protocols, parade conclusion, and dismissal procedures. Marching styles: style march, double time march, and slow march

UNIT 2:

Weapon Training, Handling firearms, Introduction and characteristics of the .22 rifle; Handling Firearm techniques, emphasizing safety protocols and Best practices.

UNIT 3:

Map Reading (MR): Topographical forms and technical terms, including relief, contours, and gradients, crucial for understanding terrain features; Cardinal points , magnetic variation and grid convergence

UNIT 4:

Field Craft & Battle Craft (FC & BC): Fundamental principles and techniques essential for effective field and battle craft operations.

UNIT 5:

Methods of judging distance, including estimation, pacing, and visual cues

COURSE OUTCOMES:

1. Mastery of Discipline and Leadership through Drill Learners would demonstrate the ability to effectively command a group, foster discipline, and work collaboratively towards achieving shared objectives.

2. Mastery of Grace and Dignity in Foot Drill Performance Learners would demonstrate an understanding of how these qualities enhance performance and foster teamwork within a group setting.

3. Proficient Weapon Handling and Safety Adherence Learners would showcase a thorough understanding of the criticality of safety measures, emphasizing accident prevention through strict adherence to safety protocols.

4. Enhanced Tactical Awareness and Strategic Decision-Making Learners would gain the ability to make informed decisions and effectively utilize terrain features to gain tactical advantage during operations.

REFERENCES BOOKS:

- DGNCC Cadet's Hand Book - Common Subjects -All Wings
- Tiwari, R. (2019). NCC: Grooming Feeling of National Integration, Leadership and Discipline among Youth. Edwin Incorporation.
- Chhetri, R.S. (2010). Grooming Tomorrows Leaders, The National Cadet Corps.
- Directorate General National Cadet Corps (2003). National Cadet Corps, Youth in Action.
- Vanshpal, Ravi (2024). The NCC Days, Notion Press.

NATIONAL SERVICE SCHEME (NSS)

COURSE OBJECTIVES:

1. To provide students with an understanding of the history, philosophy, and basic concepts of the National Service Scheme (NSS).
2. To familiarize students with the aims, objectives, and organizational structure of NSS.
3. To equip students with knowledge about NSS programmes, activities, and their relevance.
4. To develop an understanding of community mobilization techniques and their importance in NSS activities.
5. To cultivate an appreciation for volunteerism, shramdan (voluntary labor), and their role in community development initiatives.

UNIT 1: INTRODUCTION AND BASIC CONCEPTS OF NSS

National Service Scheme (NSS) - history, philosophy, and fundamental concepts, aims and objectives, providing clarity on the organization's overarching goals. Symbols of NSS - Emblem, flag, motto, song, and badge; Organizational structure of NSS

UNIT 2: NSS PROGRAMMES AND ACTIVITIES

Diverse programmes and activities conducted under the aegis of the National Service Scheme (NSS); Significance of commemorating important days recognized by the United Nations, Centre, State Government, and University; Examination of the methodology for adopting villages/slums and conducting surveys; Financial patterns of the NSS scheme

UNIT 3: COMMUNITY MOBILIZATION

Dynamics of community mobilization within the framework of the National Service Scheme (NSS); Functioning of community stakeholders; The conceptual lens of community development

UNIT 4: VOLUNTEERISM AND SHRAMDAN IN THE INDIAN CONTEXT

Ethos of volunteerism and shramdan (voluntary labor) within the cultural context of India and the framework of the National Service Scheme (NSS).

UNIT 5: ROLES AND MOTIVATIONS WITHIN THE NSS FRAMEWORK

Motivations and constraints shaping volunteer engagement; Role of NSS volunteers in initiatives such as the Swatch Bharat Abhiyan and Digital India

COURSE OUTCOMES:

1. Students will demonstrate an understanding of the history, philosophy, and objectives of the National Service Scheme (NSS), thereby fostering increased social awareness and patriotism among them.

2. Students will be able to organize and conduct various NSS programmes and activities effectively and through it understand the importance of leadership and team building.

3. Students will develop skills in community mobilization and partnership building.

4. Students will appreciate the importance of volunteerism and shramdan in societal development and thus, be able to understand role of community participation.

REFERENCE BOOKS:

1. Ministry of Youth Affairs and Sports, Government of India. (2022). National Service Scheme (NSS) Manual.
2. Agarwalla, S. (2021). NSS and Youth Development. Mahaveer Publications
3. Bhattacharya, P. (2024). Stories Of NSS (English Version). Sahityasree.
4. Borah, R. and Borkakoty, B. (2022). NSS in Socioeconomic Development. Unika Prakashan.
5. Wondimu, H., & Admas, G. (2024). The motivation and engagement of student volunteers in volunteerism at the University of Gondar. *Discover Global Society*, *2*(1), 1-16.

DISASTER MANAGEMENT

COURSE OBJECTIVES:

- to provide understanding of the concepts related to disaster
- to highlight the importance and role of disaster management
- to enhance awareness of institutional processes and management strategies to mitigate the impacts of disasters

UNIT 1: CONCEPTS AND TERMINOLOGIES

Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made); Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial); Defining Vulnerability (Physical Vulnerability; Economic Vulnerability; Social Vulnerability)

UNIT 2: KEY CONCEPTS OF DISASTER MANAGEMENT CYCLE

Components of disaster management cycle (Phases: Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning); Disaster risk reduction (DRR), Community based disaster risk reduction

UNIT 3: INITIATIVES AT NATIONAL AND INTERNATIONAL LEVEL

Disaster Risk Management in India and at international level: Related policies, plans, programmes and legislation;

UNIT 4: EMERGENCY MANAGEMENT

Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil and Hazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflicts.

UNIT 5: INITIATIVES AT INTERNATIONAL LEVEL

International strategy for disaster reduction and other initiatives

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

1. Articulate the critical role of disaster management in reducing risks and enhancing resilience
2. Identify and describe key institutional frameworks and processes in disaster management.

REFERENCE BOOKS:

1. Sharma, S.C. (2022), Disaster Management, Khanna Book Publishing.
2. Clements, B. W., (2009): Disasters and Public Health: Planning and Response, Elsevier Inc.
3. Dunkan, K., and Brebbia, C. A., (Eds.) (2009): Disaster Management and Human Health Risk: Reducing Risk, Improving Outcomes, WIT Press, UK.
4. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
5. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.
6. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
7. Carter, N. (1991) Disaster Management: A Disaster Management Handbook. Asian Development Bank, Manila.
8. Govt. of India (2008) Vulnerability Atlas of India. BMTPC, New Delhi.
9. Govt. of India (2011) Disaster Management in India. Ministryof Home Affairs, New Delhi.
10. Matthews , J.A., (2002) Natural Hazards and Environmental Change, Bill McGuire, Ian Mason.

WEB SOURCES:

- http://www.ndma.gov.in/en/
- http://nidm.gov.in/
- https://www.unisdr.org/
- http://www.emdat.be
- https://www.weather.gov/safety/
- https://www.preventionweb.net/risk/vulnerability

24DVAC41 **ENVIRONMENTAL STUDIES**

L	T	P	O	C
1	1	0	1	2

COURSE OBJECTIVES:

1. This course aims to familiarize students with basic environmental concepts, their relevance to business operations, and forthcoming sustainability challenges.
2. This course will equip students to make decisions that consider environmental consequences.
3. This course will enable future business graduates to become environmentally sensitive and responsible managers.

UNIT 1: UNDERSTANDING ENVIRONMENT, NATURAL RESOURCES, AND SUSTAINABILITY 06

Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, the man-environment relationship, and historical environmental movements. Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. The conservation and equitable use of resources, considering both intergenerational and intergenerational equity, and the importance of public awareness and education.

UNIT 2: ECOSYSTEMS, BIODIVERSITY, AND SUSTAINABLE PRACTICES 06

Various natural ecosystems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management. Strategies for in situ and ex situ conservation, nature reserves, and the significance of India as a mega diverse nation.

UNIT 3: ENVIRONMENTAL POLLUTION, WASTE MANAGEMENT, AND SUSTAINABLE DEVELOPMENT 06

Various types of environmental pollution, including air, water, noise, soil, and marine pollution, and their impacts on businesses and communities. Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts.

UNIT 4: SOCIAL ISSUES, LEGISLATION, AND PRACTICAL APPLICATIONS 06

Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption.

UNIT 5: ENVIRONMENTAL LEGISLATION 06

Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India.

Total Hours :30

COURSE OUTCOMES:

1. Explore the basic environmental concepts and issues relevant to the business and management field.
2. Recognize the interdependence between environmental processes and socio-economic dynamics.
3. Determine the role of business decisions, policies, and actions in minimizing environmental degradation.
4. Identify possible solutions to curb environmental problems caused by managerial actions.
5. Develop skills to address immediate environmental concerns through changes in business operations, policies, and decisions.

TEXT BOOKS:

1. Poonia, M.P. *Environmental Studies* (3rd ed.), Khanna Book Publishing Co.
2. Bharucha, E. *Textbook of Environmental Studies* (3rd ed.) Orient Blackswan Private Ltd.
3. Dave, D., & Katewa, S. S. *Text Book of Environmental Studies*. Cengage Learning India Pvt Ltd.
4. Rajagopalan, R. *Environmental studies: from crisis to cure* (4th ed.). Oxford University Press.
5. Miller, G.T. & Spoolman S. *Living in the Environment*. (20th ed.). Cengage.
6. Basu, M., & Xavier Savarimuthu, S. J. *Fundamentals of environmental studies*. Cambridge University Press.

