Sri
SAI RAM
ENGINEERING COLLEGE
An Autonomous Institution
West Tambaram, Chennai - 44
www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University



DEPARTMENT OF
COMPUTER SCIENCE AND BUSINESS SYSTEMS

AUTONOMOUS

CURRICULUM AND

SYLLABUS
I - V
SEMESTERS

REGULATIONS 2024
Academic Year 2024-25 onwards

SRI SAIRAM ENGINEERING COLLEGE

VISION

To emerge as a "Centre of excellence " offering Technical Education and Research opportunities of very high standards to students, develop the total personality of the individual and instil high levels of discipline and strive to set global standards, making our students technologically superior and ethically stronger, who in turn shall contribute to the advancement of society and humankind.

MISSION

We dedicate and commit ourselves to achieve, sustain and foster unmatched excellence in Technical Education. To this end, we will pursue continuous development of infra-structure and enhance state-of-the-art equipment to provide our students a technologically up-to date and intellectually inspiring environment of learning, research, creativity, innovation and professional activity and inculcate in them ethical and moral values.

Educational Organization Management System (EOMS) Policy

We at Sri Sai Ram Engineering College are committed to empower our students not only to excel academically but also imbibe essential values, enabling them to become exemplary global citizens. We build a better nation by fostering excellence and innovative practices in Engineering, Technology and Management Education. We are dedicated to consistently enhancing our systems, infrastructure and services to meet the needs and expectations of all our stakeholders for sustainable growth

DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

VISION

To impart competent industry relevant education, skillful research and innovative computer science professionals with managerial skills, human and social values.

MISSION

Department of Computer Science & Business Systems, Sri Sairam Engineering College is committed to

M1 Produce highly proficient Computer Science Professionals with managerial knowledge of global standards and practices.

M2 Ascertain new technologies through ethical and innovative research and developments

M3 Impart knowledge through learning, creativity and inculcate in them critical thinking with moral values.

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA102	Introductory Topics in Calculus, Probability and Statistics	3	0	0	3	3
2	24HSEN102	Business Communication and Value Science-I	3	0	0	3	3
3	24BSPH102	Physics for Computing Science	3	0	0	3	3
4	24ESEE101	Principles of Electrical Engineering	3	0	0	3	3
5	24ESCS101	Problem Solving and Programming in C	3	0	0	3	3
6	24HSTA101	Heritage of Tamils	1	0	0	1	1
		PRACTICALS					
1	24BSPL102	Physics for Computing Science Laboratory	0	0	2	2	1
2	24ESPL101	Programming in C Laboratory	0	0	2	2	1
3	24ESPL102	Electrical Engineering Laboratory	0	0	4	4	2
		VALUE ADDITIONS - I					
1	24ENTP101	Functional Life Skills	1	0	1	2	1
2	24ESID101	Idea Engineering Lab - I	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BOS					
					Total	**28**	**22**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA204	Discrete Mathematics for Computer Science	3	1	0	4	4
2	24HSEN202	Business Communication and Value Science–II	3	0	0	3	3
3	24BSPH205	Principles of Electronics Engineering	3	0	0	3	3
4	24BSMA205	Statistical Methods with Laboratory	3	0	2	4	4
5	24CBPC201	Data Structures and Algorithms	3	0	0	3	3
6	24HSTA201	Tamils and Technology	1	0	0	1	1
7	24CYMC201	Environmental Studies	2	0	0	2	0
8	24HSNC201	NCC Course Level 1*	2	0	0	2	0
		PRACTICALS					
1	24BSPL201	Principles of Electronics Engineering Laboratory	0	0	2	2	1
2	24CBPL201	Data Structures and Algorithms Laboratory	0	0	4	4	2
		VALUE ADDITIONS - II					
1	24ENTP201	Digital Dynamics	1	0	1	2	0
2	24ESID201	Idea Engineering Lab - II	0	0	2	2	1
		ONLINE SUPPLIMENTARY					
1	24ESMC201	MS Office (Mandatory - NC)	0	0	0	0	0
					Total	**32**	**22**

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Academic Council Meeting
No. 8 Dated: 31/9/2024

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SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA305	Linear Algebra	3	1	0	5	4
2	24CBPC301	Formal Language and Automata Theory	2	1	0	3	3
3	24CBPC302	Computer Organization and Architecture	3	0	0	3	3
4	24CBPC303	Software Engineering and Design	3	0	0	3	3
5	24CBMG301	Fundamentals of Management	3	0	0	3	3
6	24HSMC301	Universal Human Values - II Understanding Harmony	3	0	0	3	3
7	24HSNC301	NCC Course Level 2*	3	0	0	3	0
		PRACTICALS					
1	24CBPL301	Software Engineering and Design Laboratory	0	0	4	4	2
		VALUE ADDITIONS - III					
1	24CBTP301	Aptitude Skills - I	0	0	2	2	1
2	24CBID301	Innovative Design Lab - I	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
1	24ESMC301	Joy of Computing Using Python	0	2	0	2	0
				Total		**30**	**23**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24BSMA404	Computational Statistics	3	0	0	4	3
2	24BSMA405	Operations Research with Laboratory	3	0	2	5	4
3	24CBPC401	Database Management Systems	3	0	0	3	3
4	24CBPW401	Operating Systems with Laboratory	3	0	2	5	4
5	24CBMG401	Marketing Management	2	0	0	2	2
6	24CBMG402	Financial and Cost Accounting	2	1	0	3	3
7	24HSNC401	NCC Course Level 3*	3	0	0	3*	0
		PRACTICALS					
1	24CBPL401	Database Management Systems Laboratory	0	0	4	4	2
2	24CSPT401	Object Oriented Programming Laboratory with Theory	1	0	4	5	3
		VALUE ADDITIONS - IV					
1	24CBTP401	Aptitude Skills - II	0	0	2	2	0
2	24CBID401	Innovative Design Lab - II	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS					
				Total		**35**	**25**

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SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CP	C	PREREQUISITE COURSES
		THEORY						
1	24CBPC501	Compiler Design	3	0	0	3	3	24CBPC301
2	24CBPW501	Design and Analysis of Algorithms with Laboratory	3	0	2	5	4	24CBPC201
3	24CBMG501	Human Resource Management	2	0	0	2	2	24CBMG301
4	24XXELXXX	Domain Group - I	3	0	0	3	3	-
5	24XXELYYY	Domain Group - II	3	0	0	3	3	-
6	24XXOE9XX	Open Elective - I#	3	0	0	3	3	-
7	24MGMC501	Constitution of India	2	0	0	2	0	-
		PRACTICALS						
1	24CBPL501	Compiler Design Laboratory	0	0	4	4	2	24ESCS101
		VALUE ADDITIONS						
1	24CBTP501	Skill Enhancement	0	0	2	2	1	-
2	24CBID501	Prototype Development Lab - I	0	0	2	2	1	24CBID301, 24CBID401
		ONLINE SUPPLEMENTARY						
		As recommended by BoS						
					Total	29	22	

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24CBPC601	Computer Networks	3	0	0	3	3
2	24CBPC602	Design Thinking	3	0	0	3	3
3	24CBEL6XX	Professional Elective- III	3	0	0	3	3
4	24CBEL6YY	Professional Elective- IV	3	0	0	3	3
5	24CBEL6ZZ	Professional Elective-V	3	0	0	3	3
6	24CBOE6XX	Open Elective - II	3	0	0	3	3
		PRACTICALS					
1	24CBPL601	Computer Networks Laboratory	0	0	4	4	2
		VALUE ADDITIONS - VI					
1	24CBTP601	Technical Skill	0	0	2	2	0
2	24CBID601	Prototype Development Lab - II	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS			Total	26	21

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SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24CBPC701	IT Workshop	3	0	0	3	3
2	24CBPW701	IT Project Management with Laboratory	2	0	2	4	3
3	24CBPW702	Usability Design of Software Applications with Laboratory	2	0	2	4	3
4	24CBEL7XX	Professional Elective- VI	3	0	0	3	3
5	24CBOE7XX	Open Elective - IV	3	0	0	3	3
		PRACTICALS					
1	24CBPL701	Mat Lab	0	0	2	2	1
2	24CBPJ701	Project Work - Phase I	0	0	8	8	4
		VALUE ADDITIONS - VII					
1	24CBTP701	Company Specific Skills	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS					
		Total				29	21

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24CBEL8xx	Professional Elective - VII	3	0	0	3	3
		PRACTICALS					
1	24CBPJ801	Project Work - Phase II	0	0	12	12	6
		VALUE ADDITIONS - VIII					
1	24CBIN801	Internship	0	0	9	9	3
		Total				24	12

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PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL501	Exploratory Data Analysis with R Software	3	Artificial Intelligence	24BSMA404, 24BSMA205
2	24AIEL502	Artificial Intelligence Fundamentals And Applications	3	Artificial Intelligence	24BSMA205, 24BSMA305
3	24AIEL503	Human Computer Interaction	3	Artificial Intelligence	24ESCS101, 24CBPC303
4	24ITEL507	Data Warehousing And Data Mining	3	Data Science	24ESCS101, 24BSMA205, 24CBPC401
5	24ITEL508	Data Analytics With Python	3	Data Science	24ESCS101, 24BSMA205, 24CBPC401
6	24ITEL509	Big Data Essentials	3	Data Science	24CBPC201, 24CBPC401
7	24CIEL501	Dynamic Paradigm In IoT	3	Industrial IoT	24ESEE101, 24BSPH205
8	24CIEL502	Data Science for Internet of Things	3	Industrial IoT	24ESEE101,24CBPC302
9	24CIEL503	IoT Concepts and Applications	3	Industrial IoT	24BSPH205, 24CBPW401
10	24CBEL501	People Analytics	3	Management	24ENTP101, 24CBMG301
11	24CBEL502	Marketing Research	3	Management	24CBMG401, 24ENTP101
12	24CBEL503	Performance Management	3	Management	24CBMG301, 24HSMC301

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AIEL504	Business Intelligence	3	Artificial Intelligence	24BSMA205 , 24CBPC401
2	24AIEL505	Machine Learning Essentials	3	Artificial Intelligence	24CBPC201, 24BSMA305
3	24AIEL506	Decision Support Systems	3	Artificial Intelligence	24CBPC401, 24BSMA405
4	24ITEL516	Learning Analytics Tools	3	Data Science	24BSMA205, 24BSMA404
5	24ITEL517	Data Science For Engineers	3	Data Science	24CBPC201, 24BSMA305
6	24ITEL518	Data Mining For Decision Making	3	Data Science	24BSMA205 , 24CBPC401
7	24CIEL504	Web of Things	3	Industrial IoT	24CBPC302, 24BSMA405
8	24CIEL505	Wireless Technologies In Internet of Things	3	Industrial IoT	24ESEE101, 24BSPL201
9	24CIEL506	Descriptive Analytics for IoT	3	Industrial IoT	24BSMA205, 24BSMA404
10	24CBEL504	Organizational Behaviour	3	Management	24CBMG301, 24HSMC301
11	24CBEL505	Gen AI for Marketing	3	Management	24CBMG401, 24ENTP101
12	24CBEL506	International Finance & Foreign Exchange	3	Management	24CBMG402, 24CBMG301

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INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
L&T BASKET

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24ITIE501	IT Primer	3	Information Technology
2	24ITIE502	Software Engineering Tools	3	Information Technology
3	24ITIE601	Data-Driven StoryTelling and Visualization	3	Information Technology
4	24ITIE602	Fundamentals of Business Analytics	3	Information Technology
5	24ITIE603	Node.JS - The Complete Guide	3	Cross-Platform
6	24ITIE604	Security Professional	3	Security and Risk Management
7	24CSIE601	Network Professional	3	Information Technology
8	24CSIE602	Cyber Defense	3	Information Technology
9	24ITIE701	Back-End Frameworks and APIs	3	Information Security
10	24ITIE702	AI and Edge Computing	3	Artificial Intelligence and Data Science

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
HCL BASKET

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EIIE611	Embedded System For Connected Devices	3	Embedded
2	24CSIE612	C++ For Embedded Systems	3	Embedded
3	24ITIE711	Advanced C++ For Embedded Programming	3	Embedded
4	24EIIE712	Product Development Process	3	Embedded
5	24CBIE711	Project Phase-I	4	Embedded
6	24CBIE811	Internship	3	Embedded
7	24CBIE812	Project Phase-II	6	Embedded

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
SALESFORCE BASKET

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24ITIE503	Salesforce Administrator	3	Data Science
2	24CSIE504	Salesforce Developer	3	Data Science
3	24ITIE605	MuleSoft Anypoint Platform Fundamentals	3	Data Science
4	24CSIE606	Salesforce Business Analyst	3	Data Science

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 The Graduants will explore and excel in emerging domains such as Analytics, Machine Learning, Cloud Computing, and Internet of Things and apply the knowledge to design and develop solutions to business and societal needs.

PEO 2 Graduates will perform Research by designing & developing solutions using modern tools for complex problems in the field of IT by adapting to the rapid technological advancements.

PEO 3 The students graduating will have profound knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

PEO 4 The Graduants will be industry ready with required business skills in service orientated industries.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1 Ability to create innovative software professionals with the emerging technologies and service orientations.

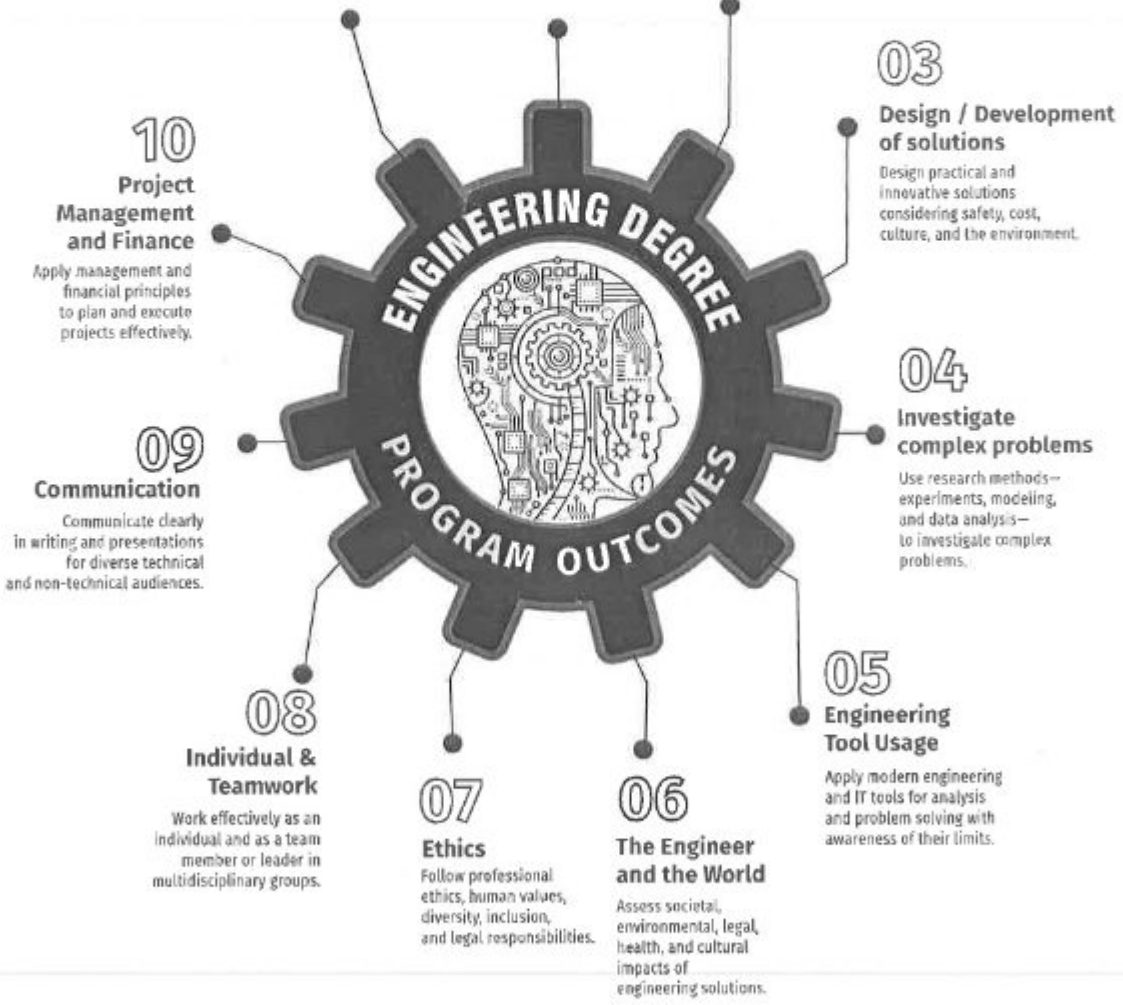
PSO 2 Ability to design and implement industry demand professionals with business principles aligned with equivalent knowledge in humanities and business systems.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences (BS)	18	33	30
Engineering Sciences (ES)	5	14	09
Humanities and Social Sciences (HS)	7	11	11
Professional Electives (EL)	12	21	21
Program Core + Program Lab (PC+PL)	27	56	45
Program theory with Lab (PW) / Program Lab With Theory (PT)	10	23	17
Open Elective (OE)	7	12	12
Training & Placement (TP)	2	14	4
Innovation & Development (ID) / Project (PJ)	10	32	16
Internships (IN)	2	9	3
Mandatory Courses (MC)	NA	2	NA
Total		**227**	**168**

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



01 Engineering knowledge
Apply math, science, computing, and engineering knowledge to solve complex engineering problems.

02 Problem Analysis
Identify and analyze complex problems using research to draw valid conclusions.

03 Design / Development of solutions
Design practical and innovative solutions considering safety, cost, culture, and the environment.

04 Investigate complex problems
Use research methods—experiments, modeling, and data analysis—to investigate complex problems.

05 Engineering Tool Usage
Apply modern engineering and IT tools for analysis and problem solving with awareness of their limits.

06 The Engineer and the World
Assess societal, environmental, legal, health, and cultural impacts of engineering solutions.

07 Ethics
Follow professional ethics, human values, diversity, inclusion, and legal responsibilities.

08 Individual & Teamwork
Work effectively as an individual and as a team member or leader in multidisciplinary groups.

09 Communication
Communicate clearly in writing and presentations for diverse technical and non-technical audiences.

10 Project Management and Finance
Apply management and financial principles to plan and execute projects effectively.

11 Life-long learning
Engage in independent lifelong learning and adapt to new technologies with critical thinking.

SEMESTER - I

24BSMA102 - SDG NO. 4	INTRODUCTORY TOPICS IN CALCULUS, PROBABILITY AND STATISTICS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To impart basic knowledge in differential and integral calculus and apply it to solve a wide variety of engineering problems.
- To introduce the fundamental concepts in the theory of probability and statistics for studying engineering subjects.

MODULE - I DIFFERENTIAL CALCULUS 8

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

MODULE - II INTEGRAL CALCULUS 8

Definite and Indefinite Integrals - Types of Integration: Integration by substitution; Integration by parts, Bernoulli's formula - Double and Triple Integrals (Cartesian coordinates) - Applications of double and triple Integrals - Area and Volume.

MODULE - III PROBABILITY AND RANDOM VARIABLES 8

Concept of experiments, sample space, event - Definition of Combinatorial Probability - Conditional Probability - Bayes theorem - Expected values and moments: mathematical expectation and its properties - Moments (including variance) and their properties, interpretation - Moment generating function.

MODULE - IV DISCRETE PROBABILITY DISTRIBUTIONS 5

Binomial, Poisson and Geometric distributions.

MODULE - V CONTINUOUS PROBABILITY DISTRIBUTIONS 8

Uniform, Exponential, Normal, Chi-square, t and F distributions.

MODULE - VI INTRODUCTION TO STATISTICS 8

Definition of Statistics - Basic objectives. Applications in various branches of science with example - Collection of data: Internal and external data, primary and secondary data - Population and sample, representative sample - Descriptive statistics: Classification and tabulation of univariate data,

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Department of Humaniti[illegible]ciences

graphical representation, frequency curves - Descriptive measures - central tendency and dispersion - Bivariate data, summarization, marginal and conditional frequency distribution.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Higher Engineering Mathematics, B. S. Grewal, 44th Edition, Khanna Publishers, New Delhi, 2023.
2. Introduction of Probability Models, S. M. Ross, 12th Edition, Academic Press, N.Y., 2019.
3. Fundamentals of Statistics, Vol. I & II, A. Goon, M. Gupta and B. Dasgupta, 3rd Edition, World Press Private Ltd., 1968.

REFERENCES:

1. Advanced Engineering Mathematics, Peter V. O'Neil, 7th Edition, Cengage Learning, 2011.
2. Advanced Engineering Mathematics, M. D. Greenberg, 2nd Edition, Pearson Education, 1998.
3. Applied Mathematics, Vol. I & II, P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Ghriha Prakashan, 1999.
4. A first course in Probability, S. M. Ross, 8th Edition, Pearson, 2010.
5. Probability and Statistics for Engineers, I. R. Miller, J. E. Freund and R. Johnson 8th Edition, PHI, 2011.
6. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D. C. Boes, 3rd Edition, McGraw Hill Education, 2017.

WEB RESOURCES:

1. https://tinyurl.com/2uyw3eys
2. https://amsi.org.au/ESA_Senior_Years/PDF/IntroDiffCall3b.pdf
3. https://mlerma54.github.io/courses/math214-2-02f/notes/c2-all.pdf
4. https://www.gpnngr.org.in/lms/1st%20Year%20Integral%20calculus.pdf
5. https://www.ebookbou.edu.bd/Books/Text/SOB/MBA/mba_2306/Unit-10.pdf
6. https://www.schoollearningresources.com/PDF/_Basics%20of%20Statistics.pdf
7. http://eflorakkl.in/staff/uploads2/Multiple%20Integrals%20and%20their%20Applications.pdf

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ONLINE RESOURCES

1. https://www.khanacademy.org/math/statistics-probability
2. https://www.khanacademy.org/math/differential-calculus
3. https://www.khanacademy.org/math/integral-calculus
4. https://www.youtube.com/watch?v=mleeVrv447s&t=55s
5. https://www.youtube.com/playlist?list=PLpklqhIbn1jq348mSrMmmWMQlixyG8Snk

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

1. Evaluate the limit, examine the continuity and use derivatives to find extreme values of function. (K3)
2. Evaluate indefinite and definite integrals of algebraic, exponential, trigonometric and logarithmic functions and apply double and triple integrals for finding area of a region and volume of a surface. (K3)
3. Calculate the probability, conditional probability and statistical averages of events. (K3)
4. Apply standard discrete probability distributions to model and solve real-life problems involving random variables. (K3)
5. Apply standard continuous probability distributions to analyze and solve practical problems involving continuous data. (K3)
6. Apply measures of central tendency, dispersion, and location to analyze and interpret statistical data. (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-

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Department of Humanities & Sciences

SEMESTER - I

24HSEN102 - SDG NO. 4	BUSINESS COMMUNICATION AND VALUE SCIENCE – I	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To motivate the learners to look within and create a better version of themselves
- To develop the basic LSRW skills of the learners
- To understand and use the tools of structural written communication
- To help students to identify personality traits and to gain social awareness
- To understand and apply the values of life skills

MODULE - I SELF AWARENESS 8

Self Intro - Self Awareness - Activity: Who Am I? - SWOT - TOWS - Reading Newspaper (Skimming & Scanning) - Writing Newspaper Report - Listening to TED Talks - Activity: Speaking: About oneself

MODULE - II BASIC TENETS OF COMMUNICATION 8

Overview of Communication Skills - Barriers in Communication - Verbal/Nonverbal Communication - Critical Reading (Essays) - Listening to Conversations - Role Play: Interviewing Celebrities

MODULE - III WRITTEN COMMUNICATION 8

Email etiquettes & Email writing - Drafting Resume and applying for a job - Paragraph Writing - Summary Writing - Creative Writing

MODULE - IV PERSONALITY TRAITS 7

Big Five Personality Traits - Introduction to Social Issues - Activity: Skit on Social Issues -- Review Writing - Listening to Audiobooks - Speaking: Group Discussion on Social Issues

MODULE - V LIFE SKILLS 7

Introduction to Life Skills - Skills and Values of a Captain - Belbin's Team Roles - Reading (Stories/Novels) - Story Writing based on Life Skills - Watching videos on Empathy - 'Fish and I' (Babak Habibifar)

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MODULE - VI LEADERSHIP TRAITS 7

Intro on leadership traits - role of team member - teamwork - motivating people – Group discussion: TCS Values – respect for individual and integrity - Speaking: Situational Dialogues

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Parikh J P, Anshu Surve, et.al, Business Communication: Basic Concepts and Skills, Orient BlackSwan, 2011.
2. Lawrence G. Fine, The SWOT Analysis: Using Your Strength to Overcome Weaknesses, Using Opportunities to Overcome Threats, 2010.
3. B. Hurn& B. Tomalin, Cross-Cultural Communication Theory and Practice, Palgrave Macmillian, 2013.

REFERENCES:

1. English vocabulary in use – Alan Mccarthy and O'dell
2. The Handbook of Communication in Cross-cultural Perspective, Ed. DonalCarbaugh, Routledge, September 5, 2016
3. Urban Diversity: Space, Culture, and Inclusive Pluralism in Cities Worldwide, Eds. Caroline Wanjiku, Blar A. Rubieet. al, John Hopkins University Press, 2010

WEB REFERENCES:

1. Train your mind to perform under pressure- Simon sinek : https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-underpressure-capture-your-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs : https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-beforenumbers.html
3. Will Smith's Top Ten rules for success : https://www.youtube.com/watch?v=bBsT9omTeh0

ONLINE RESOURCES:

1. https://www.coursera.org/learn/learning-how-to-learn
2. https://www.coursera.org/specializations/effective-business-communication

OUTCOMES:

Upon completion of the course, the student should be able to

1. Analyze their own self and write reports employing grammatically correct sentences (K3)

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2. Apply the basic tenets of communication and engage in conversations by expressing appropriate verbal and non-verbal cues and methods (K3)
3. Summarize the given passage and to construct resume and emails in a convincing manner (K3)
4. Understand positive personality traits and recognize social issues (K2)
5. Apply life skills for different situations and developing a positive self image (K3)
6. Exhibit leadership qualities and display team spirit (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	-	3	-	2	-	-
CO4	-	-	-	-	-	-	-	-	3	-	2	-	-
CO5	-	-	-	-	-	-	-	3	3	-	2	-	-
CO6	-	-	-	-	-	-	-	3	3	-	2	-	-

SEMESTER - I

24BSPH102 - SDG NO. 4	PHYSICS FOR COMPUTING SCIENCE	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the fundamentals of interference and polarization of light.
- To grasp the basic concepts and laws of thermodynamics.
- To comprehend the principles of mechanical and electrical oscillations
- To understand the structure and properties of crystals in crystallography.
- To learn the fundamentals and applications of lasers and fiber optics.
- To understand the basic principles of electromagnetism and electromagnetic waves.