7. Roy, M. G. *Sustainable Development: Environment, Energy and Water Resources*. Ane Books.

8. Pritwani, K. *Sustainability of business in the context of environmental management*. CRC Press.

9. Wright, R.T. & Boorse, D.F. *Environmental Science: Toward A Sustainable Future* (13th ed,). Pearson.

WEB SOURCES:

- https://www.ourplanet.com
- :https://www.undp.org/content/undp/en/home/sustainable-development-goals.html
- www.myfootprint.org
- https://www.globalchange.umich.edu/globalchange1/current/lectures/kling/ecosystem/ecosystem.html

SKILL ENHANCEMENT COURSE (SEC)

24SSKU11 **SOFT SKILLS -I**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

1. To learn and apply basic etiquette for personal and professional interactions.
2. To develop effective stress management techniques for maintaining mental and emotional well-being.
3. To enhance self-awareness for personal growth and informed decision-making.
4. To gain an overview of essential 21st-century skills necessary for success in a rapidly changing world.
5. To foster creativity and critical thinking skills for innovative problem-solving and adaptability.

UNIT I INTRODUCTION TO SOFT SKILLS 6

- Soft Skills vs Hard Skills
- 15 important Soft Skills
- Communication Skills, Time Management, Leadership Skills

UNIT II - OVERVIEW OF 21ST CENTURY SKILLS. 6

- Lateral Thinking – Left Brain/Right Brain Functionality
- Problem solving skills

UNIT III - SELF AWARENESS 6

- Human Values
- Mindfulness
- SWOT Analysis
- PDCA Approach

UNIT IV - CREATIVITY/CRITICAL THINKING 6

- Six Thinking Traits
- Creative writing exercises
- Open mindedness

UNIT V - PERSONAL HYGIENE AND STRESS MANAGEMENT 6

- Basic Etiquettes
- Health and Personal Grooming
- Stress-meaning and nature, Eustress, Distress
- Stress management strategies

Total Hours:30

COURSE OUTCOMES:

At the end of this course, the students would have learnt to

CO1: demonstrate basic etiquette in various personal and professional settings.

CO2: effectively manage stress using learned techniques.

CO3: show increased self-awareness and make informed decisions.

CO4: understand and articulate key 21st-century skills.

CO5: apply creativity and critical thinking to solve problems innovatively.

REFERENCE BOOKS:

- Alex, Dr. K. (2014). Soft Skills (1st edition) S Chand & Company
- Taylor. Grant English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd 2005
- Tiko, Champa& Jaya Sasikumar. Writing with a purpose. OUP New Delhi 1979
- Nelson-Jones, R. (1992). Life skills, a handbook, Trowbridge, Wilts: Detesios Ltd.
- Tuhovsky, Ian (2019). Communication Skills Training (2nd edition) Rupa Publication India.

24SSKU21 **SOFT SKILLS II**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

1. To develop strategies to enhance teamwork and collaboration in professional settings.
2. To cultivate a positive attitude and mindset to foster constructive relationships and productivity.
3. To develop leadership, decision-making and team bonding skills

UNIT I - PROFESSIONAL BEHAVIOUR 6

- Team Building – Team Bonding
- Inter-Personal Relationship– Intra-Personal Relationship

UNIT II - PERSONALITY DEVELOPMENT 6

- Types of Personality
- Self-Confidence - Confidence Building
- Attitude (Positive/Negative)

UNIT III - TELEPHONE ETIQUETTE 6

- Basics of telephone etiquette
- Giving clear and concise information
- Tone & rate of speech
- Intonations & its Importance
- Whatsapp Communications

UNIT IV - DECISION MAKING 6

- Types of Decisions – planned-unplanned, individual-group, major-minor
- Types of Leadership styles – Autocratic, democratic, lesse-faire, participative, beurocratic

UNIT V - PROFESSIONAL ETIQUETTE 6

- Respect – Salutations
- Official Behaviour

Total Hours:30

COURSE OUTCOMES:

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

CO1: understand the principles of effective team building and apply strategies to foster team bonding and cohesion in professional settings.

CO2: become self-confident individuals by mastering interpersonal skills, team managemen skills, and leadership skills.

CO3: practice techniques for effective communication in telephone conversations.

CO4: evaluate decision-making processes and their implications in professional settings.

CO5: exhibit professional conduct and demeanor in various professional situations.

REFERENCE BOOKS:

- Language Service, University Oberta de Catalunya
- Taylor. Grant English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd 2005
- Tiko, Champa& Jaya Sasikumar. Writing with a purpose. OUP New Delhi 1979
- Alex, Dr. K. (2014). Soft Skills (1st edition) S Chand & Company.
- Nelson-Jones, R. (1992). Life skills, a handbook, Trowbridge, Wilts: Detesios Ltd.

DISCIPLINE SPECIFIC ELECTIVES (DSE)

24DBCA34 SOFTWARE ENGINEERING

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

1. To acquire a comprehensive understanding of the software development lifecycle and its application in contemporary software engineering practices.
2. To develop proficiency in project management methodologies and strategic decision-making for successful software project execution.
3. To Master the art of software design and development
4. To produce robust and efficient software solutions.

UNIT I: INTRODUCTION 9

The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process. **Agile software development**: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.

UNIT II: SOFTWARE REQUIREMENT SPECIFICATION 9

Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management. **Risk management**: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. **Project planning**- Software pricing, plan-driven development, Project scheduling, Agile planning, Estimation techniques.

UNIT III: DESIGN STRATEGIES 9

Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams. **Testing Strategies**: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. **Product metrics**: Software quality, metrics for analysis model, metrics for design model,metrics for source code, metrics for testing, metrics for maintenance.

UNIT IV: QUALITY MANAGEMENT 9

Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.

UNIT V: RELEASE MANAGEMENT 9

Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring. **Product sustenance**: Maintenance, updates, End of life, migration strategies.

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Acquire a comprehensive understanding of the software development lifecycle and its application in contemporary software engineering practices.

CO2: Develop proficiency in project management methodologies and strategic decision-making for successful software project execution.

CO3: Master the art of software design and development.

CO4: Produce robust and efficient software solutions.

TEXT BOOKS:

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023 (AICTE Recommended Textbook)
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

REFERENCE BOOKS:

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

24DBCA34 **GRID COMPUTING**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

1. To introduce students to the fundamentals of grid computing and its architecture.
2. To familiarize students with grid computing applications and how it differs from traditional distributed computing.
3. To teach students the methods of resource management and job scheduling in a grid environment.
4. To explore grid computing frameworks and tools used for large-scale data processing.
5. To provide an understanding of the security, scalability, and performance challenges in grid computing.

UNIT I: INTRODUCTION TO GRID COMPUTING 09

Grid Computing Overview: Definition, history, and evolution of grid computing.-Grid vs. Cloud vs. Distributed Computing: Key differences, advantages, and challenges.-Grid Computing Architecture: Components of a grid system: resource, management, and scheduling layers.-Types of Grid Computing: Computational grid, data grid, service grid, and collaborative grid.-Applications of Grid Computing: Scientific research, healthcare, weather forecasting, financial modeling.

UNIT II: GRID ARCHITECTURE AND COMPONENTS 09

Grid Infrastructure: Key elements—resource management, resource sharing, and job scheduling-**Grid Middleware**: Introduction to middleware components like Globus, UNICORE, and OGSA (Open Grid Services Architecture).-**Grid Resources**: Virtualization of resources, resource management tools, and scheduling frameworks.-**Grid Communication**: Grid communication models, protocols, and message-passing mechanisms.

UNIT III: GRID COMPUTING TECHNOLOGIES AND FRAMEWORKS 09

Globus Toolkit: Overview, installation, and configuration of the Globus toolkit for grid computing.-**UNICORE (Uniform Interface to Computing Resources)**: Architecture and working of UNICORE in grid environments.-**Grid Computing Frameworks**: Role of middleware and frameworks in enabling grid computing, overview of Grid-Enabled Services.

UNIT IV: GRID RESOURCE MANAGEMENT AND SCHEDULING 09

Resource Management in Grid Computing: Resource discovery, allocation, and scheduling strategies.-**Job Scheduling Techniques**: Types of scheduling (static, dynamic, and hybrid scheduling) and job prioritization.-**Load Balancing**: Concepts of load balancing in grid environments for efficient resource utilization.-**Fault Tolerance and Recovery**: Handling failures in grid systems, strategies for fault tolerance.-**Performance Evaluation**: Metrics for evaluating grid performance, response time, throughput, and scalability.

UNIT V: SECURITY AND FUTURE OF GRID COMPUTING 09

Security in Grid Computing: Challenges and security issues—authentication, authorization, encryption, and data integrity.-**Grid Security Infrastructure (GSI)**: Overview of GSI for secure communication and access in grid systems.-**Scalability and Performance**: Techniques for scaling grid systems and improving performance.-**Future Trends in Grid Computing**: Integration with cloud computing, IoT, and big data analytics.

Total Hours:45

COURSE OUTCOMES:

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

- **CO1**: Understand the fundamental concepts of grid computing and its architecture.
- **CO2**: Identify the differences between grid computing and other computing models like cloud and distributed computing.
- **CO3**: Work with grid computing technologies and frameworks for resource management and job execution.
- **CO4**: Demonstrate the ability to design and implement grid computing applications.
- **CO5**: Evaluate the scalability, performance, and security challenges in grid computing systems.

TEXTBOOKS:

1. "Grid Computing: Making the Global Infrastructure a Reality" by Fran Berman, Geoffrey Fox, and Tony Hey (Wiley, 2020)
2. "Introduction to Grid Computing" by Ian Foster, Carl Kesselman, and Steven Tuecke (Pearson, 2022)
3. "The Grid: Blueprint for a New Computing Infrastructure" by Ian Foster and Carl Kesselman (Morgan Kaufmann, 2023)

REFERENCE BOOKS:

1. **Ian Foster, Carl Kesselman, & Steven Tuecke**, *The Open Grid Services Architecture: A Research Agenda*, Springer.
2. **Rajkumar Buyya, S. Thamarai Selvi**, *Grid Computing: Techniques and Applications*, Wiley India.
3. **Tarek S. S. Abdelrahman**, *Grid Computing: Methods, Models, and Applications*, Pearson Education.
4. **Thomas Sterling, Matthew Anderson**, *The Grid 2: Blueprint for a New Computing Infrastructure*, Elsevier.
5. **M. L. G. M. Van Der Meer**, *Grid Computing: An Introduction to Distributed and Parallel Computing*, John Wiley & Sons.

WEB SOURCES:

1. Globus Toolkit – http://www.globus.org/
2. Open Grid Services Architecture (OGSA) – https://www.gridforum.org/ogsa/
3. UNICORE (Universal Grid Oriented Resource Environment) – http://www.unicore.eu/
4. BOINC Project – https://boinc.berkeley.edu/
5. Grid Computing Resources – https://www.gridcomputing.com/

24DBCA45 **OPERATING SYSTEMS**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- To understand the basics and functions of operating systems.
- To understand processes and threads.
- To analyse scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyse various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

UNIT 1: INTRODUCTION 9

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

UNIT 2: PROCESS MANAGEMENT 9

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT 3: MEMORY MANAGEMENT 9

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT 4: STORAGE MANAGEMENT 9

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting -File Sharing and Protection; File System Implementation - File System Structure Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT 5: VIRTUAL MACHINES AND MOBILE OS 9

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

Total Hours: 45

COURSE OUTCOMES:

On Completion of this course, the students can able to;

CO1: Analyse various scheduling algorithms

CO2: Understand the principle of process synchronization.

CO3: Manipulate deadlock prevention and avoidance algorithms.

CO4: Compare and contrast various memory management schemes. **CO5:** Understand the virtual memory concept.

CO6: Understand the functionality of file systems, I/O systems, and Virtualization. CO7**:** Compare iOS and Android Operating Systems.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”‖, 10th Edition, John Wiley and Sons Inc., 2018.

2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCE BOOKS:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.

2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.

3. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

WEBSITE LINKS:

1. www.w3schools.com
2. www.tutorialspoint.com
3. www.javapoint.com
4. www.geeksforgeeks.org

WEB SOURCES:

1. https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf
2. https://www.cl.cam.ac.uk/teaching/1011/OpSystems/os1a-slides.pdf
3. https://www.unf.edu/public/cop4610/ree/Notes/PPT/PPT8E/CH%2002%20OS8e.pdf
4. http://www.ddegjust.ac.in/studymaterial/mca-5/mca-105.pdf
5. http://www.svecw.edu.in/Docs%5CCSEOSLNotes2013.pdf
6. https://www.maths.ox.ac.uk/system/files/legacy/2356/basic-unix.pdf

24DBCA45 **ETHICAL HACKING**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- Learn aspects of security, importance of data gathering, foot printing and system hacking.
- Learn tools and techniques to carry out a penetration testing.
- Explain Intrusion Detection, Policy Creation, Social Engineering, DDoS
- Attacks, Buffer Overflows and Virus Creation.
- Compare different types of hacking tools.

UNIT I: CASING THE ESTABLISHMENT 9

What is foot printing, Internet Foot printing, Scanning, Enumeration, basic banner grabbing, Enumerating Common Network services. Case study: Network Security Monitoring

UNIT II: SECURING PERMISSION 9

Securing file and folder permission, using the encrypting file System, Securing registry permissions. Securing service: Managing service permission, Default services in windows 2000 and windows XP. Unix: The Quest for Root, Remote Access vs Local access, Remote access, Local access, After hacking root.

UNIT III: HACKING 9

Dial-up, PBX, Voicemail and VPN hacking, Preparing to dial up, War-Dialing, Brute- Force Scripting PBX hacking, Voice mail hacking, VPN hacking, Network Devices: Discovery Autonomous System Lookup, Public Newsgroups, Service Detection, Network Vulnerability, Detecting Layer 2 Media.

UNIT IV: WIRELESS HACKING 9

Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks.

UNIT V: FIREWALLS 9

Firewalls landscape, Firewall Identification-Scanning Through firewalls, packet Filtering, Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of DosAttackers, Types of DoS attacks, Generic Dos Attacks, UNIX and Windows Dos

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Explain aspects of security, importance of data gathering, foot printing and system hacking.

CO2: Explain aspects of security, importance of data gathering, foot printing and system hacking.

CO3: Demonstrate how intruders escalate privileges.

CO4: Demonstrate how intruders escalate privileges.

TEXT BOOKS:

1. Mastering ethical hacking By Kris Hermans 2023 Cybellium Ltd
2. Ethical Hacking a Hands-on Introduction to Breaking in By DANIEL. GRAHAM • 2021 , No Strach Press

REFERENCE BOOKS:

1. Jul 2017 by Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, McGraw Hill Education; 3 ed (1 July 2017)
2. CEH v9: Certified Ethical Hacker Version 9 Study Guide by Sean-Philip Oriyano, Sybex; Stg edition (17 June 2016)
3. Hacking for Beginners: Ultimate 7 Hour Hacking Course for Beginners. Learn Wireless Hacking, Basic Security, Penetration Testing by Anthony Reynolds, CreateSpace Independent Publishing Platform (10 April 2017)

WEB SOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. https://www.cyberscope.in/home/course/ethical-hacking-nptel/2

24DBCA52 **INTRODUCTION TO ML**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- Understanding core concepts of machine learning, including algorithms for regression, classification, and clustering.
- Applying data preprocessing, feature engineering, and model evaluation techniques.
- Developing proficiency in programming with libraries like Scikit-Learn, TensorFlow, or PyTorch.
- Cultivating the ability to assess ethical considerations and impacts of machine learning applications in society.

UNIT I - INTRODUCTION TO MACHINE LEARNING: 9

Introduction to Machine learning: Type of Learning and Examples, basic concepts in machine learning, Computational Learning theory, Introduction to Parametric Models – Non-Parametric Models–Probability Basics.

UNIT II - SUPERVISED LEARNING: 9

Supervised Learning Algorithms Supervised Machine Learning Algorithms, working of supervised machine learning algorithm, Naive Bayes algorithm, decision tree, Support Vector Machines, KNN, Random Forest algorithm.

UNIT III - UNSUPERVISED LEARNING 9

Clustering- K-means -EM Algorithm- Mixtures of Gaussians - Dimensionality Reduction - Factor analysis – Feature Selection - Principal Component Analysis - Probabilistic PCA - Independent components analysis - Singular Value Decomposition.

UNIT IV - REINFORCEMENT LEARNING: 9

Reinforcement Learning Algorithms Reinforcement Machine Learning Algorithms, working of reinforcement machine learning algorithm, Finite Markov Decision Processes, Dynamic Programming, Monte Carlo Methods

UNIT V - APPLICATIONS AND USE CASE: 9

Ranking: Priority Inbox - Ordering Email Messages by Priority - Writing a Priority Inbox - Spam Filtering - Analyzing Social Graphs - Social Network Analysis - Hacking Twitter Social Graph Data - Analyzing Twitter Networks – Case Study.

Total Hours : 45

COURSE OUTCOMES:

Accomplishment of the student after completing the course:

CO1: Able to explain the need of machine learning and model building.

CO2: Understand the concept to apply the supervised algorithms.

CO3: Develop a skill to implement unsupervised algorithms for problem solving.

CO4: Understand the concept of reassurance learning algorithms.

C05: Able to apply the learning algorithms in real world problem solving.

TEXT BOOKS:

1. Ethem Alpaydın (2020), *Introduction to Machine Learning*, The MIT Press Cambridge, Fourth Edition, MIT Press Hardcover.
2. Shai Shalev-Shwartz, Shai Ben-David (2014), *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press.

REFERENCE BOOKS:

1. V Kishore Ayyadevara (2018), *Pro Machine Learning Algorithms A Hands-On Approach to Implementing Algorithms in Python and R*, Apress
2. Kevin P. Murphy (2022), *Probabilistic Machine Learning an Introduction*. The MIT Press.

WEB SOURCES:

1. https://alex.smola.org/drafts/thebook.pdf
2. https://onlinecourses.nptel.ac.in/noc21_cs85/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs70

24DBCA52 **CLOUD TECHNOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- Introducing Cloud computing and different computing concepts that involve a large number of computers
- In science, cloud computing is a synonym for distributed computing over a network and means the ability to run a program on many connected computers at the same time.
- Provides knowledge about basic concepts of cloud types, services and security etc.
- Introduces the Governance In The Cloud.