MODULE – I INTERFERENCE - PRINCIPLE OF SUPERPOSITION YOUNG'S EXPERIMENT 8

Introduction- Interference – Conditions - Coherence - Superposition -Young's double slit Experiment - Theory of Interference Fringes –Newton's Rings – Diffraction – Types - Fresnel's biprism–difference between Interference and Diffraction - Fraunhofer Diffraction at Single Slit - Plane Diffraction Grating -

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Polarization of light: Introduction – Concept of production of polarized beam of light from two SHM acting at right angle; Plane, Elliptical and Circularly Polarized Light- Brewster's Law - Double Refraction.

MODULE - II THERMODYNAMICS 7

Introduction – Difference between dynamics and thermodynamics – Thermodynamic system – Thermodynamic properties (Intensive and Extensive variables) – Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law -second law of thermodynamics and concept of Engine – entropy – change in entropy in reversible and irreversible processes.

MODULE - III OSCILLATION 8

Introduction– Periodic motion – simple harmonic motion – characteristics – Free vibration of simple spring mass system – Resonance – Types – Applications. Damped harmonic oscillator – heavy, critical and light damping – Energy Decay in a Damped Harmonic Oscillator – Quality Factor – Forced Mechanical and Electrical Oscillators.

MODULE - IV CRYSTAL PHYSICS 7

Introduction – Classification – Unit cell – Crystal system – Bravais Lattices–Miller Indices – D – Spacing – Basic parameters for Cubic system (SC, BCC, FCC) and HCP crystal Structures – Crystal defects – Burger vector.

MODULE - V LASER AND FIBER OPTICS 8

Introduction– principle – Characteristics of Laser - Temporal and Spatial Coherence (Qualitative). Einstein's theory of Matter Radiation Interaction and A and B Co-efficient – Amplification of Light by Population Inversion – Different Types of Lasers: CO2 and Neodymium Lasers – Engineering Applications of Lasers. Fiber optics – Types of optical fibers (material, refractive index and mode). Losses associated with optical fibers – applications.

MODULE – VI BASIC IDEA OF ELECTROMAGNETISMS 7

Introduction – Principle – Current Density – Continuity Equation for Current Densities - Maxwell's Equation – Electromagnetic wave equation– Maxwell's Equation in Vacuum and Non-conducting Medium – Transverse nature of electromagnetic waves – Plane electro–magnetic waves in free space – Poynting theorem - applications.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. A Beiser, "Concepts of Modern Physics", McGraw Hill International, Fifth Edition, 2017.
2. Robert Resnick and Jearl Walker, "Fundamentals of Physics", David Halliday, Wileyplus, 2004.
3. Solid state physics (10th Edition), S. O. Pillai, 2023
4. Heat and Thermodynamics, Brijlal, Subramaniyam.N, 2018

REFERENCE BOOKS:

1. Optics, (Fifth Edition) AjoyGhatak, Tata McGraw Hill.
2. Sears &Zemansky University Physics, Addison-Wesley.
3. Fundamentals of Optics, (Third Edition) Jenkins and White, McGraw-Hill.
4. Introduction to Solid state physics Kittal, Wiley India Edition.
5. Principles of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light, Max Born, Emil Wolf, Cambridge University Press.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Analyze interference, diffraction, and polarization phenomena to interpret and evaluate optical experiments. (K4)
2. Apply thermodynamic principles to analyze energy, entropy, and the behavior of different systems. (K3)
3. Utilize the principles of simple harmonic motion and oscillations to analyze free, damped, and forced vibrations in mechanical and electrical systems. (K3)
4. Examine and compare the characteristics of various crystal structures and crystal defects. (K4)
5. Apply the principles of lasers and fiber optics to explain different types of lasers and optical fibers and their engineering applications. (K3)
6. Examine Maxwell's equations and electromagnetic wave theory to analyze wave propagation and reflection-transmission phenomena in different media. (K4)

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CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-

SEMESTER - I

24ESEE101 108105112 SDG NO. 4 & 9	PRINCIPLES OF ELECTRICAL ENGINEERING	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To introduce basic electric circuits and its elements.
- To impart knowledge on solving DC circuit equations using network theorems.
- To educate on solving AC single phase and three phase circuits.
- To introduce the concept of Electrostatics and Energy storage.
- To introduce the concept of Electromagnetic and Energy conversion.
- To impart the fundamentals of Measurement technique and various sensors.

MODULE - I INTRODUCTION 8

Active and passive elements – Current and voltage relationships - Voltage and current sources - Ideal and practical sources – Reduction of networks using series and parallel combinations - Concept of work, power and energy - Kirchhoff's laws.

MODULE - II BASIC CIRCUITS 8

Network reductions using mesh and nodal analysis - Reduction of DC networks using Superposition theorem - Thevenin's theorem - Norton's Theorem - Maximum Power Transfer theorem - Star/Delta transformation.

MODULE - III FUNDAMENTALS OF AC 8

AC waveform definitions, form factor, peak factor, phasor representation, concept of impedance, admittance, complex power, power factor, single phase

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and three phase concepts - Study of RL, RC, RLC series and parallel circuit, Series resonance.

MODULE - IV ELECTROSTATICS 7

Electrostatic field - Electric field strength - Concept of permittivity in dielectrics - Energy stored in capacitors - Charging and discharging of capacitors.

MODULE - V ELECTROMAGNETICS 7

Electromagnetism, magnetic field and Faraday's law - Magnetic materials and B-H curve - Self and mutual inductance - Ampere's law - Electromechanical energy conversion - Transformers and its types.

MODULE - VI MEASUREMENTS AND TRANSDUCERS 7

Functional block of measuring devices/sensors and transducers - Piezoelectric and thermocouple - Elementary methods for the measurement of electrical quantities - Concept of indicating, integrating and recording instruments.

TOTAL : 45 Periods

TEXT BOOKS:

1. A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, "Electric Machinery", Sixth Edition, Tata McGraw Hill.
2. B. L. Theraja, "A Textbook of Electrical Technology", Vol. I, Chand and Company Ltd., New Delhi.
3. V. K. Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd.,New Delhi.
4. J. Nagrath and Kothari, "Theory and problems of Basic Electrical Engineering", Second Edition, Prentice Hall of India Pvt. Ltd.

REFERENCES:

1. T. K. Nagsarkar and M. S. Sukhija, "Basic of Electrical Engineering", Oxford University Press, 2011.
2. D. J. Grif_iths, "Introduction to Electrodynamics", Fourth Edition,Cambridge University Press.
3. William H. Hayt& Jack E. Kemmerly, "Engineering Circuit Analysis",McGraw-Hill Book Company Inc.
4. Smarjith Ghosh, "Fundamentals of Electrical and Electronics Engineering", Prentice Hall (India) Pvt. Ltd.

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WEB REFERENCES:

1. www.electrical4u.net/useful-information/top-10-electrical-website-forelectrical-engineering-students/#2_Electrical4ucom
2. www.academia.edu/35125273/Engineering_Principles_and_Applications_of_Electrical_Engineering

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc19_ee35/preview
2. https://swayam.gov.in/nd1_noc19_ee35/preview
3. https://nptel.ac.in/courses/108105112

OUTCOMES:

Upon completion of the course, the student should be able to

1. Choose the concept of basic electric circuits with series and parallel connection and Kirchoff's law. (K3)
2. Apply electrical laws to DC circuits and solve for single phase and three phase circuits. (K4)
3. Determine the basic concepts of AC circuits with R, L and C (K3)
4. Apply the concept of electrostatics and energy storage in capacitors (K3)
5. Apply the concept of electromagnetics, inductors and electromechanical energy conversion (K3)
6. Choose the various measurements techniques and transducers in electrical engineering (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	2	1	1
CO2	2	2	2	-	-	-	-	-	-	-	2	1	1
CO3	2	2	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	-	-	-	-	-	-	-	2	1	1
CO5	2	2	2	-	-	-	-	-	-	-	2	1	1
CO6	2	2	2	-	-	-	-	-	-	-	2	1	1

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SEMESTER - I

24ESCS101 106105171 SDG NO. 4 & 9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Interpret Mathematical problems using algorithms, flowchart and pseudocode.
- To understand the programming language.
- To develop C Programs using basic Programming Constructs, Loops, Arrays and Strings.
- To develop applications in C using Functions, Pointers and Structures.
- To perform I/O operations and File Handling in C.

MODULE - I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING 7

Introduction to Problem Solving through programs- Algorithm-Flowchart–Pseudocode-Memory, Variables, Values, Instructions, Programs-compilation process-Syntax and Semantic Errors- The language of C : Phases of developing a running computer program in C - Character set – Constants – Keywords – Primitive data types –Declaration, Type Conversion.

MODULE - II BASICS OF C PROGRAMMING 7

Sequential- Arithmetic Operators, Relational Operators, Logical Operators, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, selective – If, Else-If, Switch- repetitive structures-for, while, do while, Nested loops, go to, break, continue –Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD and LCM, Prime number generation.

MODULE - III ARRAYS AND STRINGS 8

Introduction to Arrays: Declaration, Initialization – One Dimensional Array – Example Program: Computing Mean, Median and Mode - Two Dimensional Arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String Operations: Length, Compare, Concatenate - Copy – Selection Sort - Linear and Binary Search.

MODULE - IV FUNCTIONS AND POINTERS 9

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions - Factorial and Fibonacci Generation - Towers of Hanoi problem - – Pointers – Pointer

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Operators – Pointer Arithmetic – Arrays and Pointers –Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

MODULE - V STRUCTURES 7

Structure - Nested Structures – Pointer and Structures – Array of Structures – Example Program using Structures and Pointers – Self Referential Structures – Dynamic Memory Allocation - Singly Linked List – Typedef.

MODULE - VI FILE PROCESSING 7

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers stored in Sequential Access File - Random Access File - Example Program: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.G. Dromey, "How to solve it by Computers", Reprint, PHI Publishers, 2011.
2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2018.
3. Kernighan, B.W and Ritchie D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCES:

1. Yashwant Kanetkar, "Let us C", 18th Edition, BPB Publications, 2021.
2. Byron Gottfried, "Programming with C", Fourth Edition, Tata McGraw Hill Education, 2018.
3. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication, 2015.
4. Jeri R. Hanly & Elliot B.Koffman, "Problem Solving and Program Design in C", Pearson Education, 2013.
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
6. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
7. Hanly J R & Koffman E.B, "Problem Solving and Programme design in C", Pearson Education, 2009.

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WEB REFERENCES:

1. https://www.learn-c.org/
2. https://codeforwin.org/
3. https://www.cprogramming.com

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programing_books/gnu_c_programming_tutorial
2. https://nptel.ac.in/courses/106105171
3. https://swayam.gov.in/nd1_noc19_cs42/preview

OUTCOMES:

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

1. Solve basic problems using algorithms, flowcharts, and pseudo code.(K3)
2. Analyze the various programming constructs for basic computational problems.(K4)
3. Implement simple C programs using arrays and strings. (K3)
4. Use functions, recursion, and pointers to perform calculations, searching, and sorting.(K3)
5. Apply structures and dynamic memory allocation in handling complex programming tasks. (K3)
6. Organize sequential and random file processing techniques to provide solutions for real-world computational problems. (K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	-	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	-	-	-	-	-	-	-	-	-	-	1	2
CO4	-	3	-	-	-	-	-	-	-	-	-	2	2
CO5	-	3	-	-	-	-	-	-	-	-	-	2	3
CO6	-	-	3	-	-	-	-	-	-	-	-	3	3

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SEMESTER - I

24HSTA101 - SDG NO. 4	HERITAGE OF TAMILS	L	T	P	CP	C
		1	0	0	1	1

OBJECTIVES:

- Develop interest for classical language and literature to promote Tamil heritage
- Understand the ancient Tamil sculptures, folk and martial arts and contribution of Tamil to the freedom of India

UNIT - I LANGUAGE AND LITERATURE 3

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

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

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

UNIT - III FOLK AND MARTIAL ARTS 3

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

UNIT - IV THINAI CONCEPT OF TAMILS 3

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

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

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

தமிழர் மரபு

அலகு - I மொழி மற்றும் இலக்கியம்: 3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை: 3

நடுகல் முதல் நவீன சிற்பங்கள் வளர - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - கதர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலொட்டம், தொல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

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அலகு - IV தமிழர்களின் திறைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கொப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு - V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்ப்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

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OUTCOMES:

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

1. Understand Tamil as a classical language & Literature (K2)
2. Explore about Tamil Heritage & Sculptures,Role of temples (K2)
3. Appreciate Sports and games of Tamils (K2)
4. Perceive Thinai concept of Tamils (K2)
5. Comprehend Education and literacy during Sangam Age (K2)
6. Understand the Contribution of Tamils to National Movement & Indian Culture (K2)

CO- PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	3	-	-	-	-	3	-	-
CO2	-	-	-	-	-	3	-	-	-	-	3	-	-
CO3	-	-	-	-	-	3	-	-	-	-	3	-	-
CO4	-	-	-	-	-	3	-	-	-	-	3	-	-
CO5	-	-	-	-	-	3	-	-	-	-	3	-	-
CO6	-	-	-	-	-	3	-	-	-	-	3	-	-

SEMESTER - I

24BSPL102 - SDG NO. 4,6,11,12 & 17	PHYSICS FOR COMPUTING SCIENCE LABORATORY	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To study the variation of the magnetic field along the axis of the current-carrying coil and find out the Hall coefficient of a given semiconductor.
- To determine experimentally the value of Planck's constant and Stefan's constant.
- To find the wavelength of a given light source by the diffraction method.
- To determine the angle of minimum deviation for a given prism by plotting a graph between the angle of incidence and the angle of deviation.
- To find the wavelength of a light source by Newton's ring method.
- To determine the laser wavelength and fiber optic parameters of a cable and size of the particle.

LIST OF EXPERIMENTS:

1. Magnetic field along the axis of the current-carrying coil—Stewart and Gee.

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2. Determination of the Hall coefficient of a semiconductor.
3. Determination of Planck's constant.
4. Determine the angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation.
5. Determination of wavelength of light by the laser diffraction method.
6. Determination of particle size of lycopodium powder using a semiconductor laser.
7. Determination of wavelength of light by Newton's Ring method.
8. Determination of laser and optical fiber parameters.
9. Determination of Stefan's Constant.
10. Determination of the wavelength of spectral lines using a plane transmission grating.

TOTAL : 30 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to

1. Demonstrate magnetic fields along a certain direction. (K2)
2. Illustrate the Hall coefficient of a semiconductor. (K2)
3. Demonstrate the value of Planck's constant. (K2)
4. Find the wavelength of light using the diffraction and minimum deviation method. (K2)
5. Determine the wavelength of a laser and find optical fiber parameters and size of the particle. (K2)
6. Find Stefan's constant and establish Stefan's law. (K2)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	2
CO2	3	3	-	-	2	-	-	-	-	-	2
CO3	3	3	-	-	2	-	-	-	-	-	2
CO4	3	3	-	-	2	-	-	-	-	-	2
CO5	3	3	-	-	2	-	-	-	-	-	2
CO6	3	3	-	-	2	-	-	-	-	-	2

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Meeting No. 6 Dated: 31/5/22

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SEMESTER - I

24ESPL101 - SDG NO. 4 & 9	PROGRAMMING IN C LABORATORY	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To develop programs in C using basic Programming Constructs
- To develop applications in C using Arrays and Strings
- To design and implement applications in C using Functions, Structures
- To develop applications in C using Files

LIST OF EXPERIMENTS

1. Write a program using I/O statements and expressions.
2. Write programs using decision-making constructs.
3. Write a program to find whether the given year is a leap year or not? (Hint: not every century is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Write a program to check whether a given number is an Armstrong number or not?
6. Write a program to check whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to print half pyramid of *.
10. Write a program to display array elements using two dimensional arrays.
11. Write a program to perform swapping using a function.
12. Write a program to display all prime numbers between two intervals using functions.
13. Write a program to solve towers of Hanoi using recursion.
14. Write a program to get the largest element of an array using the function.
15. Write a program to concatenate two strings.
16. Write a program to find the length of String.
17. Write a program to find the frequency of a character in a string.
18. Write a program to store Student Information in Structure and Display it.

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30-5-24

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Sri Sairam Engineering College

19. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:

(a) Total marks obtained by each student.

(b) The highest marks in each subject and the marks of the student who secured it.

(c) The student who obtained the highest total marks.

20. Write a program to demonstrate file operations (e.g. count the number of characters, words and lines in a file, replace a specific word with the given word in the same file).

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Stand alone desktops with C compiler 30 Nos. (Or)
   Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

1. Apply basic constructs, arrays, strings,functions and recursion for executing C programming applications.(K3)
2. Analyze C programs involving pointers and structures.(K4)
3. Evaluate applications using sequential and random access files.(K5)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	-	-	-	1	1
CO2	-	-	3	-	-	-	-	-	-	-	-	1	2
CO3	-	-	3	-	-	-	-	-	-	-	-	2	2

SEMESTER - I

24ESPL102 - SDG NO. 4 & 9	ELECTRICAL ENGINEERING LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To simulate various electric circuits using Pspice/ Matlab.
- To gain practical experience on electric circuits and verification of theorems.
- To gain practical Knowledge on electric circuits transients and resonance.

Recommended by
Board of Studies of EEE dept
Meeting No. 6 Dated: 30.5.24

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LIST OF EXPERIMENTS:

1. Study of Electrical elements, sources, measuring devices and transducers.
2. Experimental solving of electrical circuit problems using Kirchhoff's voltage and current laws.
3. Experimental solving of electrical circuit problems using Thevenin's theorem.
4. Experimental solving of electrical circuit problems using Norton's theorem.
5. Experimental solving of electrical circuit problems using Superposition theorem.
6. Measurement of variation of resistance of a thermistor with temperature.
7. Experimental verification of Maximum Power transfer Theorem.
8. Simulation of R-C electric circuit transients.
9. Simulation of frequency response of RLC electric circuit.
10. Measurement of energy using a single phase energy meter.

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER BATCH:

S.No	EQUIPMENTS	
1.	Regulated Power Supply: 0 – 15 V D.C / Distributed Power Source.	10 Nos
2.	Function Generator (1 MHz)	10Nos
3.	Single Phase Energy Meter	1 No
4.	Oscilloscope (20MHz)	10 Nos
5.	Digital Storage Oscilloscope (20 MHz)	1 No
6.	Thermistor and RTD	each 1 No
7.	10 Nos of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / Matlab / other Equivalent software Package) and Printer	(1No.)
8.	AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.) 8 Single Phase Wattmeter	3 Nos
9.	Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each	6 Nos
10.	Circuit Connection Boards	10Nos

Recommended by
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Meeting No. 6 Dated: 30.5.24

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OUTCOMES:

Upon completion of the course, the student should be able to

1. Use laboratory equipment and techniques to measure electrical quantities using multi-meters, power supplies and oscilloscopes. (K1)
2. Understand DC and AC Network theorems and apply to them in laboratory measurements. (K2)
3. Analyze the transient response of series RL and RC electric circuits. (K4)
4. Choose the frequency behavior of RLC electric circuits. (K5)
5. Determine and simulate the resonance circuits. (K5)
6. Select applications using electrical AC & DC circuits. (K5)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	1	1	-	-	1	-	-	-	1	1
CO2	2	2	2	1	1	-	-	1	-	-	-	1	1
CO3	2	2	2	1	1	-	-	1	-	-	-	1	1
CO4	2	2	2	1	1	-	-	1	-	-	-	1	1
CO5	2	2	2	1	1	-	-	1	-	-	-	1	1
CO6	2	2	2	1	1	-	-	1	-	-	-	1	1

SEMESTER - I

24ENTP101 - SDG NO.4	FUNCTIONAL LIFE SKILLS	L	T	P	CP	C
		1	0	1	2	1

OBJECTIVES:

- Resolve common communication problems
- Observe the effectiveness of nonverbal messages
- Communicate precisely through the digital media
- Understand the importance of empathetic listening
- Explore reading and speaking processes

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MODULE - I LISTENING 5

Techniques of effective listening
Listening and comprehending
Probing questions
Barriers to listening
Reflection from listening

MODULE - II SPEECH MECHANICS 5

Pronunciation
Enunciation
Vocabulary
Fluency
Common errors

MODULE - III READING SKILLS 5

Techniques of effective reading
Kinds of reading
Gathering ideas and information from the text
Evaluating the ideas and information
Interpreting the text from multiple angles

MODULE - IV WRITING ASPECTS 5

Writing process
Effective writing strategies
Different modes of writing
Optimizing the use of resources
Editing

MODULE - V PRESENTATION SKILLS 5

Types of presentations
Nonverbal communication
Understanding the purpose and the audience
Beginning and closure of presentations
Presentation tools and strategies

MODULE - VI ARTICULATION ASPECTS 5

Perform exercises
Slow speeches
Long speeches

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Monologues, Dialogues and Conversation
Feedback necessity

TOTAL : 30 PERIODS

REFERENCES:

1. Sen, Madhuchanda.2010, An Introduction to Critical Thinking, Delhi, Pearson.
2. Effective Communication Skills Strategies for Success. Edited by Nitin Bhatnager and Mamta Bhatnager. 2023, Pearson
3. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma. Oxford University Press, 2015

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. https://www.myenglishpages.com/speaking/#google_vignette

OUTCOMES:

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

1. Employ reading, writing, and listening skills to communicate clearly in academic and professional contexts.
2. Demonstrate confident oral communication and presentation skills using appropriate tools and techniques.
3. Interpret ethical, inclusive, and culturally aware communication in team and societal settings

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	3	2	-	2	-	-

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SEMESTER - I

24ESID101 - SDG NO. 1-17	IDEA ENGINEERING LAB - I	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To understand the significance of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) of the United Nations
- To familiarize with SDG targets and indicators
- To identify the Constitutional implementation pertaining to SDGs in Panchayat Raj
- To acquire knowledge of the State and the Central government welfare schemes
- To recognize the role of educational Institutions in community development
- To develop critical thinking skills to address complex societal challenges through an immersion program

MODULE - 1 United Nations Sustainability and the Sustainable Development Agenda 3

- Introduction to Sustainability
- Indian Rural Environment: Necessity and Sustainability
- Millennium Development Goals (MDGs)
- United Nations Sustainable Development Goals (SDGs) & the Agenda
- Overview of the Sustainable Development Goals (SDGs)

MODULE - 2 Universal SDG Targets 4

- SDG Framework
- Key Components
- Pillars of the SDGs
- Targets of the Goals
- Indicators of the Targets

MODULE-3 SDG and Indian Gram Panchayat 3

- Gram Panchayat
- Salient Features of Constitutional Amendments
- Transition from SDGs to LSDGs (Localizing Sustainable Development Goals)

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MODULE-4 Government Schemes 4

- Introduction to State and Central Government Schemes
- Overview of Government Schemes
- Localization and Implementation at the Regional Level
- Impact on Local Communities

MODULE-5 Community Engagement 4

- Key Recommendations of the National Education Policy
- Guidelines for Fostering Social Responsibility
- Awareness
- Participation
- Collaboration

MODULE-6 Idea Generation 12

- Immersion Program
- Focus Areas
- Channelizing Ideas
- Forming Working Teams for SDGs (Sustainable Development Goals)

TOTAL: 30 PERIODS

REFERENCES:

1. Joy Elamon and Ms. Mariamma Sanu George,"The Handbook on Sustainable Development Goals and Gram Panchayats" , State Institute for Rural Development (SIRD).
2. Dr.C.R.Rene Robin, Dr.PA.Shanthi , Dr.B.Thanuja & Dr.V.Yuvaraj ,"Sairam SDG Idea Engineering Lab I", Sri Sairam Engineering College.

WEB REFERENCES

1. UN Sustainable Development Goals
2. https://srmuniv.digimat.in/nptel/courses/video/109106200/L30.html
3. https://avcce.digimat.in/nptel/courses/video/109106200/L26.html

OUTCOMES:

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

1. Analyse and apply the concepts of sustainability,Rural environment,Gram panchayat and various government schemes to design innovative practical solutions that address real life rural challenges. (K2)
2. Compare MDG's,SDG's and LSDG's to analyse village topology and identify specific development targets to propose innovative rural solutions. (K4)

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3. Analyse the attainment levels of SDG's and write a reflective report on local community.(K4)
4. Formulate problem statement based on local community needs and propose innovative ideas for community development. (K4)
5. Perform an individual presentation of field observation by mapping them with relevant SDG's and justify their significance for rural development. (K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	-	-	-	2	-	-	1	-	2
CO4	-	2	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	3	2	3	1

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SEMESTER - II

24BSMA204 - SDG NO. 4	DISCRETE MATHEMATICS FOR COMPUTER SCIENCE	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- The aim of this course is to introduce abstraction, logical thinking and reasoning for developing algorithms and mathematical proofs related to Computer Science.

MODULE - I MATHEMATICAL LOGIC **9**

Logic: Propositional calculus - propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

MODULE - II COMBINATORICS **9**

Basic counting, balls and bins problems, generating functions, recurrence relations, Solution of recurrence relations by the method of characteristic roots and method of generating function principle of mathematical induction, pigeonhole principle.

MODULE - III ABSTRACT ALGEBRA **12**

Set, Relation, Group, Subgroups, Normal subgroups and Quotient groups, Homomorphism, Cosets, Lagrange's theorem, Rings and Fields (Definition and examples only).

MODULE - IV BOOLEAN ALGEBRA **9**

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs.

MODULE - V GRAPHS & DIGRAPHS **12**

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs.

MODULE - VI TREES AND PLANAR GRAPHS **9**

Trees, Planar graphs, Euler's formula, dual of a planar graph, independence number and clique number, chromatic number, statement of Four-color theorem.

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. 1. Mathematical Logic for Computer Science, L. Zhongwan, 2nd edition, World Scientific, Singapore, 1998.
2. Elements of Discrete Mathematics, C. L. Liu, 2nd edition, McGraw Hill, New Delhi, 1985.
3. Topics in Algebra, I. N. Herstein, 2nd edition, John Wiley and Sons,1975.
4. Digital Logic & Computer Design, M. Morris Mano, 1st edition, Pearson,2004.
5. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, 1st edition, Macmillan Press, London, 1976.

REFERENCES:

1. Introduction to Mathematical Logic, E. Mendelsohn, 2nd edition, Van-Nostrand, London, 1979.
2. Introductory Combinatorics, R. A. Brualdi, 5th edition, North-Holland, New York, 2010.
3. Graph Theory with Applications to Engineering and Computer Science, N. Deo, 1st edition, Prentice Hall, Englewood Cliffs, 1974.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=rjV4AO0iIVY
2. https://www.britannica.com/science/combinatorics/The-Ferrer-diagram
3. https://www.youtube.com/watch?v=zK8hxSwRar0
4. https://www.youtube.com/watch?v=eQA-m22wjTQ
5. https://discrete.openmathbooks.org/dmoi3/sec_planar.html

ONLINE RESOURCES:

1. www.ucl.ac.uk/~ucahmto/0007/_book/4-2-examples-of-groups.html
2. https://archive.nptel.ac.in/courses/106/108/106108051/
3. https://archive.nptel.ac.in/courses/108/105/108105132/

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply mathematical logic to understand logical arguments, construct logical proofs, solve problems and validate them. (K3)
2. Solve combinatorial problems using basic principles of counting. (K3)
3. Explain the concepts of algebraic structures such as groups, rings and fields. (K3)

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4. Apply the principles of Boolean Algebra to design and simplify the circuits. (K3)
5. Solve real world problems using graphs and use it to develop algorithms in Computer Science. (K3)
6. Apply the concepts of coloring and planarity in computer science. (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	3	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	-	2	-	-	-	-	-	-	-	2	2
CO4	3	2	3	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3
CO6	3	3	2	2	-	-	-	-	-	-	-	3	3

SEMESTER - II

24HSEN202 - SDG NO.4	BUSINESS COMMUNICATION AND VALUE SCIENCE – II	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To create awareness about Genders and CSR
- To differentiate diversified cultures of India
- To recognize the role of science in nation building and define AI and its impacts
- To understand the need for diversity and inclusion
- Identify the significance of Business Communication and the uses of communicative writing

MODULE - I SOCIAL RESPONSIBILITY **8**

Maslow's theory of Needs - Activity: Make a wish list of wants & needs - Gender Sensitization- Activity: Poster making on gender issues - Intro on Corporate Social Responsibility (CSR) - Corporate Etiquettes - Business Idioms

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MODULE - II CULTURAL STUDIES **8**

Cultures in India - Global, Glocal & Translocational cultures - Cross-cultural communication - cultural sensitivity - Activity: Presentation on different cultures of India - Activity: FauxPas in different cultures - Listening to cross cultural exchanges - Activity: Finding your roots and traditions

MODULE - III SCIENCE AND ARTIFICIAL INTELLIGENCE **8**

Role of Science in nation building - AI in everyday life - Activity: Debate - Will machines control us? - Activity: GD - AI in Future - Stress Management - Time Management - Activity: Presentation on Scientist/Mathematician who changed the world

MODULE - IV DIVERSITY AND INCLUSION **7**

Introduction to Diversity - Inclusion - Need for Diversity in corporate environment - Activity: Global Brands on diversity and inclusion - Activity: watching videos on Diversity and Inclusion (Purl) - Activity: Create a short film on social issues/diversity - Activity: GD on Challenges of Diversity

MODULE - V BUSINESS COMMUNICATION **7**

Principles of general/technical Writing - Business letters (Placing Order, Complaint, Responding to letters) - Writing Business Proposal for a Startup - Vision, Mission Statements for an NGO - Creating Tagline and Logo - Activity: Develop a Startup Idea - Activity: Speaking - Pitching start- up idea

MODULE - VI EMOTIONAL INTELLIGENCE **7**

Introduction to EI – Awareness of multiple intelligence and learning styles in communication – Activity; scenario based quiz – Impact of conflicts – Guideline to manage conflicts - Activity: Each group will draw up a list of tips to manage conflicts at work – Need of public speaking –Activity: Each group should present the list of best practices in public speaking

TOTAL: 45 PERIODS

TEXT BOOKS:

1. There are no prescribed texts– there will be handouts and reference links shared.

REFERENCES:

1. Emotional Intelligence: Why it Can Matter More Than IQ by Daniel Goleman
2. Putting Emotional Intelligence to Work by Ryback David
3. How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion by Dale Carnegie -author- Y.S. Rajan

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4. TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations

WEB REFERENCES:

1. Train your mind to perform under pressure- Simon sinek : https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-underpressure-captureyour-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs : https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people- beforenumbers.html
3. Will Smith's Top Ten rules for success : https://www.youtube.com /watch?v=bBsT9omTeh0

ONLINE RESOURCES:

1. https://www.courscra.org/lcarn/learning-how-to-learn
2. https://www.coursera.org/specializations/effective-business-communication

OUTCOMES:

Upon completion of the course, the student should be able to

1. Differentiate wants and needs and be aware of social responsibility (K2)
2. Analyze cross cultural communication (K3)
3. Recognize the role of science in nation building and the role of AI in future (K3)
4. Understand the importance of diversity and inclusion in workplace (K2)
5. Apply the principles of Business Communication in writing letters and proposals(K3)
6. Apply emotional intelligence in real life scenarios (K3)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	2	-	3	-	3	-	-
CO5	-	-	-	-	-	-	-	3	3	-	3	-	-
CO6	-	-	-	-	-	-	2	-	3	-	3	-	-

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SEMESTER - II

24BSPH205 - SDG NO.4	PRINCIPLES OF ELECTRONICS ENGINEERING	L	T	P	CP	C
		3	0	0	4	3

OBJECTIVES:

- To understand the basics of semiconductors.
- To understand the working of diode and diode circuits.
- To learn the principles of various types of transistors.
- To understand the working of feedback amplifiers and oscillators.
- To learn the linear integrated circuits.
- To understand the digital electronic principles of Logic gates.

MODULE - I INTRODUCTORY IDEA OF SEMICONDUCTORS 8

Introduction – Solid state materials – Classification – Energy band theory – Fermi Levels - Electrical properties –Semiconductors – Effect of Temperature – Hole current - Intrinsic Semiconductor – Doping - Extrinsic Semiconductors – Fermi energy level variation with Temperature - Drift & Diffusion Carriers.

MODULE - II DIODES AND DIODE CIRCUITS 7

Formation of P-N Junction - Energy Band Diagram - Built-in-Potential - Forward and Reverse Biased P-N Junction - Formation of Depletion Zone – Operating conditions - V-I Characteristics - Zener Breakdown - Avalanche Breakdown and its Reverse Characteristics- Varactor Diode - Simple Diode Circuits - Load Line - Linear Piecewise Model – Rectifier circuits –HalfWave – Full Wave - PIV, DC Voltage and Current - Ripple Factor – Efficiency – Idea of regulation.

MODULE - III TRANSISTORS AND TRANSISTOR CIRCUITS 8

Introduction - PNP and NPN Transistors - Transistors CE, CB, CC mode of configuration- Transistor Characteristics - Concept of Field Effect Transistors (Channel Width Modulation) - Gate Isolation Types - JFET Structure and Characteristics - MOSFET Structure and Characteristics - Depletion and Enhancement -Type - CS, CG, CD Configurations- CMOS: Basic Principles.

MODULE - IV FEEDBACK AMPLIFIER AND OSCILLATORS 7

Concept (Block Diagram) - Properties - Positive and Negative Feedback - Loop Gain - Open Loop Gain - Feedback Factors - Topologies of Feedback Amplifier- Effect of Feedback on Gain - Output Impedance - Input Impedance - Sensitivities (qualitative) - Bandwidth Stability- Feedback Effect of Positive - Instability - Oscillation - Condition of Oscillation - Barkhausen Criteria – Hartley – Colpitt's – Crystal Oscillators.

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MODULE - V OPERATIONAL AMPLIFIER BASICS 8

Introduction to integrated circuits - operational amplifier and its terminal properties - Application of operational amplifier - inverting and non-inverting mode of operation – Voltage follower – Adder – subtractor– comparator Integrator - Differentiator - Proportional, Integral, Derivative circuits.

MODULE - VI BASIC IDEAS OF DIGITAL ELECTRONICS 7

Introduction - Number systems - Boolean Algebra - Realization of Logic gates - DeMorgan's theorem - Half and Full Adder - Subtractor - Multiplexers – De-Multiplexers – Flip flops – Registers and Counters.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattacharya &T.Poonam, "Engineering Physics". Oxford University Press, 2015.
2. R.K. Gaur & S.L. Gupta, "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. B.K. Pandey &S.Chaturvedi, "Engineering Physics", Cengage Learning India, 2017.
4. V. Rajendran, "Engineering Physics", Mc Graw Hill Publications Ltd. New Delhi, 2014.
5. M.N. AvadhanuluAnd P.G. Kshirsagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

REFERENCES:

1. D. Halliday, Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2010.
3. N.K. Verma," Physics for Engineers", PHI Learning Private Limited, 2014.
4. P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
5. Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
6. Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.
7. Arthur Beiser. "Concepts of Modern Physics", McGraw-Hill, 6th Edition. 2003.
8. Charles Kittel, "Introduction to Solid State Physics". John Wiely& Sons. 8th Edition, 2005.

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OUTCOMES:

Upon completion of the course, the student should be able to

1. Analyze the band structures and carrier concentrations of semiconductors, study their variations with temperature, and examine carrier transport mechanisms (K4)
2. Apply the principles of P-N junctions and diodes to analyze V-I characteristics, breakdown mechanisms, and design basic rectifier circuits (K3)
3. Examine the structures, characteristics, and configurations of BJTs and FETs, including MOSFETs and CMOS, and their operating principles (K4)
4. Apply the working principles of electronic devices in circuits such as feedback amplifiers, operational amplifiers, and oscillators (K3)
5. Acquire the knowledge of the operational amplifier concept and its application (K3)
6. Analyze the digital logic and design of basic combinational and sequential circuits (K4)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	3	-	-	-	-	–	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-
CO6	-	3	-	-	-	-	-	-	-	-	-

SEMESTER - II

24BSMA205 - SDG NO. 4	STATISTICAL METHODS WITH LABORATORY	L	T	P	CP	C
		3	1	0	5	4

OBJECTIVES:

- To introduce the necessary statistical background for analyzing engineering problems.
- To introduce the R programming language.

MODULE - I TESTING OF HYPOTHESIS 7

Test of hypothesis – concept and formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing.

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MODULE - II LINEAR STATISTICAL MODELS AND DESIGN OF EXPERIMENTS 7

Test of hypothesis – concept and formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing.

MODULE - III ESTIMATION AND SUFFICIENT STATISTIC 10

Point estimation, criteria for good estimates (unbiasedness, consistency), Methods of estimation including maximum likelihood estimation. Sufficient statistics – concept and examples, complete sufficiency, their application in estimation.

MODULE - IV NON-PARAMETRIC INFERENCE 12

Comparison with parametric inference, use of order statistics, Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test, Spearman's and Kendall's test. Tolerance region.

MODULE - V BASICS OF TIME SERIES AND FORECASTING 10

Stationary, ARIMA Models: Identification, Estimation and Forecasting.

MODULE - VI R STATISTICAL PROGRAMMING LANGUAGE 14

Introduction to R, Functions, Control flow and Loops, Working with Vectors and Matrices, Reading in Data, Writing Data, Working with Data, Manipulating Data, Simulation, Linear model, Data Frame, Graphics in R.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Probability and Statistics for EngineersMiller and Freund's, R.A. Johnson, 9th edition, Pearson Publications, January 2020.
2. Fundamentals of Statistics (Vol. I), A. Goon, M. Gupta and B. Dasgupta, reprint, World press, 2013.
3. Fundamentals of Statistics (Vol. II), A. Goon, M. Gupta and B. Dasgupta, reprint,World press, 2016.
4. The Analysis of Time Series: An Introduction, Chris Chatfield, 6th edition, CRC press, 2017.

REFERENCES:

1. Introduction to Linear Regression Analysis, D. C. Montgomery and E. Peck, G.Geofferry , Third edition, WILEY student's edition, Dec 2006.
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D.C. Boes, reprint, Mc Graw Hill, India edition, 2017.
3. Applied Regression Analysis, N. Draper and H. Smith, 3rd edition, Wiley Publications, 1998.

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4. Hands on Programming With R: Write Your Own Functions and Simulations, Garrett Grolemund, Grayscale, 1st edition,, O'REILLY, 2014.
5. R for Everyone: Advanced Analytics and Graphics, Jared P. Lander, 2nd edition, Addison–Wesley (Pearson), 2018.

WEB RESOURCES:

1. https://onlinecourses.swayam2.ac.in/cec24_ma03
2. https://onlinecourses.nptel.ac.in/noc24_ma46
3. https://online.stat.psu.edu/stat415/lesson/26/26.1.pdf
4. https://learningstatisticswithr.com/book/hypothesistesting.html
5. https://www.machinelearningplus.com/time-series/arima-model-time-series-forecasting-python/
6. https://onlinecourses.swayam2.ac.in/ini24_ge09

ONLINE RESOURCES

1. https://www.youtube.com/watch?v=VPZD_aij8H0
2. https://www.youtube.com/watch?v=yZ0g-DIfVpc

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

1. Use testing of hypotheses to infer the given data. (K3)
2. Apply the methods of Simple, Multiple - Correlation, Regression, Design of experiments to infer the relation among the given data. (K3)
3. Analyze the properties of good estimators and methods of estimation in Statistical analysis. (K3)
4. Apply the appropriate non parametric hypothesis testing procedures based on inferences. (K3)
5. Analyze the various models of time series analysis for forecasting. (K3)
6. Apply the features of R language to carry out statistical tests for the given data. (K3)

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CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	2	3	-	-	-	-	-	-	-	3	3
CO4	3	3	2	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3
CO6	3	2	3	2	-	-	-	-	-	-	-	3	3

SEMESTER - II

24CBPC201 - SDG NO.4 & 9	DATA STRUCTURES AND ALGORITHMS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the basic terminologies of algorithm and data organization.
- To recognize and distinguish the applications of various linear data structures
- To analyze the concepts of non linear data structures.
- To be able to incorporate various searching and sorting techniques in real time scenarios.
- To understand the concept of files and its operations.

MODULE - I BASIC TERMINOLOGIES AND INTRODUCTION TO ALGORITHM 7

Algorithm Specification - Recursion - Performance Analysis – Asymptotic Notation - The Big-O - Omega and Theta Notation - Programming Style –Refinement of Coding-Time-Space TradeOff-Testing-Data Abstraction.

MODULE - II LINEAR DATA STRUCTURES 9

Array-Stack–Operations-Evaluating Arithmetic Expressions-Conversion of Infix to Postfix Expression-Queue–Circular Queue–DeQueue-Operations-Linked_List and its Types - Various Representations - Applications of Linear Data Structures.

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MODULE - III NON-LINEAR DATA STRUCTURE–TREES 7

Trees–Tree Traversals-Binary Tree- Threaded Binary Tree-Binary Search Tree- B & B+ Tree – AVL Tree-Splay Tree-Graph-Directed-Undirected

MODULE - IV NON-LINEAR DATA STRUCTURE–GRAPHS 7

Basic Terminologies and Representations – Graph Search and Traversal Algorithms –Operations & Applications of Non-Linear Data Structures.

MODULE - V SEARCHING AND SORTING ON VARIOUS DATA STRUCTURES 9

Sequential Search-Binary Search-Breadth First Search-Depth First Search Insertion Sort - Selection Sort - Shell Sort - Divide and Conquer Sort – Merge Sort-Quick Sort-Heap Sort-Introduction to Hashing.

MODULE - VI FILES 6

File Organisation - Sequential - Direct - Indexed Sequential - Hashed and Various Types of Accessing Schemes.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. E.Horowitz,S.Sahni,S.A-"Fundamentals of Data Structures",Universities Press, Second Edition,2008.
2. A.V.Aho, J.E.Hopperoft, J.D.Ullman, "Data Structures and Algorithms", Pearson Education, 1983.

REFERENCES:

1. The Art of Computer Programming: Volume1: Fundamental Algorithms, Donald E.Knuth.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31stEdition, Pat Morin, UBCPress.

WEB REFERENCES:

1. https://swayam.gov.in/nd2_cec19_cs04/preview
2. https://nptel.ac.in/courses/106102064/

ONLINE RESOURCES:

1. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
2. https://www.coursera.org/specializations/data-structures-algorithms

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OUTCOMES:

Upon completion of the course, the student should be able to

1. Identify suitable data structure concepts for solving given problems..(K3)
2. Construct efficient solutions using linear data structures.(K3)
3. Construct and utilize tree and graph structures to solve computational tasks. (K3)
4. Analyze graph concepts and algorithms to assess non-linear data structure uses. (K4)
5. Examine various searching, sorting, and hashing methods to assess their performance. (K4)
6. Apply file organization and access methods for effective storage and retrieval.(K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1
CO2	3	2	3	-	-	-	-	-	-	-	-	3	1
CO3	3	2	3	-	-	-	-	-	-	-	-	3	1
CO4	3	3	3	-	-	-	-	-	-	-	-	3	2
CO5	2	3	3	-	-	-	-	-	-	-	-	2	1
CO6	2	2	2	-	-	-	-	-	-	-	-	2	1

SEMESTER - II

24HSTA201 – SDG NO. 4	TAMILS AND TECHNOLOGY	L	T	P	CP	C
		1	0	0	1	1

OBJECTIVES:

- Understand the techniques that help for a better livelihood
- Identify the methods used for scientific Tamil computing

UNIT - I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT - II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during

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

UNIT - III MANUFACTURING TECHNOLOGY 3

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

UNIT - IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

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

UNIT - V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

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12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

தமிழர் மரபு

அலகு - I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு - II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க கொலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் ___ சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் கொலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு - III உற்பத்தித் தொழில் நுட்பம்: 3

கப்பல் கட்டும் கலை -உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணொடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு - IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு -சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் ___ பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு - V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூ லகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

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3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

OUTCOMES:

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

1. Understand Weaving and Ceramic Technology during Sangam Age (K2)
2. Explore about Design & Construction of House and Temples during Sangam Age (K2)
3. Appreciate Manufacturing Technology of Tamils (K2)
4. Perceive Agriculture and Agro-processing during Sangam Age (K2)
5. Comprehend Ancient Knowledge of Ocean & Fisheries(K2)
6. Understand the Scientific Tamil & Tamil Computing (K2)

CO-PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	3	-	-	-	-	3	-	-
CO2	3	-	-	-	-	3	-	-	-	-	3	-	-
CO3	3	-	-	-	-	3	-	-	-	-	3	-	-
CO4	3	-	-	-	-	3	-	-	-	-	3	-	-
CO5	3	-	-	-	-	3	-	-	-	-	3	-	-
CO6	3	-	-	-	-	3	-	-	-	-	3	-	-

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SEMESTER - II

24CYMC201 - SDG NO. 1 - 17	ENVIRONMENTAL STUDIES	L	T	P	CP	C
		2	0	0	2	0

OBJECTIVES:

- To introduce the basic concepts of the environment, ecosystems, and biodiversity, and emphasize the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects, and control or prevention measures of environmental pollution and natural disasters.
- To promote awareness of sustainable energy practices to encourage adoption and contribute to a greener and more sustainable future.
- To introduce the basic structure and components of the atmosphere, including an overview of the photochemical reactions involved.
- To familiarize with the concept of Sustainable Development Goals (SDGs) and analyze climate change, the concept of carbon credits, and the challenges of environmental management.
- To inculcate and embrace sustainability practices, develop a broader understanding of green materials and energy cycles, and analyze the role of sustainable urbanization.

MODULE - I ENVIRONMENT AND BIODIVERSITY 5

Definition, scope and importance of environment - need for public awareness. Ecosystem and Energy flow-ecological succession. Types of biodiversity: genetic, species and ecosystem diversity- values of biodiversity, India as a mega-diversity nation hot-spots of biodiversity threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ.

MODULE - II ENVIRONMENTAL POLLUTION 5

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollution. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts

MODULE - III RENEWABLE SOURCES OF ENERGY 5

Energy management and conservation, New Energy Sources: Need of new sources. Different types, new energy sources. Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy

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MODULE - IV ATMOSPHERIC CHEMISTRY 5

Atmospheric Chemistry - Composition and structure of atmosphere. Climate change - greenhouse effect- role of greenhouse gasses on global warming. Chemical and photochemical reactions in the atmosphere - Formation of smog, PAN, acid rain (causes, effect and control measures). Oxygen and ozone chemistry - Ozone layer depletion (causes, effect and control measures).

MODULE - V SUSTAINABILITY AND MANAGEMENT 5

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols - Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

MODULE - VI SUSTAINABILITY PRACTICES 5

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization-Socio-economical and technological change.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
3. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2024.

REFERENCES:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Chemistry for Environmental Engineering, Clair N. Sawyer, Perry L. Mc Carty, Gene F. Parkin, 4th Edition, McGraw-Hill.

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OUTCOMES:

Upon completion of the course, the student should be able to

1. Explain the fundamental concepts of the environment, ecosystems, biodiversity, and the conservation practices within complex ecological systems. (K3)
2. Apply knowledge of the causes and effects of environmental pollution and natural disasters to contribute to preventive measures in society. (K3)
3. Recognize renewable and non-renewable resources, describe various methods for harnessing energy from different sources and explain their applications in various contexts. (K3)
4. Identify the primary components of the atmosphere, explain the causes of atmospheric pollution and propose strategies to promote a sustainable and clean atmosphere. (K3)
5. Describe the diverse goals of sustainable development and apply them to promote appropriate technological advancement and societal progress. (K3)
6. Demonstrate various sustainability practices, identify examples of green materials, describe their life cycle impacts, and assess their suitability for sustainable development. (K3)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	-	-	-	-	-	-	1
CO2	3	3	3	2	-	-	-	-	-	-	1
CO3	3	3	3	2	-	-	-	-	-	-	1
CO4	3	3	3	2	-	-	-	-	-	-	1
CO5	3	3	3	1	-	-	-	-	-	-	1
CO6	3	3	3	1	-	-	-	-	-	-	1

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SEMESTER - II

24HSNC201 - SDG NO. 4	NCC COURSE LEVEL 1	L	T	P	CP	C
		2	0	0	2	0

ARMY WING

NCC GENERAL **6**

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS **4**

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

PERSONALITY DEVELOPMENT **7**

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

LEADERSHIP **5**

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT **8**

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

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NAVAL WING

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
		TOTAL: 30 PERIODS

ARMY WING

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

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NATIONAL INTEGRATION AND AWARENESS **4**

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

PERSONALITY DEVELOPMENT **7**

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

LEADERSHIP **5**

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT **8**

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

SEMESTER - II

24BSPL201 - SDG NO. 4	PRINCIPLES OF ELECTRONICS ENGINEERING LABORATORY	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To learn about the working of semiconductor diodes and its applications.
- To learn about the working of transistor circuits.
- To learn about the working of JFET, Oscillators and Amplifiers.

LIST OF EXPERIMENTS:

1. Characteristics of PN junction Diode.
2. Characteristics of Zener Diode.

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3. Diode-wave shaping circuit
4. Half wave and full wave Rectifier.
5. Characteristics of BJT in (NPN/PNP Transistor) C-E configuration.
6. Characteristics of BJT in common base (NPN/PNP Transistor) C-B configuration.
7. Characteristics of BJT in common collector (NPN/PNP Transistor) C-C configuration.
8. Characteristics of Junction Field Effect Transistor.
9. Determination of frequency using Hartley Oscillator.
10. Integrators and Differentiator circuit using IC 741 operational amplifier.
11. Operational amplifiers applications using IC 741.