UNIT I: INTRODUCTION 9

Introduction to Cloud Computing, History and Evolution of Cloud Computing, Types of clouds, Private Public and hybrid clouds, Cloud Computing architecture, Cloud computing infrastructure, Merits of Cloud computing, , Cloud computing delivery models and services (IaaS, PaaS, SaaS), obstacles for cloud technology, Cloud vulnerabilities, Cloud challenges, Practical applications of cloud computing.

UNIT II: CLOUD COMPUTING COMPANIES AND MIGRATING TO CLOUD 9

Web-based business services, Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies

UNIT III: ASSESSING THE CLOUD 9

Assessing the Cloud: software Evaluation, System Testing, Seasonal or peak loading, Cost cutting and cost-benefit analysis, selecting the right scalable application. Considerations for selecting cloud solution. Understanding Best Practices used in selection of Cloud service and providers, Clouding the Standards and Best Practices Issue: Interoperability, Portability, Integration, Security, Standards Organizations and Groups associated with Cloud Computing, Commercial and Business Consideration.

UNIT IV: GOVERNANCE IN THE CLOUD 9

Industry Standards Organizations and Groups associated with Cloud Computing, Need for IT governance in cloud computing, Cloud Governance Solution: Access Controls, Financial Controls, Key Management and Encryption, Logging and Auditing, API integration. Legal Issues: Data Privacy and Security Issues, Cloud Contracting models, Jurisdictional Issues Raised byVirtualization and Data Location, Legal issues in Commercial and Business Considerations

UNIT V: TEN CLOUD DO AN DO NOTS 9

Don't be reactive, do consider the cloud a financial issue, don't go alone, do think about your architecture, don't neglect governance, don't forget about business purpose, do make security the centerpiece of your strategy, don't apply the cloud to everything, don't forget about Service Management, do start with a pilot project.

Total Hours: 45

COURSE OUTCOMES:

CO1: Learn the underlying principles of Cloud Technology and various types of cloud computing architecture and types.

CO2: Learn to evaluate between different cloud solutions offered by various providers based on their merits and demerits.

CO3: Gain the knowledge about cloud computing companies and migrating to cloud

TEXT BOOKS:

1. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, Pearson Education, 2020.
2. "Cloud Computing: Principles and Paradigms" (2nd Edition) by Rajkumar Buyya, James Broberg, and Andrzej M. Goscinski, Wiley, 2020.
3. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (IaaS, PaaS, SaaS)" (2nd Edition) by Michael J. Kavis, Wiley, 2021.

REFERENCE BOOKS:

1. Brief Guide to Cloud Computing, Christopher Barnett, Constable Robinson Limited, 2010
2. Handbook on Cloud Computing, Borivoje Furht, Armando Escalante, Springer, 2010.

24PBCA52 MACHINE LEARNING LAB

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

- Understanding core concepts of machine learning, including algorithms for regression, classification, and clustering.
- Applying data preprocessing, feature engineering, and model evaluation techniques.
- Developing proficiency in programming with libraries like Scikit-Learn, TensorFlow, or PyTorch.
- Cultivating the ability to assess ethical considerations and impacts of machine learning applications in society.

LIST OF EXPERIMENTS:

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result.
2. Extract the data from database using python
3. Implement k-nearest neighbors classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of kmeans clustering with 3 means (i.e., 3 centroids) periments

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing design single twenties no -> highRisk high golf trading married forties yes -> lowRisk

low speedway transport married thirties yes -> medRisk medium football banking single thirties yes -> lowRisk

high flying media married fifties yes -> highRisk

low football security single twenties no -> medRisk

medium golf media single thirties yes -> medRisk

medium golf transport married forties yes -> lowRisk

high skiing banking single thirties yes -> highRisk

low golf unemployed married forties yes -> highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm
10. Additional Experiments: Find-S and Candidate Elimination Algorithms

COURSE OUTCOMES:

Accomplishment of the student after completing the course:

CO1: Able to explain the need of machine learning and model building.

CO2: Understand the concept to apply the supervised algorithms.

CO3: Develop a skill to implement unsupervised algorithms for problem solving.

CO4: Understand the concept of reassurance learning algorithms.

C05: Able to apply the learning algorithms in real world problem solving.

TEXT BOOKS:

3. Ethem Alpaydın (2020), *Introduction to Machine Learning*, The MIT Press Cambridge, Fourth Edition, MIT Press Hardcover.
4. Shai Shalev-Shwartz, Shai Ben-David (2014), *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press.

REFERENCE BOOKS:

3. V Kishore Ayyadevara (2018), *Pro Machine Learning Algorithms A Hands- On Approach to Implementing Algorithms in Python and R*, Apress
4. Kevin P. Murphy (2022), *Probabilistic Machine Learning an Introduction*. The MIT Press.

WEB SOURCES:

1. https://alex.smola.org/drafts/thebook.pdf
2. https://onlinecourses.nptel.ac.in/noc21_cs85/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs70

24PBCA52 CLOUD TECHNOLOGY LABORATORY

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

The student should be made to:

1. Be exposed to tool kits for grid and cloud environment.
2. Be familiar with developing web services/Applications in grid framework
3. Learn to run virtual machines of different configuration.
4. Learn to use Hadoop
5. To develop web applications in cloud
6. To learn the design and development process involved in creating a cloud based application
7. To learn to implement and use parallel programming using Hadoop

LIST OF EXPERIMENTS:

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not presentin CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

COURSE OUTCOMES:

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

CO2: Configure various virtualization tools such as Virtual Box, VMware workstation.

CO3: Design and deploy a web application in a PaaS environment.

CO4: Learn how to simulate a cloud environment to implement new schedulers.

CO5: Install and use a generic cloud environment that can be used as a private cloud.

CO6: Manipulate large data sets in a parallel environment.

24DBCA53 CRYPTOGRAPHY FUNDAMENTALS

L	T	P	O	C
3	2	0	2	5

COURSE OBJECTIVES:

- Introduction to need for development of secured systems.
- The knowledge of Types of Algorithms in Cryptography.
- To ensure the confidentiality and integrity of information.
- Learn about several forms of attack.
- Knowledge about basic concepts of Cryptography, certain cryptographic algorithms and its applications.

UNIT I: INTRODUCTION TO CRYPTOGRAPHY 15

The Confidentiality, Integrity & Availability (CIA) Triad, Cryptographic concepts, methodologies &practices, Symmetric& Asymmetric cryptography, public& private keys, Cryptographic algorithms and uses, Construction& use of Digital signatures

UNIT II: TYPES OF ALGORITHMS 15

The basic functionality of hash/crypto algorithms (DES, RSA, SHA, MD5, HMAC, DSA) and effects on key length concepts in Elliptical Curve Cryptography & Quantum Cryptography.

UNIT III: KEY MANAGEMENT 15

The basic functions involved in key management including creation, distribution, verification, revocation and destruction, storage, recovery and life span and how these functions affect cryptographic integrity

UNIT IV: 15

Major key distribution methods and algorithms including Kerberos, ISAKMP etc., Vulnerabilities to cryptographic functions, the Use and functions of Certifying Authorities (CAs),Public Key Infrastructure (PKI) and System architecture requirements for implementing cryptographic functions

UNIT V: 15

Basics of authentication, tokens, certificate-based and biometric authentication, extensible authentication protocols, message digest, security handshake pitfalls, SSO,

attacks on authentication schemes, email security

Total Hours: 75

COURSE OUTCOMES:

CO1: Understand the fundamental concepts of cloud technology within the context of Windows Azure, focusing on its architecture and core services.

CO2: Demonstrate knowledge of Azure Compute Services, including virtual machines, containers, and app hosting options.

CO3: Analyze and configure Azure Network Services, gaining expertise in virtual networks, load balancers, and secure connectivity.

CO4: Explore Azure Data Services, understanding data storage options, databases, and data management in the cloud environment.

CO5: Gain proficiency in Azure App Services, learning to deploy, manage, and scale applications on the Azure platform.

CO6: Develop and implement programs on Windows Azure, utilizing Azure SDKs, tools, and best practices for cloud application development.