TOTAL:30 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 - STUDENTS PER EXPERIMENT:

LAB REQUIREMENTS

1.	SEMICONDUCTOR DIODES 3. 4. 5. 6. 7. 8., ETC	15 sets
2.	2. SEMICONDUCTOR DIODE CIRCUIT SET	15 sets
3.	TRANSISTOR CIRCUIT SET	15 sets
4.	TRANSISTORS (NPN, PNP)	15 sets
5.	JFET CIRCUIT SET	15 sets
6.	OSCILLATOR CIRCUIT SET	15 sets
7.	AMPLIFIER CIRCUIT SET	15 nos
8.	ELECTRONIC WIRES, ACCESSORIES	15 nos

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the diode circuits and its application. (K2)
2. Apply how to construct the transistor circuit and its working and its applications. (K2)
3. Design the Junction field effect transistor and its working. (K2)
4. Design the oscillators circuit and its output waveform and their application. (K2)
5. Gain knowledge of operational amplifier circuit and its application. (K2)

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CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	-	-	-	-	-	2
CO2	3	2	2	2	3	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	1
CO4	3	2	2	2	2	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	-	1
CO6	3	3	2	2	2	-	-	-	-	-	1

SEMESTER - II

24CBPL201 - SDG NO. 4	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- Design and implement linear and non-linear data structures
- Develop & implement binary search trees with all operations
- Write functions to implement graph traversal algorithms
- Familiarize in sorting and searching algorithm
- Appropriately use the linear / non-linear data structure operations for a given problem

LIST OF EXPERIMENTS:

1. Implementations of Stack and Queue
2. Applications of Stack and Queue (Tower of Hanoi, Infix, Postfix and Prefix Conversion, Expression Evaluation)
3. Implementations of Singly, Doubly and Circular List
4. Polynomial Manipulations
5. Implementation of Trees
6. Implementation of BFS and DFS
7. Implementation of Search Operations
8. Implementation of Sorting algorithms
9. Implementation of Hashing Techniques

TOTAL: 45 PERIODS

Recommended by Board of Studies of CSBS dept. Meeting No. 6 Dated: 30.5.24

CHAIRMAN Board of Studies Computer Science and Business Systems

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT

Equipments:

Standalone desktops with C compiler 30 Nos OR Server with C compiler supporting 30 terminals or more.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Implement linear data structures such as stacks, queues using array and linked list. (K3)
2. Understand and implement non-linear data structures such as trees(K3)
3. Make use of graph algorithms in various applications of graph traversal,shortest path and sorting techniques.(K3)
4. Implement various kinds of searching and traversal techniques(K3)
5. Implement various kinds of sorting and traversal techniques(K3)
6. Solve real world problems using suitable data structures(K3)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	-	-	-	1	2	-	1	1	-	1	1
CO2	2	2	2	-	2	2	3	1	2	2	-	1	1
CO3	1	1	1	1	-	1	1	-	1	2	-	1	1
CO4	2	2	2	2	1	1	1	-	1	1	1	1	1
CO5	2	2	1	-	-	1	1	-	-	-	1	1	1
CO6	1	1	1	1	1	1	1	1	1	1	1	2	1

SEMESTER - II

24ENTP201 - SDG NO. 4	DIGITAL DYNAMICS	L	T	P	CP	C
		0	0	2	2	0

OBJECTIVES:

- Explore online communication
- Master computer skills
- Use virtual platforms
- Understand digital ethics and cyber security
- Follow do's and don'ts

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MODULE - I DIGITAL CULTURE AND SOCIETY 6

Adapting to changes
Importance in today's digital landscape
Digital identity and self- presentation
Online communities and forums
Digital divide and consequences
Online collaboration and collective action

MODULE - II DIGITAL LITERACY AND ACCESS TO TECHNOLOGY 5

Computer skills
Social and cultural understanding
Social media campaign and Activism
Netiquettes
Trending Technologies
Digital tools and softwares

MODULE - III DIGITAL ETHICS 3

Digital ethics and moral panics
The art of protecting secrets
Overview of digital tools

MODULE - IV CYBER SECURITY 3

Threats, vulnerability and consequences
Data making and usage practice
Importance of security

MODULE - V DIGITAL NETWORKING 7

Remote work and virtual teams
Authenticity in digital interactions
Engaging content creation
Tools and and techniques for insightful usage
Balancing online and offline interactions
Collaboration for research and innovation

MODULE - VI BUREAU OF INDIAN STANDARDS (BIS): BASIC CONCEPTS, STANDARDS FORMATION PROCESS AND CHALLENGES 6

Standardization –Basic Concepts:

Basic concepts of standardization
Purpose of standardization, marking and certification of articles and processes

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Importance of standards to industry, policy makers, trade, sustainability and innovation

Standards Formulation Process and Challenges:

Objectives, roles and functions of BIS, Bureau of Indian Standards Act, ISO/ IEC Directives

WTO Good Practices for Standardization

World of Standards:

Important Indian and International Standards

TOTAL: 30 PERIODS

REFERENCES:

1. Communication Skills and Soft Skills – an Integrated Approach. Edited by E. Sureshkumar, P. Sreehari and J. Savithri, Pearson.
2. Silvia. P.J.2007. How to Read a Lot. Washington DC, American Psychological Association.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

OUTCOMES:

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

1. Apply online communication techniques and collaboration skills (K3)
2. Enumerate the principles of digital ethics in online interactions (K2)
3. Understand the importance of Bureau of Indian Standards (BIS). (K2)

CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	3	2	-	2	-	-

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SEMESTER - II

24ESID201 SDG NO. 1-17	IDEA ENGINEERING LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

To impart the basics of technologies that are used to identify sustainable solutions to societal problems

- To Provide awareness on Printed Circuit Board (PCB) design using ORCAD software.
- To Raise awareness of at least three Internet of Things (IoT) projects and their applications.
- To Upskill learners through practical experience with 3D printing and scanning technologies.
- To prepare the learners to correctly align the ideas to SDGs
- To comprehensive knowledge on entrepreneurship and effective idea presentation techniques.
- To evaluate the effectiveness of SDGs and implementation strategy

MODULE-1 BASICS OF DESIGN THINKING IN ELECTRICAL AND ELECTRONIC COMPONENTS 4

- Awareness Session on Basics of Design Thinking
- Study of Active & Passive Electronic Components
- Study of Basic AC & DC Electrical Circuits
- Study of Microprocessors & Microcontrollers
- Demonstration of Arduino Board, ESP 32 Board ,Raspberry Pi Board & PCB design software-Eagle
- Demonstration of PCB design using the software's Orcad, Eagle etc.

MODULE-2 EMBEDDED SYSTEMS, IOT AND ROBOTICS 4

- Study of sensors and transducers
- Study of embedded protocols, IOT Protocols & Embedded C
- Demonstration of Robotics & Drone models

MODULE-3 BASICS OF MECHANICAL ENGINEERING 4

- Study of Mechanical Modeling using Fusion 360
- Demonstration of 3D Scanner,3D Printer, Laser Cutter &RD Works Software
- Study of Slicer Software & Master Cam Software

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MODULE 4 ALIGNMENT AND MAPPING OF IDEAS 4

- **Project Title:** Justification of SDG and SAP - Problem Statement & Solution

MODULE-5 ENTREPRENEURSHIP SKILLS 4

- Startup Awareness
- Entrepreneurship Opportunities
- Mock Presentations
- Innovation
- Novelty
- Feasibility
- Presentation Skills

MODULE-6 SCOUT for SDG IDEATHON 12

Evaluation Stages:

- First Round
- Second Round
- Idea Pitching

TOTAL: 30 PERIODS

REFERENCES:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
3. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
4. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
5. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
6. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2017.
7. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.

WEB REFERENCES

1. https://onlinecourses.nptel.ac.in/noc24_ee112/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs115/preview
3. https://onlinecourses.nptel.ac.in/noc24_me104/preview
4. https://onlinecourses.nptel.ac.in/noc24_me88/preview

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OUTCOMES:

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

1. Gain the knowledge on Basic Electronics & Electrical Circuits (K2)
2. Understand the Basics of Embedded systems,IOT & Robotics (K1)
3. Explore the the Basics of Mechanical Modeling (K2)
4. Interpret the mapping of SDGs to ideas. (K4)
5. Illustrate the ideas in the Ideathon event emphatically .(K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	1	-	-	-	-	-	-
CO2	1	-	-	-	1	-	-	-	-	-	-
CO3	1	-	-	-	1	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	3	3	-	2
CO5	-	-	-	-	-	3	-	3	3	-	2

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SEMESTER - III

24BSMA305 - SDG NO. 4	LINEAR ALGEBRA	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- The aim of this course is to impart knowledge in the concepts of linear algebra as a prerequisite for the recent thrust areas of technological advancement.

MODULE - I MATRICES AND DETERMINANTS 8

Introduction to Matrices and Determinants, Solution of Linear Equations by Cramer's rule, Inverse of a Matrix, Rank of a matrix.

MODULE - II SOLUTION OF SYSTEM OF LINEAR EQUATIONS 8

Solving Systems of Linear Equations using tools of matrices (Rank method and Inverse method), Gaussian elimination, LU Decomposition.

MODULE - III VECTOR SPACES 12

Vectors and linear combinations, Linear dependence and independence, Vector space, Subspace, Basis and Dimension.

MODULE - IV INNER PRODUCT SPACES 12

Inner product and norms, Euclidean norms, Orthogonality, Orthonormal vectors, Gram-Schmidt orthogonalization, Projections and QR decomposition.

MODULE - V LINEAR TRANSFORMATIONS 12

Linear transformations, Rank and Nullity, Dimension Theorem (without proof), Matrix representation of Linear transformation, Eigenvalues and Eigenvectors, Positive definite matrices, Hermitian and Unitary matrices.

MODULE - VI APPLICATIONS OF LINEAR ALGEBRA 8

Singular value decomposition and Principal component analysis; Introduction to their applications in Image Processing and Machine Learning.

TOTAL : 60 PERIODS

Note: Assignments & tutorials covering the following: Vectors and linear combinations, Matrices, Linear Transformations, Complete solution to Ax = b, Determinants, Eigenvalues and Eigenvectors

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TEXT BOOKS:

1. Higher Engineering Mathematics, B. S. Grewal, 44th edition, Khanna Publishers, 2017.
2. Introduction to linear algebra, Gilbert Strang, 5th edition, Wellesley-Cambridge Press, 2016.

REFERENCES:

1. Advanced Engineering Mathematics, Peter V. O'Neil, 7th edition, Cengage Learning, 2011.
2. Advanced Engineering Mathematics, Michael D. Greenberg, 2nd edition, Pearson, 1998.
3. Applied Mathematics (Vol. I & II), P. N. Wartikar & J. N. Wartikar, 1st edition, Pune Vidyarthi Griha Prakashan, 1985.
4. Digital Image Processing, R. C. Gonzalez and R. E. Woods, 5th edition, Pearson, 2018.

WEB RESOURCES:

1. Introduction to Matrices and Matrix Arithmetic for Machine Learning - MachineLearningMastery.com
2. Lecture Notes | Signals and Systems | Electrical Engineering and Computer Science | MIT OpenCourseWare
3. https://nptel.ac.in/courses/111/106/111106135/

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/
2. https://www.khanacademy.org/math/linear-algebra

COURSE OUTCOMES

Upon completion of the course, the student should be able to:

1. Apply concepts of matrices and determinants to solve systems of linear equations using Cramer's rule, inverse method, and determine the rank of a matrix (K3).
2. Solve systems of linear equations using matrix-based methods such as rank and inverse methods, Gaussian elimination, and LU decomposition (K3).
3. Demonstrate understanding of vector spaces by analysing linear dependence, forming linear combinations, and determining basis and dimension of subspaces (K3).

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4. Apply concepts of inner products, norms, and orthogonality to construct orthonormal bases using the Gram-Schmidt process, and perform projections and QR decomposition (K3).
5. Apply the concepts of linear transformations and their matrix representations to analyze eigenvalues, eigenvectors, and classify matrices such as Hermitian, unitary, and positive definite matrices (K3)
6. Apply Singular Value Decomposition and Principal Component Analysis to extract features and reduce dimensionality in data, with applications in image processing and machine learning (K3) .

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	-	-	-	-	-	-	-	-	-	-	3	2
CO6	3	-	-	-	-	-	-	-	-	-	-	3	2

SEMESTER - III

24CBPC301 106106049 SDG NO. 4	FORMAL LANGUAGE AND AUTOMATA THEORY	L	T	P	CP	C
		2	1	0	3	3

OBJECTIVES:

- To understand the language hierarchy
- To construct automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language
- To know about Turing machines and their capability
- To be familiar with undecidable problems and NP class problems

MODULE - I INTRODUCTION AND REGULAR LANGUAGES 6

Alphabet - Languages and grammars- productions and derivation- Chomsky hierarchy of languages - Regular Expressions and languages-Properties of regular languages

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MODULE - II FINITE AUTOMATA **10**

Deterministic Finite Automata (DFA) and equivalence with regular expressions- Non-deterministic Finite Automata (NFA) and equivalence with DFA- Regular grammars and equivalence with Finite Automata- - Kleene's theorem- pumping lemma for Regular languages- Myhill - Nerode theorem and its uses- Minimization of finite automata.

MODULE - III CONTEXT-FREE LANGUAGES **8**

Context-Free Grammars (CFG) and Languages (CFL) - closure properties of CFLs. - Chomsky and Greibach normal forms - parse trees - ambiguity in CFG - pumping lemma for context-free languages

MODULE - IV PUSHDOWN AUTOMATA **7**

Deterministic Pushdown Automata (DPDA) - nondeterministic pushdown automata (NPDA) and equivalence with CFG - Context-sensitive grammars and languages (CSG) - linear bounded automata and equivalence with CSG.

MODULE - V TURING MACHINES **7**

The basic model for Turing machines (TM) - Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties - variants of Turing machines - Nondeterministic TMs and equivalence with Deterministic TMs - unrestricted grammars and equivalence with Turing machines - TMs as enumerators.

MODULE - VI UNDECIDABILITY **7**

Church-Turing thesis - Universal Turing machine - the Universal and Diagonalization languages - reduction between languages and Rice's theorem - undecidable problems about languages. Basic Introduction to Complexity- Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines - P and NP classes - NP- completeness - Cook's Theorem - other NP -Complete problems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", 3rd Edition, Pearson, 2008.

REFERENCE BOOKS:

1. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the Theory of Computation", Prentice-Hall, 2nd Edition, 1981.

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2. John Martin, "Introduction to Languages and the Theory of Computation". 2010.
3. M. R. Garey and D. S. Johnson, "Computers and Intractability: A Guide to the Theory of NP Completeness", W.H. Freeman & co 1990.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/104/106104148
2. https:// automation simulator.com/
3. https://www.courseera.org/courses/
4. https://swayam.gov.in/nd1_noc19_cs79/

ONLINE RESOURCES:

1. https:// ocw.mit.edu/
2. online.standford.edu/courses/
3. http://www.youtube.com/watch?v=eqCkkC9A0Q4

OUTCOMES

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

1. Apply models of computation, including formal languages, grammars and automata to solve computational problems. (K3)
2. Construct finite automata (FAs), nondeterministic finite automata (NFAs), deterministic finite automata (DFAs), grammars, and languages. (K3)
3. Apply closure properties of context-free languages to determine the results of language operations such as union, concatenation, and Kleene star.(K3)
4. Develop push down automata and context-free grammar representations for context-free languages. (K3)
5. Construct Turing Machine for accepting recursively enumerable languages and its capabilities. (K3)
6. Apply the notions of decidability and undecidability of problems (K3)

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CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	–	–	–	–	–	–	–	–	2	1
CO2	3	2	2	–	–	–	–	–	–	–	–	2	1
CO3	3	2	2	–	–	–	–	–	–	–	–	2	1
CO4	3	2	2	–	–	–	–	–	–	–	–	2	2
CO5	3	2	2	–	–	–	–	–	–	–	–	2	2
CO6	3	3	2	–	–	–	–	–	–	–	–	1	1

SEMESTER - III

24CBPC302 106105163 SDG NO. 4	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To recognize the basic structure of a digital computer and representation of nonnumeric data.
- To learn different arithmetic operations and organization of control units.
- To study memory organization, different ways of communication with I/O devices and parallel processors.
- To understand the concept of pipelining and its impact in processor design.
- To learn memory organization techniques

MODULE - I BASIC STRUCTURE OF A COMPUTER SYSTEM 8

Revision of Basics in Boolean Logic and Combinational/Sequential Circuits - Functional Blocks of a Computer: CPU - Memory - Input-Output Subsystems - Control Unit -Instruction Set Architecture of a CPU: Registers - Instruction Execution Cycle - RTL Interpretation of Instructions - Addressing Modes - Instruction Set - Outlining Instruction Sets of some common CPUs.

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MODULE - II ARITHMETIC FOR COMPUTERS **8**

Data Representation: Signed Number Representation - Fixed and Floating Point Representations - Character Representation. Computer Arithmetic: Integer Addition and Subtraction - Ripple Carry Adder - Carry Look-Ahead Adder. Multiplication – Shift-and-Add - Booth Multiplier - Carry Save Multiplier. Division Restoring and Non-Restoring Techniques - Floating Point Arithmetic.

MODULE - III PROCESSOR, CONTROL UNIT AND PARALLELISM **8**

Introduction to X86 Architecture - CPU Control Unit Design: Hardwired and Microprogrammed Design Approaches - Design of a Simple Hypothetical CPU. Pipelining: Basic Concepts of Pipelining - Throughput and Speedup - Pipeline Hazards.- IEEE 754 Format

MODULE - IV I/O SYSTEMS **8**

Input-Output Subsystems - I/O Device Interface - I/O Transfers – Program Controlled - Interrupt Driven and DMA – Privileged and Non-Privileged Instructions - Software Interrupts and Exceptions. Programs and Processes – Role of Interrupts in Process State Transitions - I/O Device Interfaces – SCII - USB.

MODULE - V MEMORY **6**

Memory System Design: Semiconductor Memory Technologies - Memory Organization. Memory Organization: Memory Interleaving - Concept of Hierarchical memory Organization - -Replacement Algorithms - Write Policies.

MODULE - VI PARALLEL PROCESSING AND CACHE MEMORY **7**

Parallel Processors: Introduction to Parallel Processors - Flynn's Classification -SISD, SIMD, MISD, MIMD - Concurrent Access to Memory and Cache Coherency. Peripheral Devices and their Characteristics. Cache Memory - Mapping Functions -Cache Size Vs. Block Size.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. M. M. Mano, "Computer System Architecture", 3rd ed., Prentice Hall of India, New Delhi, 2009.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", The Morgan Kaufmann series, 5th Edition, 2014.

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REFERENCE BOOKS:

1. John P. Hayes, "Computer Architecture and Organization", 3rd edition, The McGraw Hill, 1998
2. William Stallings, "Computer Organization and Architecture: Designing for Performance", 10th edition, Pearson, 2016.
3. Vincent P. Heuring and Harry F. Jordan Pearson, "Computer System Design and Architecture", 1996.
4. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Mc Graw Hill, sixth edition, 2012.

WEB REFERENCES:

1. https://www.sciencedirect.com/science/article/pii/B0122274105001319
2. https://cse.iitkgp.ac.in/~ksrao/caos2018.html
3. https://nptel.ac.in/courses/106/105/106105163/
4. https://www.cse.iitm.ac.in/course_details.php?arg=NjM

OUTCOMES

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

1. Apply the concepts of CPU, memory, and I/O subsystems to demonstrate the structure and components of a computer system. (K3)
2. Solve computational problems using data representation techniques and arithmetic operations. (K3)
3. Construct the instruction execution process of a CPU through control unit design and pipelining techniques. (K3)
4. Utilize I/O transfer mechanisms and interrupts to explain process state transitions. (K3)
5. Organize system memory operations by applying memory management techniques. (K3)
6. Examine parallel processor architectures and design cache memory mechanisms to improve system performance.(K4)

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CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	3	2
CO3	2	3	3	-	-	-	-	-	-	-	-	3	3
CO4	3	1	2	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	3	2
CO6	3	3	3	-	-	-	-	-	-	-	-	3	3

SEMESTER - III

24CBPC303 106105087 SDG NO. 3, 4, 11	SOFTWARE ENGINEERING AND DESIGN	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand and apply software engineering principles and SDLC models.
- To demonstrate proficiency in software project management and estimation techniques.
- To analyze and model software requirements effectively
- To implement software testing and validation strategies.
- To design and evaluate object-oriented software solutions using UML and quality models.

MODULE - I INTRODUCTION TO SOFTWARE ENGINEERING & PROJECT MANAGEMENT 8

Programming in the Small vs. Large - Software Crisis & Importance of Quality: Project failures, quality assurance, timely delivery - Engineering Approach to Software Development - Role of Software Engineering in Large Projects - Software Development Life Cycle (SDLC) Models: Waterfall, Spiral, Agile - Software Project Management: Activity identification, resource planning, feasibility study, risk mitigation & Configuration Management

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MODULE - II SOFTWARE ESTIMATION & REQUIREMENTS ENGINEERING 8

Software Cost Estimation Models & Software Engineering Economics - Project Control & Reporting Techniques -Software Size Measurement & Metrics-Based Control Methods - Software Requirements & Analysis:Software Requirements Specification (SRS) - Requirement Elicitation & Modeling Techniques: Decision tables, event tables, state transition tables, Petri nets

MODULE - III SOFTWARE DESIGN 7

Design Engineering: Design process and design quality, design concepts, the design model. Creating a Architectural Design: Architectural styles, Architectural Design, Architectural Mapping using Data Flow.

MODULE - IV UML MODEL 8

Conceptual model of UML: basic structural modeling, use case diagram, class diagrams, sequence diagrams, collaboration diagrams, state chart diagram, activity diagram, component diagrams, deployment diagram

MODULE - V SOFTWARE TESTING & VALIDATION 7

Faults & Failures, Verification & Validation - Black Box vs. White Box Testing - White Box Coverage: Code, Condition, Branch Coverage - Black Box Techniques: Equivalence Classes, Boundary Values, State Tables, Use Cases, Transaction-Based Testing - Non-Functional Testing: Volume, Performance, Efficiency - Inspection & Review Techniques

MODULE - VI SOFTWARE QUALITY, RELIABILITY & IMPLEMENTATION 7

Technical Stack & Component Diagrams: Package Diagrams, Component Models (Physical & Logical Aspects), Initial Database Design in UML - Software Quality & Reliability - Quality Models: McCall, Boehm, FURPS/FURPS+, Dromey, ISO-9126 - Capability Maturity Models (CMM & CMMI)- Software Reliability Models & Estimation

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

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REFERENCES:

1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning PrivateLimited, 2009.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software" Addison-Wesley Professional, 1994.
4. Ali Bahrami, "Object Oriented Systems Development", McGraw Hill Edition, 2017.
5. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: using UML, Patterns, and Java", Third Edition, Prentice Hall, 2010.

ONLINE RESOURCES:

1. http://nptel.ac.in/.
2. http://infolab.stanford.edu/~burback/watersluice/watersluice.html.
3. https://www.umsl.edu/~sauterv/analysis/488_f01_papers/ quillin.htm
4. https://medium.com/omarelgabrys-blog/object-oriented-analysisand-design-introduction-part-1-a93b0ca69d36

WEB RESOURCES:

1. https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf.
2. http://www.darshan.ac.in/Upload/DIET/Documents/CE/2160701_Software%20Engineering%20Study%20Material%20GTU_23042016_032444AM.pdf.
3. https://jnec.org/lab-manuals/cse/te/se.pdf.

OUTCOMES

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

1. Apply the fundamentals of software engineering, development life cycle models, and project management techniques to ensure successful software project execution. (K3)
2. Utilize software estimation techniques, cost modeling, and requirements engineering processes to define and document software specifications effectively. (K3)
3. Apply object-oriented principles, UML modeling, and design patterns to construct high-quality software solutions.(K3)
4. Develop structured and interactive software designs using UML diagrams, logical modeling, and structured analysis techniques.(K3)

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5. Implement software testing strategies and validation techniques to ensure functional and non-functional quality requirements. (K3)
6. Analyze UML-based software architecture and evaluate quality, reliability, maturity, and estimation using established models and standards. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	–	–	–	–	–	–	2	–	1	2
CO2	3	3	2	–	–	–	–	–	–	2	–	1	2
CO3	3	2	3	–	–	–	–	–	–	1	–	2	-
CO4	3	2	3	–	–	–	–	–	–	1	–	1	-
CO5	3	2	2	–	–	–	–	–	–	1	–	2	-
CO6	3	3	2	–	–	–	–	–	–	1	–	2	-

SEMESTER - III

24CBMG301 - SDG NO. 4	FUNDAMENTALS OF MANAGEMENT	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To help students gain an understanding of the functions and responsibilities of managers.
- To provide them with techniques and be used in the decisionmaking techniques in managerial jobs.
- To help students to develop cognizance of the importance of Human Resource Planning .

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Dr. K.MARAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College

- To enable the students to learn principles of leadership and motivation.
- To help students recognize the organizational challenges and coordination

MODULE - I INTRODUCTION OF MANAGEMENT 10

Introduction to Management: Definition, Nature and Scope, Functions, ManagerialRoles,LevelsofManagement,ManagerialSkills,Challengesof Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach.

MODULE - II PLANNING AND DECISION MAKING 7

Concept of Planning - Planning Process, Types of Plans, MBO, MBE, Approaches to Planning, Barriers to Effective Planning. Decision making - Meaning, types of Decisions, Decision Making Process; Decision making techniques.

MODULE - III ORGANIZING 7

Organizing, Principles of Organizing, Formal and Informal Organization, Design of Organizational Structures; Departmentalization, Span of Management, Forms of Organisation Structure :Delegation; Centralization, Decentralization, Staffing.

MODULE - IV HUMAN RESOURCE MANAGEMENT 7

Introduction to HRM : Definition, Nature and Scope, Functions, Human Resource Planning, Recruitment- types, Selection, Training. Performance Appraisal.

MODULE - V LEADING & MOTIVATION 7

Leadership – Concept, Nature , Importance, Developing leaders across Organisation&Types,Leadership Styles,LeadershipTheories.Motivation – Concept & Meaning, Theories of Motivation

MODULE - VI CONTROLLING & COORDINATION 7

Concept of Control, Steps in Control, Types of Control, Budgetary and Non-Budgetary Control Techniques Coordination ,Characteristics, Importance, Type & Techniques, Principles, Obstacles , Concept of Managerial Effectiveness.

TOTAL : 45 PERIODS

Recommended by
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Meeting No. 5 Dated: 11/6/24

Dr. K.MARAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

TEXT BOOKS:

1. Dr.Mishraand Dr.O.P.Gupta(2022) ,Fundamentals of management, SBPD Publishing house, 1st edition
2. L. M.Prasad(2021),Principles and practice of Management, Sultan Chand and sons.
3. RanjeetVerma(2016),Fundamentalsofmanagement,Vayueducation of India, Latest edition.
4. Stephen P. Robbins & Mary Coulter, David De Cenzo (2016) " FundamentalsofManagement",Pearsonpublication,9thedition.

REFERENCE BOOKS:

1. Harold Koontz& Heinz Weihrich,"Essentials of Management",Tata McGraw Hill, 1998.
2. Prasad L M, "Principle and Practices of Management", Sultan Chand & Sons, 2019.
3. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

WEB REFERENCES:

1. https://theintactone.com/2019/09/18/fom-u1-topic-1-fundamentalsof- management-introduction-and-concepts/
2. https://www.smu.edu/cox/Executive-Education/Fundamentals-ofManagement
3. https://www.slideshare.net/Knight1040/fundamentals-ofmanagement- lesson-1

REFERENCES:

1. https://gateknowledge.in/fundamentals-of-management/
2. https://nios.ac.in/media/documents/srsec319new/319EL10.pdf
3. https://www.coursera.org/learn/fundamentals-of-management

OUTCOMES

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

1. Demonstrate the concepts of business and the evolution of management thoughts in relevant managerial situations. (K3)
2. Utilize planning and decision-making techniques, various types of plans, and the principles of Management by Objectives (MBO) in practical contexts. (K3)

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Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

3. Apply the principles of organizing to design appropriate organizational structures and manage processes such as delegation, departmen talization, centralization, and staffing. (K3)
4. Examine the role and functions of Human Resource Management, including planning, recruitment, selection, training, and performance appraisal techniques. (K4)
5. Distinguish various leadership and motivational theories and styles and interpret how they influence employee performance and organizational effectiveness. (K4)
6. Assess control and coordination mechanisms in organizations and judge techniques for enhancing managerial effectiveness. (K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	1	-	-	1	3	2	1	3	2	1
CO2	2	1	3	-	2	-	3	2	-	3	2	1	1
CO3	1	1	3	-	1	-	1	2	-	3	2	1	2
CO4	2	-	2	-	1	-	1	2	-	2	2	1	1
CO5	1	-	1	3	3	-	1	2	-	1	-	1	1
CO6	1	-	3	2	3	-	1	2	-	2	-	2	1

SEMESTER - III

24HSMC301 - SDG NO. 4, 9	UNIVERSAL HUMAN VALUES – II UNDERSTANDING HARMONY	L	T	P	CP	C
		2	1	0	3	3

OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Developing clarity with harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.
- Recognizing the potential of excellence than competition

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SYLLABUS:

The course has 28 lectures and 14 practice sessions in 6 modules:

MODULE - I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION (5+2)

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario

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

MODULE - II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF (5+2)

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

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

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MODULE - III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY HARMONY IN HUMAN-HUMAN RELATIONSHIP (6+2)

12. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values ofrelationship
13. Understanding the meaning of Trust; Difference between intention and competence
14. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
15. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

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

MODULE - IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE (6+2)

16. Understanding the harmony in the Nature
17. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
18. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
19. Holistic perception of harmony at all levels of existence.

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

MODULE - V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS (4+4)

20. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family
21. Natural acceptance of human values
22. Definitiveness of Ethical Human Conduct
23. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
24. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco friendly

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production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

MODULE - VI UNIVERSAL HUMAN ORDER **(4+3)**

25. Programs to ensure Sanyam and Health
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc

TOTAL : 45 PERIODS

TEXT BOOKS:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

REFERENCES:

1. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology)Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values,A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence-JC Kumarappa
8. Bharat Mein Angreji Raj- Pandit Sunderlal
9. Rediscovering India- by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda- Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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Department of Humanities & Sciences

OUTCOMES

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

1. Express the harmony of relationship among human being, family, society, nature and existence with right understanding and right feeling.(K2)
2. Develop the responsibility of handling problems by finding holistic and sustainable solutions based on the natural acceptance for maintaining mutual human relationships. (K2)
3. Develop a holistic perspective of life based on self-exploration about self, family, society and nature/existence. (K2)
4. Elucidate a critical ability for dedicative commitment towards human values, relationships and society. (K2)
5. Implement the process of verification and validation of learning in daily life. (K2)
6. Develop self reflection, commitment and courage to act in life challenging situations. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	2	-	-	3
CO2	-	1	-	-	-	3	3	2	-	-	-
CO3	-	-	3	-	-	3	3	2	-	-	-
CO4	-	-	-	-	-	3	3	2	-	2	3
CO5	-	-	-	-	-	3	3	-	-	-	3
CO6	-	-	-	-	-	3	3	-	-	3	2

SEMESTER - III

24HSNC301 – SDG NO. 4	NCC COURSE LEVEL 2	L	T	P	CP	C
		3	0	0	3	0

ARMY WING

PERSONALITY DEVELOPMENT **9**

PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6

PD 5 Public Speaking 3

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LEADERSHIP **7**

L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT **13**

DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3

DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9

DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION **3**

EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

ARMED FORCES 6

AF 1 Armed Forces, Army, CAPF, Police 6

ADVENTURE 1

AD 1 Introduction to Adventure Activities 1

BORDER & COASTAL AREAS **2**

BCA 1 History, Geography & Topography of Border/Coastal areas 2

TOTAL: 45 PERIODS

NAVAL WING

PERSONALITY DEVELOPMENT **9**

PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6

PD 5 Public Speaking 3

LEADERSHIP 7

L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT **13**

DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3

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DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA 1	General Knowledge	4
NAVAL ORIENTATION 6		
AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3
ADVENTURE 1		
AD 1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2
		TOTAL: 45 PERIODS

AIR FORCE WING

PERSONALITY DEVELOPMENT 9

PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3

LEADERSHIP 7

L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7

DISASTER MANAGEMENT		**13**
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1

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ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA 1	General Knowledge	4
GENERAL SERVICE KNOWLEDGE		**6**
GSK 1	Armed Forces & IAF Capsule	2
GSK 2	Modes of Entry in IAF, Civil Aviation	2
GSK 3	Aircrafts - Types, Capabilities & Role	2
ADVENTURE	**1**	
AD 1	Introduction to Adventure Actitivities	1
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2

TOTAL :45 PERIODS

SEMESTER - III

24CBPL301 - SDG NO. 4	SOFTWARE ENGINEERING AND DESIGN LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To apply requirements engineering techniques to real-world problems.
- To design and develop software test plans and perform validation.
- To model software systems using standard UML diagrams.
- To use project management tools to plan and track project activities.
- To map software designs to code and implement domain-specific mini-projects.

LIST OF EXPERIMENTS:

1. Requirements Engineering
2. Writing Problem Statement
3. Writing Requirement Specification
   a. Preparation of required documents for standard Application program in standard format (SRS).
   b. Implement Test plan /Test script

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c. Implement Software Testing - Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor

d. Use Case

4. Planning Project with PERT Diagram
5. Designing Project
   - Use Case Diagrams
   - Interaction Diagrams
   - State chart Diagrams and Activity Diagrams
   - Class Diagrams
   - Package Diagrams
   - Component Diagrams and Deployment Diagrams
6. Mapping Design to code Suggested Domains for Mini-Project:

Suggested Domains for Mini-Project:

1. Passport automation Systems
2. Online Reservation Systems
3. Student Information Systems
4. Recruitment Systems
5. Library Management Systems

TOTAL : 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT EQUIPMENTS: Argo UML/Star UML/UML Graph/Selenium or Equivalent

WEB REFERENCES

1. https://www.ibm.com/support/pages/ibm-rational-rose-enterprise7004-iix001

OUTCOMES

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

1. Analyze the fundamental principles of Requirements Engineering and Software Design to analyze software project needs. (K3)
2. Formulate well-defined Problem Statements and Software Requirement Specifications (SRS) for a given application in a standardized format. (K3)
3. Develop Test Plans, Test Scripts, and Validation Testing to ensure software quality by performing coverage analysis, memory leak detection, and test case development. (K3)

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4. Analyze various Software Design Models such as Use Case Diagrams, Interaction Diagrams, State Charts, and Activity Diagrams to understand system behavior. (K4)
5. Design a PERT Diagram and Project Plan, mapping design elements to code efficiently while considering feasibility, constraints, and risks. (K5)
6. Construct a Mini-Project by implementing software engineering principles, following design methodologies, and integrating software testing strategies to ensure a functional and efficient system. (K6)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	3	2	1
CO2	2	3	1	1	-	1	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	1	1
CO4	3	2	1	1	3	-	-	-	-	-	-	1	-
CO5	3	2	1	1	3	-	-	-	-	-	-	1	2
CO6	3	2	1	1	3	-	-	-	-	-	-	2	-

SEMESTER - III

24CBTP301 – SDG NO. 4	APTITUDE SKILLS - I	L	T	P	CP	C
		0	0	2	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Enrich students on quantitative ability, reasoning ability, and verbal ability
- Build a strong foundation for solving recruitment-based problems with speed and accuracy.
- Enhance creative thinking skills and Strengthen problem-solving skills.

MODULE - I QUANTITATIVE ABILITY **22**

Number Properties, Speed Math, HCF and LCM, Percentages, Time and Work, Time Speed and Distance, Ratio Proportion and Variations, Averages Mixtures and Alligation

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MODULE - II REASONING ABILITY **16**

Profit and Loss, Simple Interest and Compound Interest, Blood Relation, Directions, Coding and Decoding, Series, Ranking and Arrangements

MODULE - III VERBAL ABILITY **7**

Subject-Verb Agreement, Tenses, Prepositions - Concepts, Error Spotting, Sentence Correction, Fill in the Blanks

TOTAL: 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive Examinations – R.S. Aggarwal
2. A Modern Approach to Logical Reasoning – R.S. Aggarwal
3. High School English Grammar & Composition – Wren & Martin
4. Word Power Made Easy – Norman Lewis.
5. Fast Track Objective Arithmetic – Rajesh Verma

PHASE - 2

(LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS)

OBJECTIVES:

- Familiarize the team and leadership skills.
- Gain Scouting spirit.
- Understand the standards relevant to CSBS.

MODULE - I JEEVAN KAUSHAL 2.0 – TEAM SKILLS AND LIFE SKILLS 12

Trust and Collaboration: Importance of Trust in Creating a Collaborative Team- Agree to Disagree and Disagree to Agree – Spirit of Teamwork - Understanding Fear of Being Judged and Strategies to Overcome.

Brainstorming: Basics and the process – Effective technique for ideation – Types – Importance and Benefits

Internal Communication: Internal Communication – Meaning and the Need, Use of Various Channels for Transmitting Information to Team Members including Digital and Physical.

Leadership Skills: Leadership concept - Leadership skills – Leadership moralities – Leadership models

MODULE - II RANGER AND ROVER **10**

Four Bonds of BSG: Sign, Salute, Left Handshake, Moto and Good Turn.

Discipline and Uniform: Uniform of Rovers and Rangers, 14 Programme ideals.

Knowledge of Merit: Know about Knowledge of Merit Badges (Proficiency Badge).

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Sustainability E-learning: (Online Course Available in WOSM Learning Zone).

Activating the Earth Tribe Initiative in your Community.

MODULE - III ELECTROMAGNETIC COMPATIBILITY (EMC) AND ELECTROMAGNETIC INTERFERENCE 8

Introduction to the concept of Electromagnetic compatibility of electrical and/or electronic equipment, between themselves and with electrical power networks including electromagnetic interference and measurement and calculation methods to assess human exposure to electric, magnetic and electromagnetic fields. Discussion on IS 14700/ IEC 61000 series of Standards.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES:

1. https://www.cambridgeenglish.org/learning-english
2. https://lms.scout.org/course_items/show/1172182?course_id=214307#course-item-id=1172182
3. https://lms.scout.org/courses/show/214123?force_course_hub=true

OUTCOMES

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

1. Apply quantitative aptitude for solving numerical problems [K3]
2. Describe logical reasoning to tackle emotional challenges. [K2]
3. Use verbal communication and comprehension skills through grammar and language exercises. [K3]
4. Apply critical thinking and problem-solving skills in various cognitive scenarios. [K3]
5. Interpret language nuances in diversified situations and exhibit scouting spirits amidst communities. [K2]
6. Explain the basic principle of BIS Standards relevant to EMC and EMI. [K2]

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CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	2	-	-	-	-	1	-	-
CO3	-	-	-	-	-	-	-	-	2	-	1	-	-
CO4	-	2	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	-	-	-	-	-	2	3	-	1	-	-
CO6	-	-	-	-	-	3	-	-	-	-	1	-	-

SEMESTER - III

24CBID301 - SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - I	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To provide opportunities for students to develop an entrepreneurial mindset and explore real-world problem-solving through a startup-centric approach.
- To enable hands-on experience in identifying market needs
- To enable development of skill sets for designing, validating, and realizing a Minimum Viable Product (MVP) for an entrepreneurial venture.
- To guide students in validating market opportunity, and formulating a solution with realistic constraints.
- To inculcate ethical research practices, foster a commitment to lifelong learning, and promote the development of socially responsible and sustainable innovations aligned with relevant Sustainable Development Goals (SDGs).
- To prepare students to design sustainable business models and present entrepreneurial ideas through structured, outcome-driven business pitches using core startup frameworks.

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COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, specifically through the lens of entrepreneurship and innovation.
2. The project work must involve identifying a problem, validating market opportunity, and developing a solution with realistic constraints, culminating in a business plan and prototype/MVP. It must also include appropriate elements of the following: market research, competitive analysis, value proposition design, business model development, financial feasibility, go-to-market strategy, and potentially software/hardware development for the MVP.
3. Project can be individual work or a group project, with a maximum of 3 students. In case of a group project, the individual project report of each student should specify the individual's contribution to the group project. The roles and responsibilities of all team members must be well-defined and documented.
4. On completion of the project, the student shall submit a detailed project report outlining their entrepreneurial journey, solution development, and business plan. The project should be reviewed and the report shall be evaluated, and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION:

1. First evaluation (Milestone 1 - Week 4): 20 marks (Focus on Problem Identification, Opportunity Discovery, Customer & Markets, Value Proposition)
2. Second evaluation (Milestone 2 - Week 8): 30 marks (Focus on Competitive Advantage, Business Model, and MVP Development)
3. Final evaluation (Milestone 3 & 4 - Last week of the semester): 50 marks (Focus on Financial Feasibility, Go-to-Market Strategy, Growth and Scale, Funding Strategy, and Overall Project Report & Viva-Voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply entrepreneurial thinking to identify and articulate real-world problems and explore market needs using structured approaches. (K3)
2. Develop skill sets to design potential solutions and validate market opportunities within realistic constraints. (K4)

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3. Evaluate sustainable, ethical, and responsible innovation strategies, and communicate business models effectively. (K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	2	2
CO2	3	3	2	-	-	-	-	2	-	-	-	2	2
Co3	3	3	2	-	-	-	-	2	-	-	-	2	2

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SEMESTER - IV

24BSMA404 - SDG NO. 3, 4, 11	COMPUTATIONAL STATISTICS	L	T	P	CP	C
		3	0	0	4	3

OBJECTIVES:

- To understand the main features of multivariate data.
- To enable the use of exploratory and confirmatory multivariate statistical methods effectively.
- To have insights into various cluster analysis methods
- To use Factor analysis and Principal component analysis to identify patterns in the correlations between variables.
- To apply multivariate statistical techniques efficiently using statistical software such as python.

MODULE - I MULTIVARIATE NORMAL DISTRIBUTION 8

Multivariate Normal Distribution Functions - Conditional Distribution and its relation to regression model - Estimation of parameters.

MODULE - II MULTIPLE LINEAR REGRESSION MODEL AND MULTIVARIATE REGRESSION 8

Standard multiple regression models with emphasis on detection of collinearity - outliers - non-normality and autocorrelation - Validation of model assumption. Assumptions of multivariate regression models - Parameter estimation.

MODULE - III DISCRIMINANT ANALYSIS 7

Multivariate Analysis of variance and covariance. Statistical background - linear discriminant function analysis - Estimating linear discriminant functions and their properties.

MODULE - IV PRINCIPAL COMPONENT ANALYSIS 7

Principal components - algorithms for conducting principal component analysis - deciding on how many principal components to retain - H-plot.

MODULE - V FACTOR ANALYSIS 7

Factor analysis model - extracting common factors - determining number of factors - Transformation of factors analysis solutions - Factor scores.

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MODULE - VI CLUSTER ANALYSIS **8**

Introduction - types of clustering - correlations and distances - clustering by partitioning methods - hierarchical clustering - overlapping clustering - K-means Clustering - Profiling and Interpreting Clusters.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Applied Multivariate Statistical Analysis, Richard A. Johnson & Dean W. Wichern, 6th Edition, Pearson Education, 2007.
2. An Introduction to Multivariate Statistical Analysis, T.W. Anderson, 3rd Edition, Wiley, 2003
3. Learning Python, Mark Lutz, 5th Edition, O' Reilly, 2013

REFERENCE BOOKS:

1. Applied Multivariate Data Analysis, Volume I: Regression and Experimental Design J. D. Jobson, 1st Edition, Springer, 1991.
2. Applied Multivariate Data Analysis, Volume II: Categorical and Multivariate Methods, 1st edition, J.D. Jobson, Springer, 1992.
3. Statistical Tests for Multivariate Analysis, H. Kris, 1st Edition, Springer – Verlag, Heidelberg, 2003.
4. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey, 1st Edition, Apress, 2009.
5. Beginning Python: From Novice to Professional, Magnus Lie Hetland, 2nd edition, Apress, 2009.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=YgExEVji7xs
2. https://youtu.be/Tso1ikpAzIc
3. https://www.youtube.com/watch?v=azXCzI57Yfc
4. https://setosa.io/ev/principal-component-analysis/
5. https://www.youtube.com/watch?v=Jkf-pGDdy7k
6. https://en.wikipedia.org/wiki/Cluster_analysis

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/105/110105060/
2. https://onlinecourses.nptel.ac.in/noc23_ee87/preview
3. http://nptel.ac.in/courses/111104024/

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COURSE OUTCOMES

Upon completion of the course, the student should be able to:

1. Apply multivariate normal distribution to analyze conditional relationships, regression models, and parameter estimation. (K3)
2. Apply multiple and multivariate regression models, assess model assumptions, and detect issues such as collinearity, outliers, non-normality, and autocorrelation.(K3)
3. Apply multivariate analysis techniques to perform and interpret linear discriminant function analysis and estimate related statistical properties.(K3)
4. Apply principal component analysis to reduce data dimensionality and interpret results using appropriate algorithms and visualizations.(K3)
5. Apply factor analysis techniques to extract and interpret common factors, determine the number of factors, and compute factor scores.(K3)
6. Apply various clustering techniques, including partitioning and hierarchical methods, to group data and interpret cluster profiles.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	2
CO6	3	-	-	-	-	-	-	-	-	-	-	3	2

SEMESTER - IV

24BSMA405 - SDG NO. 4	OPERATIONS RESEARCH WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4

OBJECTIVES:

- To provide students with knowledge and skills needed to apply various operations research tools and techniques for decision making in organizations.

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MODULE - I INTRODUCTION TO OPERATIONS RESEARCH & LINEAR PROGRAMMING **12**

Origin of OR and its definition – Types of OR problems – Deterministic vs stochastic optimization, Phases of OR – Problem formulation – Building mathematical model – Deriving solutions, validating model, Controlling and implementing solution. Linear programming – Example from industrial cases, Formulation of LPP – Implicit assumptions of LPP. Solution of LPP – Graphical method, Simplex method – Artificial variables – Big M method –Identification & resolution of special cases – Infeasibility, Unboundedness, Redundancy & Degeneracy.

MODULE - II DUALITY OF LPP AND SENSITIVITY ANALYSIS **10**

Duality of LPP – Formulation – Fundamental Theorem of duality, Dual – Simplex method and primal-dual algorithms- Sensitivity analysis.

MODULE - III TRANSPORTATION & ASSIGNMENT PROBLEMS **10**

Transportation problem – Introduction – Mathematical formulation – Balanced & Unbalanced Transportation Problems – Initial basic feasible solution – North-west corner rule – Least cost method – Vogel's approximation method – Test for optimality – MODI method – Degeneracy & its solution. Assignment problem – Introduction – Mathematical formulation – Balanced & Unbalanced Assignment Problem. Solution method – Hungarian algorithm.

MODULE - IV INVENTORY CONTROL **10**

Functions of inventory and its disadvantages - ABC analysis - Concept of inventory costs - Basics of inventory policy – Order, lead time. Fixed Order Quantity - Economic Order Quantity (EOQ) - Production Order Quantity (POQ) and Quantity Discount models. EOQ models for discrete units - sensitivity analysis and robustness - Special cases of EOQ models for safety stock with known / unknown stock out situation - models under prescribed policy – Probability situations.

MODULE - V QUEUING THEORY **10**

Definitions – Queue (waiting line) - waiting time costs - characteristics of queuing system (arrival, service & queue discipline) - queue types (channel vs phase). Kendall's notation - Little's formula - steady state behavior - Poisson's process & queue, Queuing models – M/M/1, M/M/c and its performance measures with examples – Brief description about some special models.

MODULE - VI PERT – CPM **8**

Project definition - project scheduling techniques – PERT & CPM - Gantt chart – Determination of critical paths - Estimation of project time and its variance in

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PERT. Concept of project crashing / time – Cost trade off. Simulation methodology: Definition and steps of simulation - random number - random number generator - discrete event system simulation – Clock, event list. Application in scheduling - Queuing systems and inventory systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Operation Research: An introduction, Hamdy A. Taha, 10th Edition, Pearson, 2017.

REFERENCE BOOKS:

1. Linear Programming, Katta G. Murty, 1st Edition, Wiley, 1983.
2. Linear programming, G. Hadley, 1st Edition, Addison-Wesley publishing company, 1978.
3. Principles of Operation Research with Applications to Managerial Decisions, H.M Wagnes, 2nd Edition, Englewood Cliffs: Prentice Hall, 1975.
4. Introduction to Operation Research, F.S. Hillier and G. J. Lieberman, 11th Edition, McGraw Hill, 2021.
5. Elements of Queuing Theory, with Applications, Thomas L. Saaty, 1st Edition, McGraw – Hill, New York, 1961.
6. Operations Research and Management Science, Hand Book: Edited by A. Ravi Ravindran, 1st edition, CRC press, 2007.
7. Management Guide to PERT / CPM, J.D. Wiest and F.K. Levy, 1st Edition, NJ: Prentice –Hall, 1969.
8. Modern Inventory Management, J.W. Prichard, R.H. Eagle, 1st Edition, Wiley, 1965.

WEB REFERENCES:

1. https://freevideolectures.com/course/2678/advanced-operations-research
2. https://onlinecourses.swayam2.ac.in/cec21_ma09

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111/105/111105039/
2. https://nptel.ac.in/courses/110/106/110106059/
3. https://nptel.ac.in/courses/110/106/110106062/
4. https://nptel.ac.in/courses/110/105/110105095/

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COURSE OUTCOMES

Upon completion of the course, the student should be able to:

1. Construct LP models for various types of problems and solve them using graphical methods and simplex algorithms and analyze the sensitivity of the optimal solution based on the changes in the model parameters. (K3)
2. Formulate the dual problem from primal and solve it to find the solution of the primal using duality principles. (K3)
3. Apply appropriate methods such as North-West Corner Rule, Least Cost Method, Vogel's Approximation Method, and MODI Method to find and optimize solutions for balanced and unbalanced transportation and assignment problems using the Hungarian Algorithm. (K3)
4. Apply inventory management techniques such as EOQ, POQ, Quantity Discount Models, and ABC analysis to determine optimal order policies, perform sensitivity analysis, and address safety stock scenarios under deterministic and probabilistic conditions(K3).
5. Derive the mathematical models of Markovian queues and compute various measures of performance through these models. (K3)
6. Construct networks and find optimal scheduling using CPM and PERT and apply simulation techniques in Project scheduling, Queueing and Inventory systems.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO4	3	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	3	3
CO6	3	-	-	-	-	-	-	-	-	-	-	3	3

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SEMESTER - IV

24CBPC401 106106220 SDG NO. 4	DATABASE MANAGEMENT SYSTEMS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To study the SQL and relational database design
- To understand the Query processing Techniques and internal storage structures using different file and indexing techniques
- To understand the fundamental concepts of transaction processing concurrency control techniques and database security concepts
- To know the advanced database systems

MODULE - I INTRODUCTION 7

Introduction to Database. Hierarchical, Network and Relational Models. Database system architecture: Data Abstraction, Data Independence. Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints.

MODULE - II RELATIONAL DATABASE DESIGN 8

Relational algebra, Tuple and domain relational calculus, Relational database design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design. Relational Data Model :Concept of Relations, Schema-Instance distinction, Keys, Referential integrity and Foreign keys.

MODULE - III INTERACTIVE SQL 7

SQL-Data Definition Languages(DDL), Data Manipulation Languages (DML), Data Control Languages(DCL), Transaction Control Language (TCL).Views, Sequences, Indexes. Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

MODULE - IV QUERY OPTIMIZATION AND STORAGE STRATEGIES 8

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. Storage strategies: Indices, B-trees, Hashing.

MODULE - V TRANSACTION PROCESSING AND DATABASE SECURITY 8

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic. Concurrency Control schemes, Database recovery: Database

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Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection

MODULE - VI ADVANCED TOPICS 7

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017

REFERENCE BOOKS:

1. A.Silberschatz, H.F.KorthS.Sudershan, "Database System Concepts", McGrawHill, 6th Edition 2010.
2. Thomas Connolly, Carolyn Begg, "Database Systems:A Practical Approach to Design, Implementation and Management", 6th Edition, 2012.
3. PramodJ. Sadalage and Martin Fowler, "NoSQL Distilled: A brief guide to merging the world of Polyglot persistence",Addison Wesley, 2012.
4. Shashank Tiwari,"Professional No Sql",Wiley,2011

ONLINE RESOURCES:

1. https://inst.eecs.berkeley.edu/~cs186/sp08/notes.html
2. https://www2.seas.gwu.edu/~bhagiweb/cs2541/lectures/lectures.html

WEB REFERENCES

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/lecture-notes/

OUTCOMES

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

1. Apply the concepts of database system architecture, data models, and integrity constraints to relational databases.(K3)

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2. Build complex database queries by applying relational algebra and calculus (K3)
3. Develop SQL queries using DDL, DML, DCL, and TCL across different DBMS platforms.(K3)
4. Utilize query execution plans and storage strategies such as indexing and hashing. (K3)
5. Examine transaction schedules to determine serializability and evaluate concurrency control mechanisms. (K4)
6. Develop an understanding of advanced database systems through real-world applications of object-oriented, distributed, and data warehousing.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	2	-
CO2	3	2	3	-	-	-	-	-	-	-	-	3	2
CO3	3	2	3	-	-	-	-	-	-	-	-	3	2
CO4	3	2	3	-	-	-	-	-	-	-	-	3	2
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3
CO6	2	2	3	-	-	-	-	-	-	-	2	3	3

SEMESTER - IV

24CBPW401 106106144 SDG NO. 4	OPERATING SYSTEMS WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4

OBJECTIVES:

- Learn concepts of operating systems .
- Learn the mechanisms of the OS to handle processes scheduling.
- Understand the semaphores and communication between two processes.
- Gaining knowledge of deadlock prevention and detection techniques.
- Study of various mechanisms involved in memory management techniques.
- Analyzing disk management and File Management functions and techniques and study of Linux OS.