TEXT BOOKS:

1. "Cryptography and Network Security: Principles and Practice" by William Stallings (8th Edition, 2021)
2. "Understanding Cryptography: A Textbook for Students and Practitioners" by Christof Paar and Jan Pelzl (2nd Edition, 2020)
3. "Network Security Essentials: Applications and Standards" by William Stallings (6th Edition, 2021)

REFERENCE BOOKS:

1. Understanding Cryptography: A Textbook for Students and Practitioners Hardcover, Springer, 1st ed; 2010
2. Introduction to Modern Cryptography by Jonathan Katz, Chapman & Hall/CRC Cryptography, 2nd ed; 2014
3. Everyday Cryptography: Fundamental Principles and Applications by Keith Martin, OUP Oxford, 2nd ed; 2017

24DBCA72 **UI AND UX DESIGN**

L	T	P	O	C
3	2	0	2	5

COURSE OBJECTIVES:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I : FOUNDATIONS OF DESIGN **15**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN **15**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN **15**

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING **15**

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE **15**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

Total Hours :45

COURSE OUTCOMES:

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

CO1:Build UI for user Applications

CO2:Evaluate UX design of any product or application CO3:Demonstrate UX Skills in product development CO4:Implement Sketching principles

CO5:Create Wireframe and Prototype

TEXT BOOKS:

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021

REFERENCE BOOKS:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015

WEB SOURCES:

1. https://www.nngroup.com/articles/
2. https://www.interaction-design.org/literature

24DBCA62 **BIG DATA ANALYTICS**

L	T	P	O	C
3	2	0	2	5

COURSE OBJECTIVES:

1. To set up single and multi-node Hadoop Clusters
2. To solve Big Data problems using Map Reduce Technique.
3. To design algorithms that uses Map Reduce Technique to apply on Unstructured and structured data.
4. To learn NoSQL query.
5. To learn Scalable machine learning using Mahout

UNIT I: INTRODUCTION 15

Dawn of the Big Data Era, Definition and Features of Big Data, Big Data Value, The Development of Big Data, Challenges of Big Data. RELATED TECHNOLOGIES: Cloud Computing - Cloud Computing Preliminaries, Relationship Between Cloud Computing and Big Data, IoT - IoT Preliminaries, Relationship Between IoT and Big Data, Data Center, Hadoop - Hadoop Preliminaries, Relationship between Hadoop and Big Data.

UNIT II: BIG DATA GENERATION AND ACQUISITION 15

Big Data Generation-Enterprise Data,IoT Data, Internet Data, Bio-medical Data, Data Generation from Other Fields, Big Data Acquisition- Data Collection, Data Transportation, Data Pre-processing.

UNIT III: BIG DATA STORAGE 15

Storage System for Massive Data,Distributed Storage System,Storage Mechanism for Big Data - Database Technology, Design Factors, Database Programming Model. **HADOOP & MAP REDUCE**: Data Storage and Analysis, Comparison with Other Systems, A Brief History of Hadoop , Apache Hadoop and the Hadoop Ecosystem, A Weather Dataset, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop(Map and Reduce, Java MapReduce), Scaling Out, Hadoop Streaming, Hadoop Pipes.

UNIT IV: BIG DATA ANALYSIS 15

Traditional Data Analysis, Big Data Analytic Methods, Architecture for Big Data Analysis - Real-Time vs. Offline Analysis, Analysis at Different Levels, Analysis with Different

Complexity, Tools for Big Data Mining and Analysis.

UNIT V: BIG DATA APPLICATIONS **15**

Application Evolution, Big Data Analysis Fields - Structured Data Analysis, Text Data Analysis,Web Data Analysis, Multimedia Data Analysis, Network Data Analysis, Mobile Traffic Analysis, Key Applications - Application of Big Data in Enterprises, Application of IoT Based Big Data, Application of Online Social Network-Oriented Big Data,Applications of Healthcare and Medical Big Data, Collective Intelligence, Smart Grid.

Total Hours: 75

COURSE OUTCOMES:

At the end of this Course, the Student will be able to,

CO 1: Understand big data analytics as the next wave for businesses looking for competitive advantage.

CO 2: Understand the financial value of big data analytics.

CO 3: Explore tools and practices for working with big data.

CO 4: Understand how big data analytics can leverage into a key component.

CO 5: Learn about stream computing.

TEXT BOOK:

1. Min Chen, Shiwen Mao, Yin Zhang,Victor C.M. Leung, "Big Data: Related Technologies, Challenges and Future Prospects", Springer; 2014 edition.

REFERENCE BOOKS:

1. Tom White, "Hadoop- The Definitive Guide", O'reilly, 2nd Edition, 2021.
2. VigneshPrajapati,"Big Data Analytics with R and Hadoop", PACKT Publishing,November 2013.

24DBCA62 **ADVANCED DATA VISUALIZATION**

L	T	P	O	C
3	2	0	2	5

COURSE OBJECTIVES:

Understand the Data security and privacy and its Use cases

- **Master Advanced Visualization Techniques**
- Utilize Modern Data Visualization Tools and Libraries
- Design Data-Driven Storytelling
- Analyze and Apply Visualization Best Practices
- Implement Real-World Data Visualization Projects

UNIT-I ADVANCED DATA ANALYTICS 09

Advanced Data Preparation: Data wrangling, cleaning, and transformation, Handling missing and imbalanced data, Feature engineering and dimensionality reduction (PCA, t-SNE, UMAP).
Advanced Statistical Analysis: Hypothesis testing, time series analysis, advanced regression techniques, Bayesian analysis.Big Data Analytics: Distributed computing with Apache Spark, Machine learning pipelines in big data frameworks.

UNIT-II DATA VISUALIZATION FUNDAMENTALS 09

Principles of Data Visualization: Importance of storytelling in visualization, Understanding perception and visual encoding (color, size, position).Types of visualizations: Line charts, scatter plots, heat maps, etc.
Tools for Data Visualization: Python libraries: Matplotlib, Seaborn, Plotly, Bokeh.Dash boarding tools: Tableau, Power BI, Looker. Cloud-based visualization tools: Google Data Studio.

UNIT-III INTERACTIVE AND ADVANCED VISUALIZATIONS 09

Interactive Visualization Techniques, Plot and Dash for interactive web apps, JavaScript-based libraries: D3.js, Streaming data visualization.
Advanced Visualization Types: Geospatial visualizations (Mapbox, Kepler.gl), Network graphs and hierarchy visualizations, 3D visualizations and VR/AR integration.
Data Storytelling: Narrative techniques for visual storytelling, Combining text, visuals, and interactivity.

UNIT-IV DOMAIN-SPECIFIC APPLICATIONS 09

Finance: Stock market analysis and visualization, Risk assessment and portfolio visualization.
Healthcare: Patient data analysis and medical imaging, Epidemiological visualizations (COVID-19 dashboards).
Geospatial Analytics: Heat maps, choropleth maps, and satellite data visualization, Geospatial tools: QGIS, ArcGIS.
Marketing and Social Media: Sentiment analysis and campaign performance dashboards.

UNIT-V ETHICS, EVALUATION, AND TRENDS 09

Ethical Issues in Data Analytics and Visualization: Misleading visualizations and bias, Ensuring privacy and compliance (e.g., GDPR, CCPA).
Evaluating Data Visualizations: Visualization quality metrics (accuracy, clarity, efficiency), User testing for interactive visualizations.Emerging Trends: AI-driven visualization (NLP-generated visual summaries), Real-time visual analytics and edge computing, Use of generative AI in visualization design.

Total Hours: 45

COURSE OUTCOMES:

At the end of the course learners will be able to:

CO1: Understand advanced data processing, transformation, and analysis techniques.
CO2: Utilize state-of-the-art tools and frameworks for big data analytics and visualization.

CO3: Design and implement interactive, insightful, and impactful data visualizations.
CO4: Apply storytelling techniques to effectively communicate data insights.
CO5: Explore domain-specific visualization techniques in fields such as finance, healthcare, and geospatial analytics.
CO6: Address challenges in handling large datasets, data ethics, and data privacy during analysis and visualization.

TEXT BOOKS:

1. "Interactive Data Visualization for the Web" by Scott Murray
2. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic

REFERENCE BOOKS:

1. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (IaaS, PaaS, SaaS)" by Michael J. Kavis
2. "The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios" by Steve Wexler, Jeffrey Shaffer, and Andy Cotgreave.
3. "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics" by Nathan Yau.

24PBCA62 BIG DATA ANALYTICS LAB

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

1. To set up single and multi-node Hadoop Clusters
2. To solve Big Data problems using Map Reduce Technique.
3. To design algorithms that uses Map Reduce Technique to apply on Unstructured and structured data.
4. To learn NoSQL query.
5. To learn Scalable machine learning using Mahout.

LIST OF EXPERIMENTS:

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves)
2. MapReduce application for word counting on Hadoop cluster
3. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
4. K-means clustering using map reduce
5. Page Rank Computation
6. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
7. Application of Recommendation Systems using Hadoop/mahout libraries.

Total Hours: 30

COURSE OUTCOMES:

At the end of this course, the student will be able to;

CO1: Set up single and multi-node Hadoop Clusters.

CO2: Apply Map Reduce technique for various algorithms

CO3: Design a new algorithm that uses Map Reduce to apply on Unstructured and structured data.

CO4: Develop Scalable machine learning algorithms for various Big data applications using Mahout.

CO5: Represent NoSQL data.

TEXT BOOK:

1. Min Chen, Shiwen Mao, Yin Zhang,Victor C.M. Leung, "Big Data: Related Technologies, Challenges and Future Prospects", Springer; 2014 edition.

REFERENCE BOOKS:

1. Tom White, "Hadoop- The Definitive Guide", O'reilly, 2nd Edition, 2021.
2. VigneshPrajapati,"Big Data Analytics with R and Hadoop", PACKT Publishing,November 2013.

24PBCA62 DATA VISUALIZATION LAB

L	T	P	O	C
0	0	4	1	2

COURSE OBJECTIVES:

Students will be able to

1. Understand the importance of data visualization for business intelligence and decision making.
2. Know approaches to understand visual perception
3. Learn about categories of visualization and application areas
4. Familiarize with the data visualization tools
5. Gain knowledge of effective data visuals to solve workplace problems

LIST OF EXPERIMENTS:

1. Introduction to various Data Visualization tools
2. Basic Visualization in Python
3. Basic Visualization in R
4. Introduction to Tableau and Installation
5. Connecting to Data and preparing data for visualization in Tableau
6. Data Aggregation and Statistical functions in Tableau
7. Data Visualizations in Tableau
8. Basic Dashboards in Tableau

COURSE OUTCOMES:

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

1. Use Python, R and Tableau for data visualization
2. Apply data visuals to convey trends in data over time using tableau
3. Construct effective data visuals to solve workplace problems
4. Explore and work with different plotting libraries
5. Learn and create effective visualizations

REFERENCE BOOKS:

1. Data visualization with python: create an impact with meaningful data insights using interactive and engaging visuals, Mario Dobler, Tim Grobmann, Packt Publications, 2019
2. Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master, Ryan Sleeper, Oreilly Publications, 2018
3. Data Visualization with R: 111 Examples by Thomas Rahlf, Springer, 2020

24DBCA63 EXPLORATORY DATA ANALYSIS

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- To impart basic managerial skills for collection & analysis of statistical data.
- To learn about graphical and modelling techniques for exploring data, with an emphasis on visualization, interpretation, and clear communication of findings.

UNIT – I INTRODUCTION TO STATISTICAL METHODS 09

Introduction to Statistical Methods Statistics & Managerial Decisions, Statistical Data, Operation Research Techniques

UNIT – II DATA COLLECTION AND ANALYSIS 09

Collection and presentation of data in terms of tables, graphs, raw data, frequency distributions, histogram etc. Cumulative frequency curve, Measures of central tendency and location, Partition values, Comparison of various measures of central tendencies, Measures of dispersion, skewness & kurtosis, comparison of various measures of dispersion

UNIT – III PROBABILITY DISTRIBUTION & STATISTICS 09

Introduction of Probability, sample, space & events, Basic rules of probability, permutation & combinations, conditional probability, Bayes' theorem, distributions: Binomial, Poisson, Exponential and Normal distribution with their properties and application. Random variables – discrete and continuous probability distribution functions

UNIT – IV CORRELATION AND REGRESSION ANALYSIS 09

Curve fitting, correlation and regression analysis, Autocorrelation, Multiple regression, statistical Inference & estimation applied to Industrial problems 6 5. Understanding Data for Exploratory Analysis Exploratory data analysis and data visualization, Perception, Continuous variables, Discrete variables, Dependency relationships, Multivariate categorical variables, Temporal data, Spatial data Data Science Pipeline: Collect, Import, Clean, Transform, Visualize, Model, Communicate

UNIT V – STATISTICAL TESTS AND TESTING OF HYPOTHESIS 09

Elementary theory and practice of sampling, standard error or means and variance, tests of significance, T test, F test, Z test and chi-square test along with their applications, Goodness of fit, testing of hypotheses and decision making, analysis of variance (ANOVA)

Total Hours: 45

COURSE OUTCOMES:

After completion of this subject, students would be able to:

- Identify objectives of statistical analysis.
- Apply methods of data collection & analysis.
- Use correlation and regression analysis.
- Visualize the data to get the insights from it further for decision making process.

TEXT BOOK:

1. Engineering Statistics Handbook Exploratory Data Analysis With R, Roger D.Peng
2. Interactive Data Visualization for the Web, Scott Murray
3. Advanced Analytics with R and Tableau, Jen Stirrup, Packt Publications
4. https://poldham.github.io/ggplot_pizza_patents_part2j/ 6. https://www.tableau.com/solutions/topic/r

REFERENCE BOOKS:

1. Quantitative Techniques for Managerial Decision by U. K. Srivastava, G. V. Shenoy and S. C. Sharma New Age International Publishers
2. Probability & Statistics for Engineers by Rao SCITECH
3. Statistics for Management by Lewis Pearson
4. Graphical Data Analysis with R by Unwin, Antony CRC Press, 2015 ISBN 978-1498715232
5. Interactive Data Visualization for the Web by Scott Murray O'REILLY, Second edition, ISBN-13: 978-1491921289

24DBCA63 **EDGE COMPUTING**

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- To understand the fundamentals of Edge Computing and IOT, including definitions, use cases, and hardware architectures.
- To analyze IOT architectures and core modules, recognizing the differences between IOT, machine-to-machine (M2M), and SCADA systems and the value of connected networks.
- To gain hands-on experience with Raspberry Pi as a microcomputer, including setup, configuration, and programming for IOT applications.
- To explore edge-to-cloud communication protocols (focusing on MQTT) for efficient data transmission and remote device management.
- To apply Edge Computing concepts in real-world scenarios, including edge analytics, data management, and reference architectures for various IoT applications.

UNIT-I **09**

IoT and Edge Computing Definition and Use Cases Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures.

UNIT-II **09**

IoT Architecture and Core IoT Modules-A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment.

UNIT-III **09**

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH.

UNIT-IV **09**

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats.

UNIT-V **09**

Edge computing Concepts - Reference Architecture - Edge Computing in the IoT–Edge Analytics and Data Management -Use Cases.

Total Hours :45

COURSE OUTCOMES:

CO1: Demonstrate understanding of Edge Computing and IOT fundamentals
CO2: Analyze and design IOT architectures
CO3: Configure and program Raspberry Pi for IOT applications
CO4: Implement and manage edge-to-cloud communication protocols
CO5: Apply edge analytics and data management techniques

TEXT BOOKS:

1. "Mastering Internet of Things: Design and Implement Edge Computing" by Peter Waher, Packt Publishing, 2020.
2. "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions" (4th Edition) by Simon Monk, O'Reilly Media, 2022.
3. "Internet of Things (IoT): Architecture, Implementation, and Security" by Rajkumar Buyya and Amir Vahid Dastjerdi, Wiley, 2021.

REFERENCE BOOKS:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
2. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE.
4. Ajit Singh, "Edge Computing", Shroff Publishers, 2019.
5. Perry Lea, "IoT and Edge Computing for Architects", Packt publishers, 2020.

24DBCA72 BUSINESS INTELLIGENCE & ANALYTICS

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- Explain the Business Intelligence, Analytics and Decision Support system
- List the technologies for Decision making, automated decision systems
- Explain sentiment analysis techniques
- Illustrate Multi-criteria Decision making systems, predictive modelling techniques

UNIT I - AN OVERVIEW OF BUSINESS INTELLIGENCE 09

Analytics, and Decision Support Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics,

UNIT II - DECISION MAKING INTRODUCTION AND DEFINITIONS 09

Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

UNIT III - NEURAL NETWORKS AND SENTIMENT ANALYSIS 09

Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics.

UNIT IV - MODEL-BASED DECISION MAKING 09

Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets,Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons

UNIT V- AUTOMATED DECISION SYSTEMS AND EXPERT SYSTEMS 09

Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

Total Hours: 45

COURSE OUTCOMES:

CO1: Able to analyze Business Intelligence, Analytics and Decision Support

CO2: Explain the technologies for Decision making

CO3: Apply predictive modelling techniques(can be attained through assignment

CO4 : Apply sentiment analysis techniques(can be attained through assignment

TEXT BOOKS:

1. Ramesh Sharda, Dursun Delen, EfraimTurban, J.E.Aronson,Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013

REFERENCE BOOKS:

1. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017 by Edward Mize
2. Web links and Video Lectures (e-Resources):
3. https://www.youtube.com/watch?v=zbcCdoHeS4w

24DBCA72 **DATA WAREHOUSING AND DATA MINING**

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

1. Be familiar with mathematical foundations of data mining tools.
2. Understand and implement classical models and algorithms in data warehouses and data mining
3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
4. Master data mining techniques in various applications like social, scientific and environmental context.
5. Develop skill in selecting the appropriate data mining algorithm for solving practical Problem.

UNIT I: **09**

Data Warehouse: Introduction to Data Ware House, Differences between operational database systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction-Transformation-Loading, Logical (MulitDimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; FactLess-Facts, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics; OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.

UNIT II: **09**

Introduction to Data Mining: Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing- Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation , Data Transformation; Measures of similarity and dissimilarity-Basics.

UNIT III: **09**

Association Rules: Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation, APRIORI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set-Maximal Frequent Item Set, Closed Frequent Item Set.

UNIT IV: **09**

Classification: Problem definition, General Approaches to solving a classification problem, Evaluation of Classifiers, Classification techniques, Decision trees-Decision Tree Construction, Methods for expressing attribute test conditions, Measures for Selecting the Best split, Algorithm for Decision tree Induction, Naïve-Bayes Classifier, Bayesian Belief Networks; K-nearest Neighbor classification-Algorithm and characteristics.

UNIT V: **09**

Clustering: Problem Definition, Clustering overview, Evaluation of clustering algorithms, Partitioning clustering K-Means Algorithm, K-Means Additional Issues, PAM Algorithm, Hierarchical Clustering-Algorithm- Agglomerative Methods and Divisive Methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and weakness, Outlier Detection

Total Hours : 45

COURSE OUTCOMES:

CO1: Understand the functionality of the various data mining and data warehousing component

CO2: Appreciate the strengths and limitations of various data mining and data warehousing models

CO3: Explain the analyzing techniques of various data

CO4: Describe different methodologies used in data mining and data ware housing.

CO5: Compare different approaches of data warehousing and data mining with various technologies.