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MODULE - I OPERATING SYSTEM OVERVIEW 6

Introduction - Concept of Operating Systems (OS) - Generations of OS – Types of OS - OS Services – Interrupt handling and System Calls - Basic architectural concepts of an OS - Concept of Virtual Machine - Resource Manager view - Process view and Hierarchical view of an OS.

MODULE - II PROCESS SCHEDULING 9

Processes – Definition - Process Relationship - Different states of a Process - Process State – transitions - Process Control Block (PCB) - Context switching - Thread: Definition - Various states - Benefits of threads - Types of threads - Concept of multi threads - Process Scheduling: Foundation and Scheduling objectives - Types of Schedulers – Scheduling criteria: CPU utilization – Throughput - Turnaround Time - Waiting Time - Response Time – Scheduling algorithms: Preemptive and non-pre-emptive – FCFS – SJF – RR – Multiprocessor scheduling: Real Time scheduling: RM and EDF.

MODULE - III INTER-PROCESS COMMUNICATION 6

Concurrent processes - precedence graphs - Critical Section - Race Conditions - Mutual Exclusion - Hardware Solution – Semaphore s - Strict Alternation - Peterson' s Solution - T h e Producer/Consumer Problem - Event Counters – Monitors - Message Passing - Classical IPC Problems: Reader's & Writer Problem - Dining Philosopher Problem - Barber's shop problem

MODULE - IV DEADLOCKS 6

Definition - Necessary and sufficient conditions for Deadlock – Deadlock Prevention – Deadlock Avoidance: Banker's algorithm - Deadlock detection and Recovery - Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP).

MODULE - V MEMORY MANAGEMENT 9

Basic concept - Logical and Physical address maps – Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction – Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference - Page allocation – Partitioning – Paging - Page fault - Working Set – Segmentation - Demand paging - Page Replacement algorithms: Optimal - First in First Out (FIFO) - Second Chance (SC) – Not recently used(NRU) and Least Recently used (LRU).

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MODULE - VI FILE SYSTEMS AND I/O SYSTEMS 9

I/O Hardware: I/O devices - Device controllers - Direct Memory Access - Principles of I/O -File Management: Concept of File - Access methods – File types - File operation – Directory structure - File System structure – Allocation methods (contiguous, linked, indexed) - Free-space management (bit vector, linked list, grouping) - directory implementation(linear list, hash table) - efficiency and performance - Disk Management: Disk structure – Disk scheduling – FCFS - SSTF – SCAN - C-SCAN – LOOK - Disk reliability – Disk formatting - Boot-block - Bad blocks.

Case study: UNIX OS file system, shell programming, programming with the standard I/O, UNIX system calls.

Lab Experiments:

1. Write programs using the following system calls of UNIX operating system fork,exec,getpid,exit,wait,close,stat,opendir,readdir,cp,ls,grep,etc
2. Write C programs to implement the various CPU scheduling Algorithms.
3. Implementation of Semaphores.
4. Implementation of Shared memory and IPC.
5. Bankers Algorithm for Deadlock Avoidance.
6. Implementation of Deadlock Detection Algorithm.
7. Write a C program to implement Threading & Synchronization Applications.
8. Implementation of the following Memory Allocation Methods for fixed partition(First Fit, Worst Fit, Best Fit)
9. Implementation of Paging Technique of Memory Management.
10. Implementation of the following Page Replacement Algorithms(FIFO,. LRU,LFU)

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.

REFERENCE BOOKS:

1. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.

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3. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
4. Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
6. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

OUTCOMES

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

1. Apply core operating system concepts, interrupt handling, architecture, and virtual machine principles. (K3)
2. Experiment with process management, including scheduling techniques and thread concepts, and analyze CPU scheduling algorithms for efficiency. (K3)
3. Build concurrent process solutions using mutual exclusion and synchronization techniques (K3)
4. Examine resource-sharing and deadlocks to implement effective prevention and detection methods (K4)
5. Analyze memory management techniques, including paging, segmentation, and page replacement Algorithms. (K4)
6. Analyze file system and I/O system operations to determine efficient methods for data handling and device management. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1	1
CO2	2	3	-	2	-	-	-	-	-	-	-	2	1
CO3	3	.	-	1	-	-	-	-	-	-	-	1	1
CO4	3	.	-	1	-	-	-	-	-	-	-	1	1
CO5	2	3	-	2	-	-	-	-	-	-	-	1	1
CO6	3	.	-	-	-	-	-	-	-	-	-	1	1

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SEMESTER - IV

24CBMG401 - SDG NO. 3, 4, 11	MARKETING MANAGEMENT	L	T	P	CP	C
		2	0	0	2	2

OBJECTIVES:

- Understand basic marketing concepts
- Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world
- Understand and develop insights and knowledge base of various concepts that driving digital marketing strategies.
- Assess the best practices in digital and social media marketing field across various markets.
- Develop proficiency in interpreting social media analytics.

MODULE - I INTRODUCTION 5

Marketing Concept and its Evolution; Nature, Scope and Importance of Marketing; Role of Marketing in Modern Business; Marketing Mix: Four Ps; Marketing Information Systems; Strategic Marketing Planning.

MODULE - II CONSUMER BEHAVIOUR 5

Concept and Determinants of Consumer Behavior - Buying Decision Process - Buying Motives - Buying Roles. Market Segmentation: Concept and Need; Principles; Basis for the Segmentation. Target Marketing and Positioning - Positioning Tools and Strategies.

MODULE - III PRODUCT, PRICE AND PROMOTION 5

Concept of Product; Consumer and Industrial Goods; Product Line and Product Mix Decisions; Product Life Cycle- Meaning and Stages; Branding: Concept and Elements; Price: Concept and Importance, Factors Affecting Price. Pricing Strategies: Price Discrimination, Price Skimming, Penetration Pricing and Discounts. Promotion Mix: Advertising- Definition Features and Functions; Advertising Media Legal and Ethical Aspects of Advertising; Types of Sales Promotion- Sales Promotion Techniques.

MODULE - IV DIGITAL MARKETING 5

Evolution of Digital Marketing from traditional to modern era- Role of Internet- Info-graphics, implications for business & society - Emergence of digital marketing as a tool- Drivers of the new marketing environment- Digital marketing strategy-Digital landscape- Digital marketing plan- Digital marketing models.

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MODULE - V SOCIAL MEDIA MARKETING 5

Introduction to social media platforms- Building a successful social media marketing strategy- Trends in Digital Advertising: Need for SEO- How to use internet & search engines and its working pattern- SEO Tactics.

MODULE - VI SOCIAL MEDIA ANALYTICS 5

Introduction-Types of Analytics in Social Media: Analytics, Listening, Advertising Analytics, Analytics from CMS and CRM, The Analytics Process, Metrics, Dashboards, and Reports- Google Analytics Features, Benefits, and Limitations, Google Analytics Reports, Creating custom reports, Dashboard and Segments.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Kotler, Philip: Marketing Management; Prentice Hall, New Jersey.
2. Condiff E.W. and Still, R.R., Basic Marketing Concepts, Decisions and Strategy; Prentice Hal of India, New Delhi.
3. Stanton W.J., Etzel Michael J and Walter Bruce J; Fundamentals of Marketing; McGraw Hill, NY
4. Rorsiter Johan R, Percy Larry: Advertising and Promotion Management; McGraw Hill, New York.
5. Aaker, David and Myers Johan G, et. al,: Advertising Management; Prentice Hall of India; New
6. Ramaswamy, Namakumari, Marketing Management, Mcgraw Hill Education.
7. RajanSaxena ,Marketing Management ,Tata Mcgraw Hill Education. 8. C.N.Sontakki, Marketing Management, Kalyani Publishers.

REFERENCE BOOKS:

1. S.A.Sherlekarand R.Krishnamoorthy,"Marketing Management", Himalaya Publishing House, 2015
2. Micheal R.Czinkota & Masaaki Kotabe,"Marketing Management", Vikas Thomson Learning, 2016
3. KS Chandrasekar, "Marketing Management Text and Cases", McGrawHill Publications, 2015.
4. NAG,"Marketing successfully-A Professional Perspective",Macmillan 2012.
5. Social Media Analytics Strategy,Alex Goncalves,Apress.
6. Advanced Web Metrics with Google Analytics, SYBEX, Brian Clifton, Second Edition.

Recommended by
Board of Studies of MBA dept.
Meeting No. 5 Dated: 11.6.24

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Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

ONLINE&WEBRESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg51/preview
2. https://www.edx.org/course/marketing management?index=product&queryID=d757b8fcf377fb56ab5f232913737553&position=1
3. https://www.edx.org/course/marketing-management 2?index=product&queryID=3f97462d431d5de04821d99a5a8ce238&position=2
4. https://www.udemy.com/course/event-marketing-how-to-create-a-successful-event-series/

OUTCOMES

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

1. Utilize the components of the marketing environment and identify the different fields in marketing. (K3)
2. Demonstrate methods of market segmentation, targeting, and positioning, and make use of marketing mix factors and methods. (K3)
3. Build consumer buying behaviour models and apply suitable methods to practical scenarios. (K3)
4. Examine key concepts of digital marketing by distinguishing consumer behaviour, online marketing communications, and social media marketing. (K4)
5. Analyse the importance of business and economic development by interpreting ideas of social media marketing and e-commerce. (K4)
6. Assess Social Media Analytics strategies used in digital marketing and justify their effectiveness. (K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	2	-	-	1	3	1	1	3	1	1
CO2	1	2	3	-	2	-	3	2	-	3	2	1	1
CO3	1	1	3	-	1	-	1	2	-	3	2	1	1
CO4	2	-	2	-	1	-	1	2	-	2	2	1	1
CO5	1	-	3	3	3	-	1	2	-	2	-	1	1
CO6	1	-	3	3	3	-	1	2	-	2	-	1	1

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Chennai, Tamil Nadu, India.

SEMESTER - IV

24CBMG402 - SDG NO. 4	FINANCIAL AND COST ACCOUNTING	L	T	P	CP	C
		2	1	0	3	3

OBJECTIVES:

- To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications.
- To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements.
- To create awareness about cost accounting, different types of costing and cost management.

MODULE - I ACCOUNTING CONCEPT 9

Introduction- Book Keeping and Record Maintenance-accounting concepts and Conventions Fundamental Principles and Double Entry, Journal, Ledger, Trial Balance-Subsidiary books- Trading, Profit and Loss accounts -Balance sheet

MODULE - II FINANCIAL STATEMENTS 9

Meaning-importance of financial statement-types-analysis Interpretation of Financial Statements-common size statement income and balance sheet - comparative balance sheet and interpretation - Ratio analysis-inter and intra firm comparative analysis -case study

MODULE - III FUNDS FLOW AND CASH FLOW STATEMENT 8

Funds- funds from operation- Fund flow Statement –cash from operation- Cash Flow Statement-distinguish between funds flow and cash flow statement.

MODULE - IV COSTING SYSTEMS 7

Cost-Meaning, importance-types-target costs, Job order costing, Process costing, Batch costing -marginal costing -Cost Volume Profit Analysis –Break Even Analysis.

MODULE - V BUDGETARY CONTROL, STANDARD COSTING 7

Standard costing and variance analysis-Techniques-Budgetary control-Techniques of budgetary control -types of budgets –flexible budget.

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Chennai, Tamil Nadu, India.

MODULE - VI ACCOUNTING REPORTING 5

AI in accounting decision making –merits-ERP-accounting software – billing and invoicing system.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Robert N Anthony, David Hawkins, Kenneth Marchant, "Accounting:Texts andCases",Thirteenth Edition, McGraw- Hill,2021
2. M.Y.Khan&P.K.Jain,"ManagementAccounting",TataMcGrawHill,2020.
3. R.Narayanaswamy, Financial Accounting–A managerial perspective, Fifth Edition,PHILearning,NewDelhi,2022.

REFERENCE BOOKS(S):

1. JanWilliams," Financial and Managerial Accounting–Thebasisfor businessDecisions",FifteenthEdition,TataMcGrawHillPublishers,2019
2. Horngren, Surdem, Stratton, Burgstahler,Schatzberg," Introduction to Management Accounting", Sixteenth Edition ,PHI Learning, 2018.
3. Stice&Stice," Financial Accounting Reporting and Analysis", Eight Edition, CengageLearning, 2018.
4. Singhvi Bodhanwala,"ManagementAccounting-Textandcases",Third Edition,PHILearning,2018.
5. AshishK. Battacharya, IntroductiontoFinancialStatementAnalysis, Elsevier,2012

ONLINE RESOURCES:

1. https://www.coursera.org/specializations/costaccounting
2. https://www.udemy.com/course/managementaccounting/
3. https://onlinecourses.nptel.ac.in/noc19_mg38/preview
4. https://alison.com/course/diploma-in-cost-accounting
5. http://ecoursesonline.iasri.res.in/course/view.php?id=485

OUTCOMES

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

1. Apply the basic concepts of financial and cost accounting to practical situations. (K3)
2. Demonstrate the interpretation of various financial and management accounting results for decision-making. (K3)
3. Utilize the basic concepts of management accounting for in-depth understanding and problem-solving. (K3)

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4. Possess the knowledge of applying in cost-oriented problem solving in an organization. (K3)
5. Analyze the problems that arise in standard costing and budgetary control techniques by breaking down and interpreting the acquired knowledge. (K4)
6. Evaluate the financial reporting system to assess its effectiveness in providing accurate and timely information to top-level management.(K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	-	2	-	-	-	1	3	1	3	3
CO2	2	1	2	3	2	1	1	-	-	2	1	3	2
CO3	2	1	2	2	2	2	-	-	-	2	1	3	2
CO4	2	1	2	3	2	2	-	-	1	1	2	3	3
CO5	2	1	2	3	2	1	--	-	1	2	1	2	2
CO6	2	1	2	2	3	3	-	-	1	1	1	3	2

SEMESTER - IV

24HSNC401 - SDG NO. 4	NCC COURSE LEVEL 3	L	T	P	CP	C
		3	0	0	3	0

ARMY WING

PERSONALITY DEVELOPMENT **9**

PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4

BORDER & COASTAL AREAS **4**

BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2

ARMED FORCES 3

AF 2	Modes of Entry to Army, CAPF, Police	3

COMMUNICATION **3**

C 1	Introduction to Communication & Latest Trends	3

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INFANTRY **3**

INF 1 Organisation of Infantry Battalion & its weapons 3

MILITARY HISTORY **23**

MH 1 Biographies of Renowned Generals 4

MH 2 War Heroes - PVC Awardees 4

MH 3 Study of Battles - Indo Pak War 1965, 1971 & Kargil 9

MH 4 War Movies 6

TOTAL: 45 PERIODS

NAVAL WING

PERSONALITY DEVELOPMENT **9**

PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6

PD 5 Public Speaking 3

LEADERSHIP 7

L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT **13**

DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3

DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9

DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION **3**

EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

NAVAL ORIENTATION 6

AF 1 Armed Forces and Navy Capsule 3

EEZ 1 EEZ Maritime Security and ICG 3

ADVENTURE 1

AD 1 Introduction to Adventure Activities 1

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BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2
		TOTAL: 45 PERIODS
AIR FORCE WING		
PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
AIRMANSHIP		**1**
A 1	Airmanship	1
BASIC FLIGHT INSTRUMENTS		**3**
FI 1	Basic Flight Instruments	3
AERO MODELLING		**3**
AM 1	Aero Modelling Capsule	3
GENERAL SERVICE KNOWLEDGE		**2**
GSK 4	Latest Trends & Acquisitions	2
AIR CAMPAIGNS		**6**
AC 1	Air Campaigns	6
PRINCIPLES OF FLIGHT		**6**
PF 1	Principles of Flight	3
PF 2	Forces acting on Aircraft	3
NAVIGATION		**5**
NM 1	Navigation	2
NM 2	Introduction to Met and Atmosphere	3
		TOTAL: 45 PERIODS

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Meeting No. 6 Dated: 31/5/24

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Board of Studies
Department of Humanities & Sciences

SEMESTER - IV

24CBPL401 - SDG NO. 3, 4, 11	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To understand and learn the data definitions and data manipulation commands
- To use of nested and join queries
- To learn functions, procedures and procedural extensions of databases
- To be familiarize with the use of front end tool
- To expose the DBMS concepts on different applications

LIST OF EXPERIMENTS:

1. Database Design using ER modeling, normalization and Implementation for any application.
2. Data definition commands, Data manipulation commands performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Database querying – Simple queries, Nested queries, sub queries and join queries to retrieve information from the database.
4. Creation of Views, Synonyms, Sequence, Indexes, Save point.
5. Creation of Cursors, Procedures and Functions
6. Creation of Triggers
7. Write a PL/SQL block that handles all types of exceptions.

Mini project (Application Development using Oracle/ Mysql)

a. Inventory Control System.
b. Material Requirement Processing.
c. Hospital Management System.
d. Railway Reservation System.
e. Personal Information System.
f. Web Based User Identification System.
g. Timetable Management System.
h. Hotel Management System

TOTAL: 45 PERIODS

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:

Standalone desktops 30 Nos. (or)

Server supporting 30 terminals or more. 107

SOFTWARE:

Front end: VB/VC ++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/ PostGress / DB2 or Equivalent

OUTCOMES

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

1. Create databases with different types of key constraints. (K6)
2. Design and implement a database schema for a given problem-domain by using typical data definitions and manipulation commands. (K6)
3. Analyse the database and normalise it. (K4)
4. Populate and query a database for implementing in real world applications. (K3)
5. Demonstrate PL/SQL programming using stored procedures, functions and packages. (K6)
6. Design front end and back end for enterprise applications . (K6)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	1	-	1	-	-	-	-	-	1	1	-
CO2	1	1	2		-	-	-	-	-	-	1	2	-
CO3	-	2		2	-	-	-	-	-	-	-	2	-
CO4	-	1	2		-	-	-	-	-	-	1	2	-
CO5	-	-	1	2	2	-	-	-	-	-	1	2	-
CO6	-	-	3		2	-	-	-	-	-	2	2	-

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SEMESTER - IV

24CSPT401 - SDG NO. 4 & 9	OBJECT ORIENTED PROGRAMMING LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To understand Object Oriented Programming concepts and principles of Packages, Inheritance and Interfaces
- To have the understanding of Exceptions and to make use I/O streams
- To develop a Java application with threads and generic classes.
- To design and build simple Graphical User Interfaces
- To build interactive applications using Lambda and Reactive Programming.

MODULE - I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 8

Object Oriented Programming - Abstraction - Objects and Classes -Encapsulation- Inheritance - Polymorphism- Characteristics of Java - The Java Environment - Java Source File - Compilation - Fundamental Programming Structures in Java - Defining Classes in Java - Constructors Methods -Access Specifiers- Static Members - Comments - Data Types -Variables - Operators - Control Flow - Arrays - Packages - Javadoc Comment

LIST OF EXPERIMENTS

1. Write a program to find the sum of individual digits of a positive integer.
2. Write a program to generate the first n terms of the sequence.
3. Write a program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a program to find both the largest and smallest number in a list of integers.
5. Write a Java program to implement a package for currency, distance and time converter.

MODULE - II INHERITANCE AND INTERFACES 8

Inheritance - Superclasses- Subclasses -Protected Members - Constructors in SubClasses- The Object Class - Abstract Classes and Methods- FinalMethods and Classes - Interfaces - Defining an Interface - ImplementingInterface - Differences Between Classes and Interfaces - Extending interfaces -Object Cloning - Inner Classes - Strings.

LIST OF EXPERIMENTS

1. Write a Java program that creates a class hierarchy for employees of a company. The base class should be Employee, with subclasses Manager, Developer, and Programmer. Each subclass should have properties such as

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name, address, salary, and job title. Implement methods for calculating bonuses, generating performance reports, and managing projects.

2. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape. Use interface Concept.
3. Write a Java program to perform the following operations.

a. Find the string index.
b. Compare two strings.
c. Retrieve the single character from sting.
d. Find the substring of the given string.
e. Split the string.

MODULE - III EXCEPTION HANDLING AND I/O **8**

Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – BuiltIn Exceptions - Creating Own Exceptions - Stack Trace Elements - Input /Output Basics – Streams – Byte Streams and Character Streams – Reading and Writing Console – Reading and Writing Files.

LIST OF EXPERIMENTS

1. Create a Custom Exception for Invalid Age Input in a Voting System.
2. Design a Java interface for ADT Stack. Implement this interface using an array. Provide necessary exception handling in both the implementations.
3. Write a Java Program that opens a file using FileReader and handles FileNotFoundException and IOException.
4. Write a Java program that reads the contents of a text file named input.txt and creates a new file named output.txt that contains the same contents in uppercase letters.
5. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.

MODULE - IV MULTI-THREADING AND GENERIC PROGRAMING **7**

Differences between Multithreading and Multitasking - Thread Life Cycle - Creating Threads - Synchronizing Threads - Inter-Thread Communication - Daemon Threads - Thread Groups - Java Concurrency Packages - Generic Programming – Generic Classes – Generic Methods – Bounded Types – Restrictions and Limitations.

LIST OF EXPERIMENTS

1. Write a Java Program to calculate the sum of the array using Multi threading.

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2. Write a Java program to create a producer-consumer scenario using the wait() and notify() methods for thread synchronization.
3. Write a Java Program to implement to create multiple threads which prints the message alternatively.
4. Write a Java Program to create a generic method that takes a list of any type and returns it as a new list with the elements in reverse order.
5. Write a Java Program using Generic Classes to count the number of occurrences of the element in a list.

MODULE - V GUI PROGRAMMING WITH SWINGS **7**

Swing – Jframe, Jlabel, Jbutton, Jpanel – Handling Events – ActionListener – Layouts – Swing Components - JTextField, JCheckBox, JRadioButton, JcomboBox – Menu and Menubar – Dialog Box – Model –View Controller (MVC) – File Handling – Creating applications.

LIST OF EXPERIMENTS

1. Create a simple GUI that changes the background color of a panel based on button clicks using Swing components.
2. Write a Java Program to build a Calculator in Swings
3. Write a Java program to design student registration form using Swing controls.
4. Write a Java Program to display Digital Watch using Swings.
5. Write a Java Program using Swings to develop a simple inventory management system that allows users to add, remove, and update inventory items.

MODULE – VI LAMBDA EXPRESSIONS AND REACTIVE PROGRAMMING **7**

Lambda expressions – Library Enhancements to Support Lambdas – No Parameter-Single Parameter - Multiple Parameters – With or Without Return Keyword-Comparator– Filter Collection Data-Streams-Generating Streams-Java Stream Interface Methods – For each Map-Filter-Limit-Sorted.

LIST OF EXPERIMENTS

1. Write a Java Program to sort a list of Strings using Lambda function.
2. Write a Java Program to use map () to double each element in a list using Lambda.
3. Write a Java Program to filter even numbers from an ArrayList using Collections.
4. Write a Java program that concatenates all strings in a list into a single string using lambda expression.
5. Write a Java Program to create a stream that emits a sequence of numbers (e.g., 1 to 5) using a transformation operator.

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LAB REQUIREMENTS:

1. Standalone desktops with Systems with either Netbeans or Eclipse / Windows operating system / JDK 1.8, 30 Nos.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, "Java - The Complete Reference", 8th Edition, McGrawHill Education, 2011.
2. E.Balagursamy- "Programming with Java", 6th Edition, McGrawHill Education, 2019.

REFERENCES:

1. Paul Deitel, Harvey Deitel, "Java SE 8 for Programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Blackbook", Dream Tech Press, 2011.
3. Timothy Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education, 2000.
4. Kathy Sierra, Bert Bates, Trisha Gee, "Head First Java", 3rd Edition, O'Reilly, 2022.
5. Joshua Bloch, "Effective Java", 3rd Edition, Addison Wesley, 2018.

WEB REFERENCES:

1. https://www.w3schools.com/java/java_oop.asp
2. https://www.edureka.co/blog/object-oriented-programming/
3. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html

OUTCOMES

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

1. Implement Object-Oriented Programming concepts in Java to develop solutions using packages and inheritance.(K3)
2. Construct Java applications using exceptions, I/O streams, multithreading, and generic classes.(K3)
3. Examine real-time applications using the concepts of Swing, lambda expressions, streams, and reactive programming.(K4)

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CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	3	-	-	-	-	2	-	-	-	3	3
CO2	3	-	-	-	-	-	-		2	-	-	3	3
CO3	-	-	-	3	-	-	-	2	-	-	-	3	3

SEMESTER - IV

24CBTP401 - SDG NO. 4	APTITUDE SKILLS - II	L	T	P	CP	C
		0	0	2	2	0

PROBLEM SOLVING USING JAVA - PHASE 1

OBJECTIVES:

- Develop strong algorithmic problem-solving skills using Java
- Enable students to analyze problems and design efficient solutions
- Familiarize students with coding patterns used in technical interviews and prepare students for competitive programming and placement coding rounds

MODULE - I FOUNDATIONS OF JAVA PROBLEM SOLVING 16

Competitive programming mindset, Understanding problem statements and constraints, Java input and output handling, Time and space complexity, Asymptotic notations, Loop and recursion analysis, Arrays and strings problem patterns, Prefix sum, Sliding window, Two-pointer techniques.