TEXT BOOKS:

1) Data Mining-Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.

2) Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

REFERENCE BOOKS:

1) Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.

2) Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.

3) The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition.

4) Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University

24DBCT82 **PREDICTVE ANALYSIS**

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- To explain terminology, technology and applications of predictive analysis
- To apply data preparation techniques and generate appropriate association rules.
- To discuss various descriptive models, their merits, demerits and application
- To describe various predictive modelling methods.
- To introduce the text mining tools, technologies and case study which is used in day-to-day analytics cycle

UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 09

Overview of Predictive Analytics- Setting up the Problem - Data Understanding- SingleVariable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions- The Value of Statistical Significance- Pulling It All Together into a Data Audit.

UNIT II DATA PREPARATION AND ASSOCIATION RULES 09

Data Preparation- Variable Cleaning- Feature Creation- Item sets and Association Rules- Terminology- Parameter Settings- How the Data Is Organized- Measures of Interesting Rules- Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules.

UNIT III MODELLING 09

Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation

UNIT IV PREDICTIVE MODELLING 09

Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms.

UNIT V TEXT MINING 09

Motivation for Text Mining- A Predictive Modeling Approach to Text Mining- Structured vs. Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features- Modeling with Text Mining Features- Regular Expressions- Case Studies:- Survey Analysis.

Total Hours :45

COURSE OUTCOMES:

CO1: Understand core predictive analytics concepts and their applications.

CO2: Clean and preprocess data, applying feature engineering techniques.

CO3: Use models like regression, decision trees, and ensemble methods for predictive tasks.

CO4: Measure model accuracy and effectiveness using key performance metrics.

CO5: Build complete predictive models using real-world data.

TEXT BOOKS:

1. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die" by Eric Siegel (2020, 2nd Edition)
2. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett (2020, 2nd Edition
3. "Data Preparation for Data Mining Using SAS" by Mamdouh Refaat (2020)

24DBCA73 DEEP LEARNING

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

To understand the major technology trends driving Deep Learning and apply fully connected deep neural networks. This course is used to analyze the key parameters and hyper parameters in a neural network's architecture.

UNIT I PROBABILITY AND INFORMATION THEORY 09

Random Variables- Probability Distributions- Marginal Probability- Conditional Probability- Expectation- Variance and Covariance- Bayes' Rule-Information Theory - Numerical Computation- Overflow and Underflow- Gradient-Based Optimization- Constrained Optimization- Linear Least Squares.

UNIT II MACHINE LEARNING BASICS 09

Machine Learning Basics and under fitting, Hyper parameters and Validation Sets Estimators- Bayesian Statistics- Supervised and Unsupervised Learning-Stochastic Gradient Descent- Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR- Gradient-Based Learning- Hidden Units-Architecture Design- Back- Propagation and other Differentiation Algorithms.

UNIT III REGULARIZATION FOR DEEP LEARNING 09

Regularization for Deep Learning: Parameter Norm Penalties- Norm Penalties as Constrained Optimization- Regularization and Under-Constrained Problems- Dataset Augmentation- Noise Robustness- Semi-Supervised Learning- Multi-Task Learning- Optimization for Training Deep Models: Pure Optimization- Challenges in Neural Network Optimization- Basic Algorithms- Algorithms with Adaptive Learning Rates- Optimization Strategies and Meta-Algorithms.

UNIT IV CONVOLUTIONAL NETWORKS 09

Convolutional Networks: The Convolution Operation, Pooling- Convolution- Basic Convolution Functions -Structured Outputs, Data Types -Efficient Convolution Algorithms- Random or Unsupervised Features -Basis for Convolutional Networks.

UNIT V SEQUENCE MODELLING 09

Sequence Modeling: Recurrent and Recursive Nets- Unfolding Computational Graphs- Recurrent Neural Networks- Bidirectional RNNs-Deep Recurrent Networks - Recursive Neural Networks- Echo State Networks- LSTM –Gated RNNs- Optimization for Long- TermDependencies.

Total Hours: 45

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO-1: Analyze mathematical foundation of neural network.

CO-2: Apply Efficient Convolution Algorithms.

CO-3: Understand the Concept of Convolutional Networks.

CO-4: Understand about Information theory.

CO-5: Understand Supervised and Unsupervised Learning.

TEXT BOOKS:

1. "Deep Learning with Python" by François Chollet (2021, 2nd Edition)
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron (2022, 2nd Edition)
3. "Bayesian Reasoning and Machine Learning" by David Barber (2020, 2nd Edition)

REFERENCE BOOKS:

1. Nikhil Buduma, O'Reilly, Fundamentals of Deep Learning, Designing next- generation machine intelligence algorithms, Shroff Publishers, 2019.
2. Douwe Osinga, O'Reilly,Deep learning Cook Book, Practical recipes to get started Quickly, Shroff Publishers, 2019.

WEB SOURCES:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf

24DBCA81 **CLOUD FOR DATA ANALYSIS**

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

1. To introduce students to cloud computing concepts and how they relate to data analysis.
2. To familiarize students with popular cloud platforms and their data analysis tools.
3. To teach students how to perform data analysis in the cloud environment.
4. To equip students with the skills to deploy and analyze data in cloud-based environments.
5. To develop an understanding of cloud storage, data processing, and visualization in a cloud setting.

UNIT I: INTRODUCTION TO CLOUD COMPUTING AND DATA ANALYSIS 09

Introduction to Cloud Computing: Definition, history, and types (Public, Private, Hybrid)-Key Characteristics of Cloud Computing: On-demand services, scalability, elasticity-Overview of Cloud Service Models: IaaS, PaaS, SaaS-Benefits and Challenges of Cloud Computing-Cloud for Data Analysis: Importance, use cases, and applications

UNIT II: CLOUD PLATFORMS AND DATA MANAGEMENT 09

Popular Cloud Platforms: Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP)-Introduction to Cloud Storage: S3, Blob Storage, Google Cloud Storage-Data Processing in the Cloud: Data pipelines, batch vs. real-time processing-Using Cloud Databases: Amazon RDS, Azure SQL, Google Cloud SQL-Cloud Data Management Best Practices

UNIT III: DATA ANALYSIS IN THE CLOUD 09

Tools and Services for Data Analysis in the Cloud: AWS Lambda, Google BigQuery, Azure Machine Learning-Data Cleaning and Transformation in Cloud: Data wrangling techniques using cloud tools-Cloud-based Statistical Analysis: Using cloud platforms for data statistics and insights-Case Study: Analyzing a dataset using cloud-based tools

UNIT IV: CLOUD COMPUTING FOR DATA VISUALIZATION 09

Cloud Tools for Data Visualization: Google Data Studio, AWS Quick Sight, Microsoft Power BI-Connecting Data Sources to Visualization Tools in the Cloud-Building Interactive Dashboards and Reports in the Cloud-Real-world Examples of Data Visualization for Businesses-Hands-on: Creating simple visualizations using a cloud platform.

UNIT V: DEPLOYMENT, SECURITY, AND FUTURE TRENDS 09

Deploying Data Analysis Solutions in the Cloud: Automation, CI/CD pipelines-Data Security in Cloud: Best practices, encryption, and compliance-Cloud Scalability and Cost Management: Optimizing resources and costs in the cloud-Future Trends in Cloud Computing and Data Analysis-Ethical and Legal Considerations in Cloud Data Analysis.

Total Hours :45

COURSE OUTCOMES:

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

- **CO1**: Understand basic cloud computing concepts and terminologies.
- **CO2**: Identify and use different cloud platforms for data analysis.
- **CO3**: Demonstrate the ability to process and analyze data in the cloud environment.
- **CO4**: Utilize cloud tools to store, manage, and visualize data.
- **CO5**: Critically evaluate cloud-based solutions for data analysis tasks.

TEXTBOOKS:

1. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, Prentice Hall, 2020
2. "Cloud Data Management and Analytics" by Dinesh Samuel, Springer, 2021.
3. "Cloud Computing: A Practical Approach" by Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, McGraw-Hill, 2020

REFERENCE BOOKS:

1. **R. R. Pethuru Raj**, *Cloud Computing: Concepts, Technology & Architecture*, PHI Learning.
2. **Tom White**, *Hadoop: The Definitive Guide*, O'Reilly Media.
3. **D. A. T. Dias**, *Data Science on the Cloud: A Step by Step Guide*, Wiley India.
4. **Peter Membrey**, *Cloud Computing for Developers*, Packt Publishing.
5. **William Bell**, *Cloud Computing: A Practical Approach*, McGraw-Hill Education.

WEB SOURCES:

1. **AWS Training and Certification** – https://aws.amazon.com/training/
2. **Google Cloud Training** – https://cloud.google.com/training
3. **Microsoft Azure Learning** – https://learn.microsoft.com/en-us/training/
4. **Kaggle** – https://www.kaggle.com/
5. **Cloud Academy** – https://cloudacademy.com/

24DBCA81 NEURAL NETWORKS

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

UNIT I INTRODUCTION 09

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 ASSOCIATIVE MEMORY 09

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 THIRD-GENERATION NEURAL NETWORKS 09

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

UNIT IV DEEP FEEDFORWARD NETWORKS 09

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 RECURRENT NEURAL NETWORKS 09

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Auto encoder, Stochastic Encoders and Decoders, Contractive Encoders.

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Apply Convolution Neural Network for image processing.

CO2: Understand the basics of associative memory and unsupervised learning networks.

CO3: Apply CNN and its variants for suitable applications.

CO4: Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.

CO5: Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCE BOOKS:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.

2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.

4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018

5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.

7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.

24DBCA82 INTRODUCTION TO DATA SCIENCE

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

UNIT I INTRODUCTION 9

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

UNIT II DESCRIBING DATA 9

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III DESCRIBING RELATIONSHIPS 9

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line

– Standard error of estimate

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING 9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT V DATA VISUALIZATION 9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – threedimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

Total Hours: 45

COURSE OUTCOMES:

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

CO1: Define the data science process

CO2: Understand different types of data description for data science process

CO3: Gain knowledge on relationships between data

CO4: Use the Python Libraries for Data Wrangling

CO5: Apply visualization Libraries in Python to interpret and explore data

TEXTBOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2020. (Unit I)

2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2018. (Units II and III)

3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2018. (Units IV and V)

REFERENCE BOOKS:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,2014.

WEB SITES:

1. Www.w3schools.com
2. Www.tutorialspoint.com
3. https://en.wikipedia.org
4. Www.geeksforgeeks.org
5. www.investopedia.com
6. www.guru99.com

WEB SOURCES:

1. https://nathancarter.github.io/MA346-course-notes/_build/html/chapter-1-intro to-data-science.html2.

2. http://bedford-computing.co.uk/learning/wp content/uploads/2016/09/introducing- data-science-machine-learning-python.pdf

3. https://www.objectivequiz.com/objective-questions/computer-science/datascience

24DBCA82 **NETWORK SECURITY**

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- To understand basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

UNIT I: INTRODUCTION TO NETWORK SECURITY 9

Network security involves protecting the integrity, confidentiality, and availability of data and resources as they are transmitted across or accessed through networked systems. Topics include an overview of network security, threats, vulnerabilities, and attacks. The fundamental concepts of risk management, including risk assessment and mitigation strategies, are discussed, along with the importance of securing communication channels.

UNIT II: CRYPTOGRAPHY AND ITS APPLICATIONS 9

Cryptography plays a crucial role in network security by providing mechanisms for securing communications and protecting sensitive information. This unit covers symmetric and asymmetric encryption techniques, cryptographic algorithms like DES, AES, and RSA, as well as key management protocols. Public Key Infrastructure (PKI), digital signatures, and digital certificates are also examined, along with hashing algorithms and their application in maintaining dataintegrity.

UNIT III: FIREWALLS AND INTRUSION DETECTION SYSTEMS (IDS) 9

Firewalls act as a barrier between trusted internal networks and untrusted external networks, controlling incoming and outgoing traffic based on predetermined security rules. This unit explores the different types of firewalls (packet filtering, stateful inspection, proxy firewalls) and their configuration. The concept of Intrusion Detection and Prevention Systems (IDS/IPS) is introduced, focusing on how they detect, log, and mitigate various forms of network intrusions.

UNIT IV: NETWORK ATTACKS AND DEFENSE MECHANISMS 9

Various types of network attacks, including Denial of Service (DoS), Distributed Denial ofService (DDoS), spoofing, phishing, and man-in-the-middle attacks, are covered. The unit discusses methods for preventing these attacks, such as anomaly detection, network segmentation,and the implementation of strong network authentication protocols. The role of encryption and multi-factor authentication in securing network access is also addressed.

UNIT V: WIRELESS NETWORK SECURITY AND VPN 9

Wireless networks pose unique security challenges due to their broadcast nature. This unit focuses on the security risks associated with Wi-Fi networks and the various standards designed to protect them, such as WEP, WPA, and WPA2. Virtual Private Networks (VPNs), which secure communication over potentially insecure networks like the internet, are explored in detail. The unit includes a discussion on the types of VPNs (IPSec, SSL) and how they function to secure remote access and data transmission.

Total Hourrs : 45

TEXT BOOKS:

1. "Practical Network Security: A Hands-On Approach" by J. C. Knight and R. S. Yadav (2020)
2. "Network Security Essentials: Applications and Standards" by William Stallings (7th Edition, 2017)
3. "Cryptography and Network Security: Principles and Practice" by William Stallings (7th Edition, 2016)
4. "Network Security Bible" by Eric Cole (2009)

REFERENCE BOOKS:

1. "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross (7th Edition, 2017)
2. "Security+ Guide to Network Security Fundamentals" by Mark Ciampa (6th Edition, 2017)
3. "The Basics of Hacking and Penetration Testing" by Patrick Engebretson (2011)
4. "Hacking: The Art of Exploitation" by Jon Erickson (2nd Edition, 2008)

WEB SOURCES:

1. Www.w3schools.com
2. Www.tutorialspoint.com
3. https://en.wikipedia.org
4. Www.geeksforgeeks.org
5. www.investopedia.com
6. www.guru99.com

24DBCA83 **TIME SERIES ANALYSIS**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES:

To make students familiar with

• To equip various forecasting techniques, get familiarize to modern statistical methods for analyzing time-series data.

• Learn the intellectual facts of the time series data and to implement the same.

• To link time-dependent analytical tools and building the models by extracting real-time data

UNIT-1 09

Real life examples of time series, types of variation in time series, exploratory time seriesanalysis, tests of randomness, tests for trend, seasonality. Auto-covariance and auto-correlation functions and their properties.

UNIT-II 09

Exponential and Moving average smoothing. Holt -Winters smoothing. Forecasting based on smoothing, adaptive smoothing. Time - series as a discrete parameter stochastic process. Portmanteau tests for noise sequence.

UNIT-III 09

Transformation to obtain Gaussian series. General linear processes. Auto regressive (AR), Moving average (MA) and Autoregressive moving average (ARMA), Stationarity and invertibility conditions.

UNIT-IV 09

Nonstationary and seasonal time series models: Auto regressive integrated moving average (ARIMA) models, Seasonal ARIMA (SARIMA) models, Transfer function models (Time series regression). Estimation of mean, auto covariance and autocorrelation functions.

UNIT-V 09

Yule-Walker estimation. Forecasting in time series models, Durbin-Levinson algorithm,innovation algorithm. Estimation of ARIMA model parameters, Choice of AR and MA periods.

Total Hours : 45

COURSE OUTCOMES:

CO1: Understand the foundational theory of linear time series models, including estimation and forecasting techniques.

CO2: Demonstrate knowledge of stationarity concepts in time series analysis, identifying stationary and non-stationary series.

CO3: Apply ARCH and GARCH models to analyze and model time series data with volatility clustering.

CO4: Use information criteria (e.g., AIC, BIC) effectively for model selection to optimize time series forecasting accuracy.

CO5: Conduct exploratory analysis on time series data, identifying patterns, trends, and seasonal variations.

CO6: Solve practical problems in time series analysis, employing suitable models and methods to interpret and forecast real-world data.

TEXT BOOKS:

1. "Introduction to Time Series and Forecasting" by Peter J. Brockwell and Richard A. Davis (2020, 3rd Edition)
2. "Time Series: A Data Analysis Approach Using R" by Robert H. Shumway and David S. Stoffer (2021)
3. "The Analysis of Time Series: An Introduction" by Chris Chatfield (2021, 7th Edition)

REFERENCE BOOKS:

1. Chatfield, C. (2001): Time Series Forecasting, Chapman &Hall.
2. Lutkepohl, H. (2005): New Introduction to Multiple Time Series Analysis, Springer
3. Shumway, R. H. and Stoffer, D. S. (2010): Time Series Analysis & Its Applications, Springer.

WEB SOURCES:

1. Www.w3schools.com
2. Www.tutorialspoint.com
3. https://en.wikipedia.org
4. Www.geeksforgeeks.org
5. www.investopedia.com
6. www.guru99.com

24DBCA83 FULL STACK WEB DEVELOPMENT

L	T	P	O	C
3	2	0	3	5

COURSE OBJECTIVES:

- To understand the various components of full stack development
- To learn Node.js features and applications
- To develop applications with MongoDB
- To understand the role of Angular and Express in web applications
- To develop simple web applications with React

UNIT I BASICS OF FULL STACK 9

Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React

UNIT II NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks –Handling Data I/O – Implementing HTTP services in Node.js

UNIT III MONGO DB 9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications

UNIT IV EXPRESS AND ANGULAR 9

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives

UNIT V REACT 9

MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering

Total Hours : 45

COURSE OUTCOMES:

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

CO1: Understand the various stacks available for web application development

CO2: Use Node.js for application development

CO3: Develop applications with MongoDB

CO4: Use the features of Angular and Express

CO5: Develop React applications

TEXT BOOKS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular WebDevelopment', Addison-Wesley, Second Edition, 2018
2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo,Express, React, and Node', Second Edition, Apress, 2019.

REFERENCE BOOKS:

1. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday SkillsExpected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018
2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web ApplicationsUsing React and Redux', Addison-Wesley Professional, 2nd edition, 2018
3. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
4. https://www.coursera.org/specializations/full-stack-react
5. https://www.udemy.com/course/the-full-stack-web-development/

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1. Www.w3schools.com
2. Www.tutorialspoint.com
3. https://en.wikipedia.org
4. Www.geeksforgeeks.org
5. www.investopedia.com
6. www.guru99.com