MODULE - II SEARCHING, SORTING AND ADVANCED TECHNIQUES 15

Binary search patterns, Search on answer technique, Sorting-based problem solving, Stack and queue applications, Monotonic stack, Simulation problems, Recursion templates, Backtracking framework, Constraint-based problem solving.

MODULE - IIIDYNAMIC PROGRAMMING, GREEDY AND GRAPH BASICS14

Dynamic programming principles, Memorization and tabulation, One-dimensional and two-dimensional DP problems, Greedy strategies, Interval problems, Graph traversal basics – BFS and DFS, Competitive coding strategies.

TOTAL: 45 PERIODS

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REFERENCES:

1. Herbert Schildt, Java: The Complete Reference, McGraw Hill.
2. E. Balagurusamy, Programming with Java, McGraw Hill Education

ONLINE RESOURCES

1. LeetCode – https://leetcode.com
2. HackerRank – https://www.hackerrank.com
3. GeeksforGeeks – Java and DSA Track

LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS - PHASE 2

OBJECTIVES:

- Explore core domain BIS standards related to Information security and AI.
- Implement strategies to learn career and managerial skills for career growth.

MODULE - I JEEVAN KAUSHAL 2.0 – CAREER SKILLS AND MANAGERIAL SKILLS **14**

Group Discussion Skills - Meaning and Methods of Group Discussion - Procedure of Group Discussion - Group Discussion - Simulation - Group Discussion - Common Errors.

Managerial Skills - Basic Managerial Skills - Planning for effective management - How to organize teams? - Recruiting and retaining talent - Delegation of tasks - Learn to coordinate - Conflict management - Self-management Skills - Understanding self-concept - Developing self-awareness - Self-examination - Self-reflection and Introspection - Self-regulation.

Entrepreneurial Skills - Basics of Entrepreneurship - Meaning of entrepreneurship – Classification and types of entrepreneurships - Traits and competencies of entrepreneur -. Creating Business Plan - Problem identification and idea generation - Idea validation - Pitch making.

Managing Personal Finance - Budgeting - Setting personal goals - Estimate likely expenses Monitor spending to obtain the most value for the available funds - Saving and Investing - Advantages of saving money - Concept of present and future value of money.

MODULE - II RANGER AND ROVER **10**

Scouting for Boys: Scout Craft, Campaigning.

Knots: Managing of rope, types of ropes and uses, Basic Knots: - Clove Hitch, Reef Knot, Fisherman knot, Sheet bend, Bowline, Sheep shank, whippings.

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Growing Together: Understanding the growth context.

Intergenerational Dialogue: How to enhance learning and cooperation across generations.

MODULE - III INFORMATION SECURITY & ARTIFICIAL INTELLIGENCE 6

Information security, network security and privacy protection: Introduction to the standards and concepts related to security [CIA (Confidentiality, Integrity, and Availability)] and privacy.

Software - Quality Assurance, Life Cycle & Testing: Introduction to Software life cycle processes and Software Testing (IS 16124 and IS 11291).

Artificial Intelligence: Introduction to the concepts of Artificial Intelligence and related standards:

- Overview of trustworthiness in artificial intelligence.
- Framework for Artificial Intelligence (AI) Systems Using Machine Learning (ML).
- AI system life cycle processes.
- Data life cycle framework.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/courses/show/214175?force_course_hub=true
2. https://lms.scout.org/courses/show/214194?force_course_hub=true

OUTCOMES

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

1. Interpret problem statements and develop Java programs with appropriate complexity analysis.
2. Apply array, string, searching, sorting, stack, and queue based problem-solving techniques.
3. Design solutions using recursion, backtracking, and dynamic programming approaches.
4. Solve real-time and placement-oriented problems using greedy techniques and graph traversal basics.

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5. Demonstrate career and managerial skills. (K2)
6. Understand BIS standards for Information security and AI domain. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	2	-	-
CO3	3	3	3	3	2	-	-	-	-	-	2	2	2
CO4	3	3	3	2	3	-	-	-	2	1	3	-	-
CO5	-	-	-	-	-	3	-	-	1	-	2	2	2
CO6	-	-	-	-	-	3	-	-	1	-	2	2	2

SEMESTER - IV

24CBID401 - SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To empower students to transform innovative ideas into viable venture blueprints through structured entrepreneurial exploration and opportunity framing.
- To provide experiential learning in adaptive product evolution by focusing on user-centric redesign, iterative testing, and technical refinement.
- To develop proficiency in assessing market traction, decoding customer behavior, and aligning product strategy with investment-readiness metrics.
- To instill a foundation of ethical entrepreneurship by integrating inclusive design principles, sustainability values, and responsible leadership.
- To enable data-driven innovation by leveraging field research, applying performance analytics, and integrating emerging technologies for solution optimization.
- To facilitate multidisciplinary problem-solving through advanced engineering integration, MVP systemization, and standards-compliant validation.

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COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, focusing on the practical execution and refinement of entrepreneurial ventures.
2. The project work must involve the continuous development, iterative enhancement, and potential launch of an entrepreneurial solution. It must also include appropriate elements of the following: compliance with advanced engineering standards, iterative design analysis, enhanced prototyping, robust experimentation, real-world user feedback collection, data correlation, and advanced software/hardware development for the solution.
3. Projects can be individual work or group projects, with a maximum of Three students. In case of a group project, each student must submit an individual project report clearly specifying their unique contributions to the collective work.
4. On completion of the project, the student shall submit a detailed project report encompassing the evolution of their venture, technical implementation, market validation, and future roadmap. The project shall undergo a formal review process, after which the report will be evaluated. Students shall appear for a mandatory viva-voce examination on the project, approved jointly by the Coordinator and the respective project guide.

EVALUATION:

1. First evaluation (Immediately after first internal examination): 20 marks (Focus on refined problem statement, advanced MVP design, and detailed development plan)
2. Second evaluation (Immediately after second internal examination): 30 marks (Focus on prototype/MVP implementation, initial testing, and preliminary market validation results)
3. Final evaluation (Last week of the semester): 50 marks (Focus on the complete refined solution, comprehensive market validation, growth strategy, final project report, and viva-voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply structured entrepreneurial exploration to convert innovative ideas into venture blueprints, incorporating user-centric and iterative design approaches. (K4)

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2. Assess customer behavior and market trac strategies with ethical and sustainable (K5)
3. Integrate multidisciplinary knowledge, t technologies to optimize and validate engi.

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	3	3	2	-	-	-	-	2	-	-	-	
CO2	3	3	2	-	-	-	-	2	-	-	-	2
CO3	3	3	2	-	-	-	-	2	-	-	-	2

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SEMESTER V

COURSE CODE: 24CBPC501	COMPILER DESIGN	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105190	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24CBPC301					

OBJECTIVES:

- Learn the various phases of a Compiler.
- Analyze the various parsing techniques and different levels of translation.
- Understand Semantic analysis and run-time environment.
- Understand intermediate code generation and optimization.
- Learn about code improvement and type systems.

MODULE - I INTRODUCTION TO COMPILERS 6

Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (Lex, Flex).

MODULE - II SYNTAX ANALYSIS 10

Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(0), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, parser generator (yacc, bison).

MODULE - III SEMANTIC ANALYSIS 8

Attribute grammars, syntax directed definition, evaluation and flow of attributes in a syntax tree.

MODULE - IV SYMBOL TABLE & RUN-TIME ENVIRONMENT 8

Symbol Table: Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory location, scope.

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MODULE - V INTERMEDIATE CODE GENERATION & OPTIMIZATION 7

Translation of different language features, different types of intermediate forms. Code Improvement: Control-flow, data-flow dependence, local optimization, global optimization, loop optimization, peephole optimization.

MODULE - VI ADVANCED CODE OPTIMIZATION & ARCHITECTURE 6

Instruction scheduling (pipeline), loop optimization (cache memory), register allocation, target code generation, type systems, data abstraction, compilation of object-oriented features and non-imperative programming language

TOTAL : 45 PERIODS

TEXT BOOK:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers-Principles, Techniques and Tools", Second Edition, Pearson Education,2007.

REFERENCE BOOKS:

1. Doug Brown, John Levine, and Tony Mason, "Lex & Yacc Second Edition,O'Reilly & Associates, 1995.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation,Morgan Kaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.
3. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

WEB REFERENCES:

1. http://www.cs.usfca.edu/~galles/compilerdesign/x86.pdf

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/compiler_design/index.htm

OUTCOMES:

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

1. Implement the phases of a compiler to process source programs. (K3)
2. Construct lexical analyzers using regular expressions and finite automata. (K3)
3. Apply parsing techniques to generate syntax trees for given grammars. (K3)

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4. Utilize semantic analysis methods to handle attributes and symbol tables. (K3)
5. Illustrate intermediate code and employ optimization techniques to enhance performance. (K3)
6. Make use of efficient target code by incorporating code generation and architecture-based optimizations. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	2	-	-	–	-	-	-	2	2
CO2	3	3	2	2	3	-	-	–	-	-	-	1	1
CO3	3	3	3	2	2	-	-	–	-	-	-	1	1
CO4	3	2	2	-	2	-	-	–	-	-	-	2	1
CO5	3	3	2	2	3	-	-	–	-	-	-	1	2
CO6	3	3	3	2	3	-	-	–	-	-	-	2	1

SEMESTER V

COURSE CODE: 24CBPW501	DESIGN AND ANALYSIS OF ALGORITHMS WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4
NPTEL CODE: 106106131	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24CBPC201					

OBJECTIVES:

- Understand the principles and performance analysis of algorithms.
- Apply asymptotic notations and recurrence relations to analyze algorithm efficiency.
- Apply algorithm design paradigms to solve computational problems.
- Implement graph and tree algorithms for problem-solving.

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- Analyze computational complexity and tractability of problems.
- Explore advanced algorithmic approaches including approximation, randomized and quantum algorithms.

MODULE - I INTRODUCTION TO ALGORITHMS **7**

Characteristics of Algorithms - Analysis of Algorithms - Asymptotic Analysis - Complexity Bounds - Best, Average and Worst-case Analysis - Performance Measurement of Algorithms - Time and Space Trade-offs

MODULE - II ANALYSIS OF RECURSIVE ALGORITHMS **8**

Recursive Algorithms - Recurrence Relations – Substitution Method - Recursion Tree Method - Master's Theorem - Comparative Analysis of Recursive Solutions

MODULE - III ALGORITHMIC DESIGN STRATEGIES **8**

Brute Force Method - Heuristics - Greedy Method - Dynamic Programming - Branch and Bound - Backtracking Techniques - Applications: Bin Packing , Knapsack Problem , Travelling Salesman Problem.

MODULE- IV GRAPH AND TREE ALGORITHMS **8**

Graph Traversal Techniques - Depth First Search (DFS) - Breadth First Search (BFS) - Shortest Path Algorithms - Transitive Closure - Minimum Spanning Tree - Topological Sorting - Network Flow Algorithms

MODULE - V COMPUTABILITY AND COMPLEXITY **7**

Computability of Algorithms - Complexity Classes – P, NP, NP-Complete, NP-Hard - Cook's Theorem - Standard NP-Complete Problems - Reduction Techniques

MODULE - VI ADVANCED ALGORITHMIC TOPICS **7**

Approximation Algorithms - Randomized Algorithms - Problems Beyond NP - PSPACE- Introduction to Quantum Algorithms

TOTAL : 45 PERIODS

Laboratory Experiments

1. Implement Bin Packing Algorithm and analyze its execution efficiency.
2. Develop and implement Knapsack Problem using Greedy Method and compare solution performance.

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3. Implement Travelling Salesman Problem using Dynamic Programming and evaluate optimal route generation.
4. Develop programs for Binary Tree Traversals
5. Implement Graph Traversal Algorithms .
6. Develop and implement Dijkstra's Shortest Path Algorithm for weighted graphs.
8.. Implement Minimum Spanning Tree Algorithms: Prim's Algorithm and Kruskal's Algorithm.
9. Develop and implement Topological Sorting Algorithm for Directed Acyclic Graph (DAG).
10. Implement Network Flow Algorithm to determine maximum flow in a graph.

TEXT BOOK:

1. E. Horowitz and S. Sahni., "Fundamental of Computer Algorithms", Second Edition, Computer Science Press, 2008.
2. Aho, J. Hopcroft and J. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley Publishing Company, 1974.

REFERENCE BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, PHI Learning Private Limited, Third Edition, 2012.
2. Donald E. Knuth, The Art of Computer Programming, Addison-Wesley, 3rd Edition, 1998.
3. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Edition, 2010.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106101060
2. https://www.cse.iitm.ac.in/course_details.php?arg=OTI

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/
2. http://www.learnalgorithms.in/
3. https://courses.cs.vt.edu/ cs online/Algorithms/Lessons/

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OUTCOMES:

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

1. Apply algorithm performance using asymptotic notations, complexity measures, and time–space trade-offs. (K3)
2. Examine recursive algorithms by applying recurrence relation solving techniques and comparing computational efficiency. (K4)
3. Analyze and select appropriate algorithm design strategies to solve optimization and decision-making problems. (K4)
4. Apply graph and tree algorithms to determine suitable solutions for traversal and network-related problems. (K3)
5. Analyze computational problems using complexity classes and reduction techniques to determine tractability. (K4)
6. Analyze advanced algorithmic approaches to evaluate solutions for complex computational problems. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	2	-	-	-	-	-	-	1	2
CO2	3	3	2	2	2	-	-	-	-	-	-	1	2
CO3	3	3	2	3	3	-	-	-	-	-	-	1	1
CO4	3	3	1	2	1	-	-	-	-	-	-	1	1
CO5	2	3	2	3	2	-	-	-	-	-	-	1	1
CO6	3	3	3	3	3	-	-	-	2	2	-	1	1

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SEMESTER V

COURSE CODE: 24CBMG501	HUMAN RESOURCE MANAGEMENT	L	T	P	CP	C
		2	0	0	2	2
NPTEL CODE: 109105121	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24CBMG301					

OBJECTIVES:

- Facilitate students to imbibe knowledge about understanding the basic concepts and importance of Human Resources Management, Recruitment, Training, Communications, Employee Empowerment, Employee Interaction, Various Human Resources Applications and Practices, Managerial functions etc.

MODULE - I HUMAN RESOURCES MANAGEMENT 5

Human Resource Management – Importance and Challenges – Human Resource Policy, Procedures and Practices.

MODULE - II HUMAN RESOURCE PLANNING 5

Human Resource Planning – Human Resource Demand, Forecasting and Supply – Human Resource Retention and Strategy – Performance Appraisal – Benefits, Methods.

MODULE - III HUMAN RESOURCE FUNCTIONS 5

Human Resource Functions – Recruitment and Staffing, Training – Types Of Training, Compensation, Promotion – Types Of Promotion – Job Security in Software Division – Employees Relations – Human Resource Information Systems and Payroll.

MODULE - IV QUALITY OF WORK LIFE 5

Quality of Work Life – Need and Importance of Workplace Environment – Stress Management, IQ vs EQ, Cross Culture and Adoptability in MNC's Environment.

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Dr. K.MARAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

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MODULE - V STRATEGIC HUMAN RESOURCE MANAGEMENT **5**

Strategic Management of Human Resources – SHRM , Relationship Between HR and Corporate Strategy, Strategies for Managing Careers.

MODULE - VI TALENT MANAGEMENT AND COMPETENCY DEVELOPMENT **5**

Career and Competency Management - Talent Acquisition and Retention, Competency Needs for Recruitment, Recruitment Based on Competencies, Employee Retention Strategies, Retaining and Developing Talent in Organizations.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Pearson Gary Dessler, Human Resource Management, 17th Edition, Pearson Education, 2024.
2. McGraw Hill Education Raymond A. Noe, John R. Hollenbeck, Barry Gerhart and Patrick M. Wright, Human Resource Management: Gaining a Competitive Advantage, 12th Edition, McGraw Hill, 2024.
3. McGraw Hill Education India K. Aswathappa, Human Resource Management: Text and Cases, 11th Edition, McGraw Hill Education, 2023.

REFERENCE BOOKS

1. Sultan Chand & Sons Dr. C.B. Gupta, Human Resource Management: Text and Cases, 20th Revised Edition, Sultan Chand & Sons, New Delhi, 2025.
2. S. Chand Publishing Dr. S.S. Khanka, Human Resource Management (Text and Cases), 2nd Edition, S. Chand Publishing, New Delhi, 2019.
3. Wiley India Susan L. Verhulst, David A. DeCenzo and Promila Agarwal, Human Resource Management: An Indian Adaptation, 15th Edition, Wiley India, 2025.

OUTCOMES:

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

1. Identify the basic principles and functions of Human Resource Management. (K3)
2. Utilize the concepts and system design of Human Resource Management. (K3)
3. Analyze the roles, functional areas and activities involved in HR management. (K4)

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DR. K.MARAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

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4. Experiment with employee motivation, satisfaction, fair treatment and quality of work life in organizations. (K3)
5. Apply HR strategies and practices to improve organizational performance and sustainability. (K3)
6. Analyze talent management, competency development and retention strategies for effective workforce management. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	1	1	2	1
CO2	2	3	3	2	2	-	-	-	-	1	1	2	1
CO3	2	2	2	2	2	-	-	-	-	1	1	2	1
CO4	2	2	2	2	1	-	-	-	-	1	1	2	1
CO5	2	2	2	2	1	-	-	-	-	1	1	2	1
CO6	2	3	2	3	2	-	-	-	-	1	1	2	2

SEMESTER V

COURSE CODE: 24MGMC501	CONSTITUTION OF INDIA	L	T	P	CP	C
		2	0	0	2	0
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- To know about Indian constitution.
- To know about central government functionalities in India.
- To know about state government functionalities in India.
- To know about Constitution function.
- To Know about Constitutional remedies

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MODULE - I INTRODUCTION 5

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties.

MODULE - II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 5

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

MODULE - III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 5

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

MODULE - IV CONSTITUTION FUNCTIONS 5

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

MODULE - V CONSTITUTIONAL REMEDIES 5

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

MODULE - VI CONSTITUTIONAL GOVERNANCE IN THE DIGITAL ERA AND CONTEMPORARY ISSUES 5

Constitutional Values and Good Governance – Right to Information (RTI) and Citizen Participation – Digital Governance and e-Governance Initiatives in India – Constitutional Perspectives on Artificial Intelligence (AI) and Emerging Technologies.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Durga Das Basu, Introduction to the Constitution of India, 27th Edition (2024), LexisNexis Butterworths Wadhwa.
2. M. V. Pylee, An Introduction to the Constitution of India, Latest Revised Edition (2024), Vikas Publishing House.

Recommended in Board of Studies (BoS) Meeting No. 8 **held on** 12.6.2025

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3. P. M. Bakshi, The Constitution of India, 18th Edition (2025), Universal LexisNexis
4. Brij Kishore Sharma, Introduction to the Constitution of India, 15th Edition (2024), PHI Learning

REFERENCE BOOKS:

1. D. D. Basu, Shorter Constitution of India, Latest Revised Edition, LexisNexis
2. Subhash C. Kashyap, Our Constitution: An Introduction to India's Constitution and Constitutional Law, Latest Edition, National Book Trust
3. M. Laxmikanth, Indian Polity, 7th Edition (2025), McGraw Hill Education
4. J. N. Pandey, Constitutional Law of India, Latest Edition (2024), Central Law Agency.
5. V. N. Shukla, Constitution of India, Revised by Mahendra Pal Singh, 14th Edition / Latest Available Edition, Eastern Book Company

ONLINE REFERENCES

1. https://iasexamportal.com/ebook/the-constitution-of-india
2. https://eclass.cc/courses/udemy_basics_of_indian_constitution_a_refresher_course
3. https://ox.libguides.com/c.php?g=422964&p=2888489
4. https://mylaw.net/litigation/constitutional-law-course
5. www.tutorialspoint.com/indian_polity/indian_polity_sources_consitution.htm
6. www.drishtiias.com/gs-special/gs-special-polity/important-sources-of-the-indian-constitution
7. www.india.gov.in/my-government/constitution-india/constitution-india-full-text
8. http://legislative.gov.in/constitution-of-india

MOOC REFERENCES

1. https://www.mooc-list.com/tags/law
2. https://www.udemy.com/course/polity-and-constitution/
3. https://swayam.gov.in/nd2_cec19_hs13/preview
4. https://www.udemy.com/course/basics-of-indian-constitution-a-refresher-course/

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OUTCOMES:

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

1. Explain the historical evolution, philosophy and fundamental principles of the Constitution of India. (K2)
2. Describe the structure, powers and functions of the Union Government under the Constitution. (K2)
3. Interpret the structure and functioning of State Governments and the judicial system in India. (K2)
4. Analyze federal relations, constitutional amendments and constitutional functionaries. (K4)
5. Examine constitutional remedies and mechanisms for protection of fundamental rights. (K4)
6. Apply constitutional values and principles to contemporary governance, digital rights, AI ethics and emerging societal challenges. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	1	-	-	-	2	1	2	-	-	-	2	2
CO2	-	2	-	-	-	2	2	2	-	-	-	2	2
CO3	-	2	-	-	-	2	2	2	-	-	-	2	2
CO4	-	2	1	-	-	2	2	2	-	-	-	2	2
CO5	-	2	1	-	-	2	2	2	-	-	-	2	2
CO6	-	2	1	-	-	2	2	2	-	-	-	2	2

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SEMESTER V

COURSE CODE: 24CBPL501	COMPILER DESIGN LABORATORY	L	T	P	CP	C
		0	0	4	4	2
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- To understand the phases of compiler design and implement lexical and syntax analysis techniques using LEX and YACC tools.
- To design parsers, intermediate code generators, and semantic analyzers for programming language constructs.
- To implement code optimization techniques and generate efficient target machine code.

LIST OF EXPERIMENTS

1. Implement a lexical analyzer to recognize tokens in C. (Ex. identifiers, constants, operators, keywords etc.).
2. Implement a Lexical Analyzer using the LEX Tool.
3. Program to recognize a valid arithmetic expression that uses +,-,* and /.
4. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
5. Design a Calculator using LEX and YACC.
6. Generate Three address codes for a given expression (arithmetic expression, flow of control).
7. Program to implement type checking using C.
8. Implement Code Optimization Techniques like copy propagation, dead code elimination, common subexpression elimination.
9. Generate Target Code (Assembly language) for the given set of Three Address Code.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

1. Standalone desktops with C / C++ / Java / Equivalent compiler 30 Nos. with Linux OS (or)
2. Server with C / C++ / Java / Equivalent compiler 30 terminals or more with Linux OS.Open source: C, LEX, YACC, BISON

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OUTCOMES:

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

1. Evaluate lexical analysis by implementing token recognition, expression validation, variable recognition, and LEX-based analyzers. (K5)
2. Create compiler components using LEX/YACC, three-address code generation, type checking, code optimization, and target code generation. (K6)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	1	1	-	2	2
CO2	3	3	3	-	-	-	-	-	1	1	-	2	2

SEMESTER V

COURSE CODE: 24CBTP501	SKILL ENHANCEMENT	L	T	P	CP	C
		0	0	2	2	1
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	-					

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Educate and enrich students on quantitative ability, reasoning ability, and verbal ability.
- Build a strong foundation for solving recruitment-based problems with speed and accuracy.
- Enhance creative thinking skills.
- Enhance logical problem-solving skills.

MODULE - I QUANTITATIVE ABILITY **22**

Number Properties, Speed Math, HCF and LCM, Percentages, Time and Work, Time Speed and Distance, Ratio Proportion and Variations, Averages Mixtures and Alligation

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MODULE - II QUANTITATIVE ABILITY REASONING ABILITY 16

Profit and Loss, Simple Interest and Compound Interest, Blood Relation, Directions, Coding and Decoding, Series, Ranking and Arrangements

MODULE - III VERBAL ABILITY 7

Subject-Verb Agreement, Tenses, Prepositions - Concepts, Error Spotting, Sentence Correction, Fill in the Blanks

TOTAL : 45 PERIODS

REFERENCES

1. Quantitative Aptitude for Competitive Examinations – R.S. Aggarwal
2. A Modern Approach to Logical Reasoning – R.S. Aggarwal
3. High School English Grammar & Composition – Wren & Martin
4. Word Power Made Easy – Norman Lewis.
5. Fast Track Objective Arithmetic – Rajesh Verma

BIS STANDARDS, RANGER AND ROVER, LIFE SKILLS – PHASE 2

OBJECTIVES

To enable students to,

- Familiarize the team and leadership skills.
- Understand the standards relevant to ECE.

MODULE - I JEEVAN KAUSHAL 2.0 - COGNITIVE SKILLS, INNOVATIVE LEADERSHIP AND DESIGN THINKING, ETHICS AND INTEGRITY 14

Cognitive and Non-cognitive Skills - Cognitive Skills: Meaning, Types of Cognitive Skills, Strategies to Develop Cognitive Skills- Critical Thinking Skills- Problem-solving skills - Ability to Learn, Non-cognitive Skills: Meaning and Types of Non-cognitive Skills, Strategies to Develop Non-cognitive Skills- Empathy- Creativity- Teamwork- Collaboration- Resilience - Interpersonal Skills- Perseverance- Social Control- Social Skill, Peer Pressure – Stress and Stress Management.

Innovative Leadership and Design Thinking- Concept of emotional and social intelligence, Concept of emotional and social intelligence, Innovative Leadership- Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders? Design Thinking- What is design thinking?, Key elements of design thinking, How to transform challenges into opportunities?, How to develop human-centric solutions for creating social good?

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Ethics and Integrity - Learning through Biographies - What makes an individual great?, Understanding the persona of a leader for deriving holistic inspiration, Drawing insights for leadership, How leaders sail through difficult situations? Ethics and Conduct - Importance of ethics, Ethical decision making, Personal and professional moral codes of conduct, creating a harmonious life

MODULE - II RANGER AND ROVER **10**

Scouting for Boys: Camp Life, Trekking Wood Craft.

Community Service: Meaning, Types of Community Service & duration, difference between Community Service and Community Development.

WOSM / WAGGGS / Govt. of India Initiatives (One Event At least) - Surf Smart, Free Being Me, Messengers of Peace, Scouts of the World Award

Messengers of Peace and Scouts

MODULE - III INTERNET OF THINGS AND ENVIRONMENTAL TESTING OF ELECTRONIC EQUIPMENT PROCEDURES **6**

Internet of Things: Brainstorming about the standards pertaining to IoT & Digital Twins, including maritime and underwater IoT i.e; IS/ISO/IEC TR 22417:2017, IS/ISO/IEC 21823 series.

Environmental Testing of Electronics Equipment: Introduction to Standards pertaining to Environmental Test Procedures i.e. IS/IEC 60068 series, IS 9000, IS 9001 and IS 9002 series that are used extensively in the testing of all electronics products.

TOTAL :30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/courses/show/214209?force_course_hub=true
2. https://free-being-me.com/wp-content/media/ABC_OLDER-2.pdf
3. https://www.wagggs.org/en/what-we-do/surf-smart-20/surf-smart-get-involved/

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OUTCOMES

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

1. Demonstrate improved quantitative aptitude for solving numerical problems. [K2]
2. Apply logical reasoning to tackle reasoning-based challenges. [K2]
3. Enhance verbal communication and comprehension skills through grammar and language exercises. [K2]
4. Use ethical principles, emotional intelligence, and leadership insights from biographies to practice responsible decision-making and professional conduct. (K3)
5. Illustrate the objectives and practices of WOSM/WAGGGS and Government of India initiatives such as Messengers of Peace, Surf Smart, and Scouts of the World Award. (K3)
6. Apply the concepts of IoT, Digital Twins, and related standards in identifying applications of connected systems in modern technologies. (K3)

CO - PO - PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	2	-	-
CO2	2	2	2	2	1	-	-	-	1	-	2	-	-
CO3	2	2	2	2	-	-	-	-	1	-	2	-	-
CO4	-	-	-	-	-	2	-	3	3	3	-	2	2
CO5	-	-	-	-	-	3	2	2	2	2	1	2	2
CO6	3	2	2	-	3	1	-	-	-	-	-	2	2

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SEMESTER V

COURSE CODE: 24ECID501	PROTOTYPE DEVELOPMENT LABORATORY – I	L	T	P	CP	C
		0	0	0	4	1
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ESID101, 24ESID201, 24SCID301, 24SCID401					

OBJECTIVES:

- To enable students to transform innovative ideas into feasible prototype solutions through structured problem identification, design thinking, and concept development.
- To provide experiential learning in prototype design and development by focusing on user-centric requirements, iterative design, and technical validation.
- To develop proficiency in problem analysis, feasibility assessment, requirement engineering, and prototype implementation.
- To instill a foundation of innovation and entrepreneurship by integrating ethical design principles, sustainability values, and responsible technology development.
- To enable data-driven solution development through literature survey, user feedback analysis, and technology exploration.
- To facilitate multidisciplinary problem-solving through engineering design, prototype realization, testing, validation, and technical communication.

COURSE METHODOLOGY

- This course is designed to develop innovation-oriented thinking and practical problem-solving abilities through prototype development activities focusing on real-world challenges.
- The project work shall involve the identification of a problem, requirement analysis, feasibility study, solution design, prototype development, testing, validation, and documentation. Students shall apply design thinking principles throughout the development cycle.
- Projects may be carried out individually or in groups with a maximum of three students. In the case of group projects, each student shall submit an individual project contribution report clearly specifying their role and responsibilities.

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- Students shall maintain a detailed project portfolio containing problem statements, literature survey findings, design documents, prototype iterations, testing results, and validation reports.
- Periodic reviews shall be conducted to assess progress in prototype development, implementation, testing, and refinement. Students shall demonstrate prototype functionality during review evaluations.
- At the end of the semester, students shall submit a comprehensive project report and present a working prototype for evaluation by the course coordinator and project review committee.

EVALUATION

1. First Evaluation (Immediately after first internal examination): 20 Marks
   (Problem Identification and Validation, Literature Survey, Requirement Analysis, Initial Design Proposal)
2. Second Evaluation (Immediately after second internal examination): 30 Marks
   (Prototype Design Completion, Prototype Development Progress, Initial Testing and Validation Results)
3. Final Evaluation (Last week of the semester): 50 Marks
   (Functional Prototype Demonstration, Innovation and Creativity, Technical Implementation, Project Report, Viva-Voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL : 30 PERIODS

OUTCOMES:

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

1. Analyze real-world problems, user requirements, and design constraints to formulate innovative prototype solutions using design thinking methodologies. (K4)
2. Evaluate alternative technologies, development approaches, and feasibility aspects for prototype design and implementation. (K5)
3. Create functional prototypes by integrating appropriate tools, technologies, and engineering principles to address identified problems. (K6)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	2	3
CO2	3	3	3	--	3	-	-	-	-	-	-	2	3
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL501	EXPLORATORY DATA ANALYSIS WITH R SOFTWARE	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 8, 9				
PRE-REQUISITE COURSES	24ITPW401					

OBJECTIVES:

- To understand the fundamental concepts, applications, and workflow of Data Science.
- To apply R programming concepts and commands for performing data manipulation and statistical computations.
- To prepare and preprocess datasets for analysis using appropriate data cleaning and transformation techniques.
- To perform Exploratory Data Analysis (EDA) using graphical and statistical methods to discover patterns and insights from data.
- To analyze data using measures of central tendency, dispersion, moments, and scaling techniques.

MODULE - I: INTRODUCTION TO DATA SCIENCE AND R SOFTWARE 7

Introduction to Data Science - Introduction to R software with R commands - Calculations with R software - Data Preparation and Introduction to Exploratory Data Analysis

MODULE - II EXPLORATORY DATA ANALYSIS AND UNIVARIATE VISUALIZATION 8

Introduction to Exploratory Data Analysis - Frequency Distribution - Univariate Graphics -Univariate Plots

MODULE - III UNIVARIATE ANALYSIS AND MEASURES OF DATA DISTRIBUTION 7

Univariate Graphics - Plots - Central Tendency of Data - Central Tendency of Data and Variation in Data

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MODULE - IV STATISTICAL MEASURES OF DISPERSION AND DATA TRANSFORMATION **8**

Variation in Data :Variation in Data - Variation in Data - Moments- Scaling of Data

MODULE - V ASSOCIATION ANALYSIS AND CORRELATION OF VARIABLES **7**

Association of Variables with Graphic - Association of Variables and Correlation Coefficient

MODULE - VI MULTIVARIATE DATA ANALYSIS AND REGRESSION TECHNIQUES **8**

Association of Variables for rank data - discrete data - Least Squares Method - Least Squares Method - EDA with Multivariate Data

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Hadley Wickham and Garrett Grolemund, "R for Data Science", O'Reilly Media, 2nd Edition, 2023.
2. Roger D. Peng, "R Programming for Data Science", Leanpub, 2016.

REFERENCES

1. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Professional, 2nd Edition, 2017.
2. Peter Bruce, Andrew Bruce, and Peter Gedeck, "Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python", O'Reilly Media, 2nd Edition, 2020.
3. John M. Chambers, "Software for Data Analysis: Programming with R", Springer, 2nd Edition, 2017.

WEB REFERENCES

1. https://r4ds.hadley.nz/
2. https://posit.co/resources/
3. https://r-graph-gallery.com/

ONLINE REFERENCES

1. https://r4ds.hadley.nz/
2. https://r-graphics.org/
3. https://dplyr.tidyverse.org/

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OUTCOMES:

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

1. Apply the fundamental concepts of Data Science and R programming to perform data manipulation, computations, and preliminary data preparation tasks.(K3)
2. Utilize exploratory data analysis techniques, frequency distributions, and univariate visualizations to summarize and explore datasets..(K3)
3. Analyze data distributions using graphical methods and measures of central tendency to interpret the characteristics of datasets..(K4)
4. Examine data variability through measures of dispersion, moments, and data scaling techniques for effective data transformation..(K4)
5. Analyze the association between variables using graphical methods and correlation coefficients to identify relationships and dependencies..(K4)
6. Evaluate relationships among rank, discrete, and multivariate data using association measures and least squares regression techniques for data-driven insights.(K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	2	-	-	-	-	-	-	-	2	3
CO2	3	1	-	2	-	-	-	-	-	-	-	2	2
CO3	2	2	1	2	-	-	-	-	-	-	-	2	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	2
CO5	2	2	3	2	2	-	-	-	-	-	-	2	-
CO6	2	2	-	2	2	-	-	-	-	-	-	3	2

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL502	ARTIFICIAL INTELLIGENCE FUNDAMENTALS AND APPLICATIONS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106108705	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24AIPT201, 24AMPC302					

OBJECTIVES:

- To introduce the fundamental concepts, techniques, and applications of Artificial Intelligence.
- To equip learners with problem-solving methods, knowledge representation, machine learning, and deep learning techniques, and to provide an understanding of the ethical implications of AI in society.
- Apply uninformed and informed search algorithms (BFS, DFS, A*, etc.).
- Analyze real-world applications such as: Natural Language Processing (NLP) Expert Systems, Robotics and Computer Vision.
- To understand the machine learning concept.
- To explore real-world AI applications.

MODULE - I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 7

Foundations and history of AI, definitions and goals of AI, the Turing Test and intelligent behaviour, intelligent agents and rationality, agent architectures (reactive, deliberative, hybrid), PEAS framework (Performance measure, Environment, Actuators, Sensors), types of environments — deterministic vs stochastic, static vs dynamic, fully vs partially observable, discrete vs continuous. Applications of AI in healthcare, finance, transportation, and entertainment. Current trends, opportunities, and limitations of AI.

MODULE - II PROBLEM SOLVING AND SEARCH TECHNIQUES 8

Problem formulation and state space representation. Uninformed search strategies — Breadth-First Search (BFS), Depth-First Search (DFS), Uniform Cost Search, Depth-Limited Search, Iterative Deepening Search. Informed/heuristic search techniques — Greedy Best-First Search, A* algorithm, IDA*. Properties of heuristics: admissibility and consistency. Local search algorithms — Hill Climbing, Simulated Annealing, Genetic Algorithms. Adversarial search — Minimax algorithm, Alpha-Beta pruning. Constraint Satisfaction Problems (CSPs) and backtracking search.

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MODULE - III KNOWLEDGE REPRESENTATION AND REASONING 8

Propositional logic — syntax, semantics, inference rules. First-order logic (predicate logic) — quantifiers, variables, functions. Resolution and unification. Forward chaining and backward chaining. Semantic networks, frames, and ontologies. Rule-based expert systems. Reasoning under uncertainty: probability basics, Bayes' theorem, Bayesian networks, Dempster-Shafer theory. Introduction to fuzzy logic — fuzzy sets, membership functions, fuzzy inference systems.

MODULE - IV MACHINE LEARNING FOUNDATIONS 8

Introduction to machine learning and its relationship with AI. Supervised, unsupervised, and reinforcement learning paradigms. Regression techniques — linear and logistic regression. Classification algorithms — Decision Trees, k-Nearest Neighbours (k-NN), Naive Bayes classifier, Support Vector Machines (SVM). Unsupervised learning — k-Means clustering, hierarchical clustering- Performance metric evaluation

MODULE - V NEURAL NETWORKS AND DEEP LEARNING 7

Biological inspiration and the artificial neuron. Perceptron and Multilayer Perceptron (MLP). Activation functions — sigmoid, tanh, ReLU, softmax. Forward propagation and the backpropagation algorithm. Gradient descent and its variants — SGD, Momentum, Adam. Convolutional Neural Networks (CNNs) — convolution, pooling, architectures like LeNet, AlexNet, ResNet. Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), and Gated Recurrent Units (GRU).

MODULE - VI ETHICS AND AI APPLICATIONS 7

AI ethics — bias and fairness, accountability, explainable AI (XAI), privacy and security concerns. Societal impact and the future of AI.Natural Language Processing (NLP) — tokenization, stemming, lemmatization, word embeddings (Word2Vec, GloVe), sentiment analysis, chatbots. Computer Vision — image classification, object detection, face recognition. Expert Systems — architecture and case studies (MYCIN, DENDRAL). Robotics and autonomous systems — perception, planning, control. Generative AI and Large Language Models (LLMs) — GPT, BERT, diffusion models.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2021.

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2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill, 2017.
3. Tom M. Mitchell, "Machine Learning", McGraw Hill, 2017.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
5. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 3rd Edition, O'Reilly, 2022.

REFERENCES:

1. Deepak Khemani, "Search Methods in Artificial Intelligence", Cambridge University Press in 2024.
2. George F. Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Addison Wesley, 1998.

WEB REFERENCES:

1. NPTEL – Artificial Intelligence: Search Methods for Problem Solving
2. NPTEL – Introduction to Machine Learning
3. IBM Artificial Intelligence Resources

ONLINE RESOURCES:

1. NPTEL Course – Artificial Intelligence
2. NPTEL Course – Introduction to Machine Learning
3. Coursera – Artificial Intelligence Courses
4. edX – Artificial Intelligence Programs
5. Kaggle Learn – Machine Learning and AI Tutorials

OUTCOMES:

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

1. Apply the fundamental concepts, history, definitions, and goals of Artificial Intelligence to analyze intelligent systems. (K3)
2. Apply problem formulation and state space representation techniques to model Artificial Intelligence search problems. (K3)
3. Utilize propositional logic concepts including syntax, semantics, and inference rules for logical problem solving in Artificial Intelligence. (K3)
4. Examine the fundamentals of machine learning and its relationship with Artificial Intelligence, including supervised, unsupervised, and reinforcement learning paradigms. (K4)

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5. Implement artificial neuron models, Perceptron, and Multilayer Perceptron (MLP) networks for basic neural network applications. (K3)
6. Construct expert system models based on architectures and case studies such as MYCIN and DENDRAL for knowledge-based problem solving. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	2	3	-	-	-	-	-	-	-	-	-	2	3
CO4	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	2	2
CO6	2	3	-	-	-	-	-	-	-	-	-	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL503	HUMAN CENTERED COMPUTING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106701	SYLLABUS VERSION 1.0	SDG NO. 9, 11, 13				
PRE-REQUISITE COURSES	24ITPC302, 24ESCS101					

OBJECTIVES:

- To understand the principles, concepts, and foundations of Human–Computer Interaction (HCI).
- To learn user-centered design methodologies and interaction design processes.
- To apply design principles, usability guidelines, and accessibility standards in interface design.
- To develop prototypes and user interfaces using modern design tools and frameworks.
- To evaluate interactive systems using qualitative and quantitative usability assessment techniques.
- To explore emerging interaction paradigms, AI-driven interfaces, and ethical considerations in HCI.

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MODULE - I FOUNDATIONS OF HCI 8

Introduction to Human-Computer Interaction (HCI), history and evolution of HCI, importance of human-centered design. The human — sensory perception (vision, hearing, touch), memory (sensory, short-term, long-term), cognition, attention, and motor skills. The computer — input devices (keyboard, mouse, touchscreen, voice, gesture), output devices (display, audio, haptic). Interaction styles — command line interfaces, menu-based, form fill-in, direct manipulation, GUI/WIMP, web-based, mobile, voice, and immersive interfaces. Norman's seven stages of action and the gulfs of execution and evaluation.

MODULE - II INTERACTION DESIGN PROCESS 8

User-Centered Design (UCD) principles and philosophy. Design thinking framework — empathize, define, ideate, prototype, test. Requirements gathering techniques — interviews, surveys, questionnaires, ethnographic studies, contextual inquiry, focus groups. Personas, user profiles, and scenarios. User stories and use cases. Task analysis — Hierarchical Task Analysis (HTA), GOMS model. Participatory and co-design approaches. Iterative design cycle and the role of stakeholders.

MODULE - III DESIGN PRINCIPLES AND GUIDELINES 8

Shneiderman's Eight Golden Rules of interface design. Nielsen's Ten Usability Heuristics. Don Norman's design principles — visibility, feedback, affordance, signifiers, mapping, constraints, consistency. Gestalt principles of visual perception — proximity, similarity, closure, continuity, figure-ground. Visual design fundamentals — color theory, typography, layout, white space, hierarchy. Accessibility — Web Content Accessibility Guidelines (WCAG), assistive technologies, universal design principles. Designing for diverse users including users with disabilities, elderly users, and children.

MODULE - IV PROTOTYPING AND IMPLEMENTATION 7

Importance and role of prototyping in design. Low-fidelity prototyping — sketches, paper prototypes, storyboards, wireframes. High-fidelity prototyping — interactive mockups, clickable prototypes. Industry-standard prototyping tools — Figma, Adobe XD, Sketch, Balsamiq, InVision, Axure. Design systems and style guides (Material Design, Apple Human Interface Guidelines). Responsive and adaptive design. Mobile-first design approach. Cross-platform design considerations — web, iOS, Android. Handoff from designer to developer.

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MODULE - V EVALUATION TECHNIQUES 7

Goals and types of evaluation — formative vs summative. Expert-based evaluation methods — heuristic evaluation, cognitive walkthrough, pluralistic walkthrough. User-based evaluation methods — usability testing, think-aloud protocol, A/B testing, eye-tracking studies. Quantitative metrics — task completion time, error rate, success rate, System Usability Scale (SUS), Net Promoter Score (NPS). Qualitative analysis — affinity diagrams, thematic analysis. Remote vs lab-based testing. Use of analytics and heatmaps. Ethics in user research and informed consent.

MODULE - VI ADVANCED TOPICS AND EMERGING INTERFACES 7

Mobile and touch interfaces — gestures, multi-touch, haptics. Voice User Interfaces (VUI) and conversational design — Alexa, Siri, Google Assistant. Augmented Reality (AR) and Virtual Reality (VR) interfaces — design challenges and opportunities. Wearable computing and smart devices. Tangible and embedded interaction. Brain-Computer Interfaces (BCI). Designing for AI systems and chatbots — trust, transparency, explainability. Ethics in design — dark patterns, persuasive design, addictive design, privacy. Case studies of successful and failed interface designs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human-Computer Interaction", Pearson/Prentice-Hall, 2004.
2. Ben Shneiderman, Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 6th Edition,Pearson Education, 2016.

REFERENCES

1. Donald A. Norman, "The Design of Everyday Things", Revised and Expanded Edition, Basic Books, 2013.
2. Helen Sharp, Jennifer Preece, Yvonne Rogers, "Interaction Design: Beyond Human-Computer Interaction", 5th Edition, Wiley, 2019.
3. Steve Krug, "Don't Make Me Think, Revisited: A Common-Sense Approach to Web Usability", 3rd Edition, New Riders, 2014.

WEB REFERENCES:

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

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3. World Wide Web Consortium (W3C) Web Accessibility Initiative https://www.w3.org/WAI

ONLINE RESOURCES:

1. NPTEL Course – Human Computer Interaction
2. Coursera – User Experience (UX) Design Courses
3. edX – Human Computer Interaction Courses

OUTCOMES:

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

1. Apply human cognitive and perceptual principles in interaction design. (K3)
2. Apply user-centered design methods to identify user requirements and problems. (K3)
3. Analyse usability principles and design guidelines to create user interfaces. (K4)
4. Develop low- and high-fidelity prototypes using design tools. (K3)
5. Analyse usability issues using expert reviews and user testing methods. (K4)
6. Analyse emerging interaction technologies and ethical aspects of interface design. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	-	-	-	-	-	-	-	-	-	2	3
CO4	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	2	2
CO6	2	3	-	-	-	-	-	-	-	-	-	3	2

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

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Board of Studies
Artificial Intelligence and Data Science

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ITEL507	DATA WAREHOUSING AND DATA MINING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24BSMA301, 24BSMA402					

OBJECTIVES:

- To examine the concepts, architecture, and design of data warehousing systems to support efficient data management and business decision-making.
- To analyze multidimensional data models, OLAP operations, and data pre-processing techniques for transforming raw data into meaningful insights.
- To implement data mining algorithms for discovering patterns, associations, and knowledge from large datasets.
- To apply classification, clustering, and data analysis tools for building and evaluating data-driven models.

MODULE - I DATA WAREHOUSING FUNDAMENTALS 7

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support - Concept Hierarchies

MODULE - II OLAP AND BUSINESS ANALYSIS 8

Multidimensional Data Model – OLAP Operations (Roll-up, Drill-down, Slice, Dice, Pivot) – OLAP vs OLTP – Characteristics of OLAP Systems – Database Architectures for Parallel Processing – Parallel DBMS

MODULE - III DATA PRE-PROCESSING AND VISUALIZATION 8

Data Mining Overview and KDD Process – Data Objects and Attribute Types – Statistical Description of Data – Data Cleaning, Integration, Reduction – Data Transformation and Discretization – Data Similarity and Dissimilarity Measures – Data Visualization Techniques

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

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MODULE - IV FREQUENT PATTERN MINING 7

Mining Frequent Patterns – Association Rule Mining – Correlation Analysis – Pattern Evaluation Methods – Multilevel and Multidimensional Pattern Mining – Constraint-Based Pattern Mining – Classification using Frequent Patterns

MODULE - V CLASSIFICATION TECHNIQUES 7

Decision Tree Induction – Bayesian Classification – Rule-Based Classification – Support Vector Machines – Lazy Learners – Model Evaluation and Accuracy Improvement Techniques

MODULE - VI CLUSTERING AND DATA ANALYSIS TOOLS 8

Clustering Techniques and Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density-Based and Grid-Based Methods – Outlier Detection Techniques – Introduction to WEKA Tool – Classification, Clustering and Association using WEKA

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jiawei Han, Jian Pei, Hanghang Tong, "Data Mining: Concepts and Techniques," Fourth Edition, Elsevier, 2022.
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, "Introduction to Data Mining," Second Edition, Pearson, 2019.

REFERENCE BOOKS

1. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining & OLAP," Tata McGraw-Hill, Reprint 2016.
2. Ian H. Witten, Eibe Frank, Mark A. Hall, Christopher J. Pal, "Data Mining: Practical Machine Learning Tools and Techniques," Fourth Edition, Elsevier, 2016.
3. Martin Kleppmann, "Designing Data-Intensive Applications," O'Reilly Media, 2017.
4. Parteek Bhatia, "Data Mining and Data Warehousing: Principles and Practical Techniques," Cambridge University Press, 2019.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105174
2. https://swayam.gov.in/nd1_noc20_cs12/preview
3. https://www.cs.waikato.ac.nz/ml/weka/
4. https://www.tutorialspoint.com/data_mining/index.htm

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OUTCOMES:

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

1. Apply data warehousing concepts, architectures, and multidimensional models for decision support systems. (K3)
2. Utilize OLAP operations and business analysis techniques to analyze multidimensional data. (K3)
3. Perform data pre-processing and visualization techniques to transform raw data into suitable formats for analysis. (K3)
4. Execute frequent pattern mining and association rule techniques to discover meaningful patterns in datasets. (K3)
5. Implement classification algorithms to develop predictive models and improve their performance. (K3)
6. Apply clustering techniques and data mining tools to analyze data and extract useful knowledge. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	2	-	-	-	-	-	-	-	-	2
CO3	3	3	-	2	-	-	-	-	-	-	-	-	2
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	-	-	-	-	-	-	-	-	2	3
CO6	2	-	-	-	3	-	-	-	-	-	-	3	3

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ITEL508	DATA ANALYTICS WITH PYTHON	L	T	P	CP	C
		3	0	0	4	3
NPTEL CODE: 106107220	SYLLABUS VERSION 1.0	SDG NO. 4, 8, 11				
PRE-REQUISITE COURSES	24ESCS101, 24BSMA301					

OBJECTIVES:

- To introduce the fundamental concepts, lifecycle, and applications of Data Analytics in various domains.
- To develop proficiency in Python programming and essential libraries such as NumPy and Pandas for data manipulation and analysis.
- To enable students to perform data preprocessing, exploratory data analysis, and data visualization for extracting meaningful insights from datasets.
- To provide knowledge of statistical analysis and basic machine learning techniques for solving real-world data-driven problems and supporting decision-making.

MODULE - I INTRODUCTION TO DATA ANALYTICS 7

Data Analytics – Definition – Data Analytics Lifecycle – Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive – Applications of Data Analytics – Data Types and Sources.

MODULE - II PYTHON PROGRAMMING BASICS 7

Python Fundamentals – Variables and Data Types – Operators – Control Structures – Functions and Modules – Introduction to NumPy, Arrays and Operations.

MODULE - III DATA HANDLING USING PANDAS 8

Data Collection – Data Formats (CSV, Excel, JSON) – Pandas Data Structures – Data Cleaning – Handling Missing Values – Data Transformation – Data Integration.

MODULE - IV EXPLORATORY DATA ANALYSIS 7

Descriptive Statistics – Data Summarization – Correlation and Covariance – Identifying Patterns and Trends – Basic Statistical Measures.

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MODULE - V DATA VISUALIZATION 8

Principles of Visualization – Matplotlib – Seaborn – Types of Plots: Line, Bar, Histogram, Scatter – Visualization for Decision Making.

MODULE - VI STATISTICAL ANALYSIS AND APPLICATIONS 8

Probability Basics – Hypothesis Testing – Regression Analysis – Classification and Clustering Basics – Case Studies and Mini Project.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Wes McKinney, Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter, 3rd Edition, O'Reilly Media, 2022.
2. Fabio Nelli, Python Data Analytics: Data Analysis and Data Science Using Pandas, Matplotlib and the Python Programming Language, 3rd Edition, Apress, 2023.
3. Jake Vander Plas,Python Data Science Handbook,O'Reilly Media, 1st Edition, 2016.

REFERENCES

1. Fabio Nelli, Python Data Analytics: Data Analysis and Science Using Pandas, Matplotlib and the Python Programming Language, 3rd Edition, Apress, 2023.
2. Yuli Vasiliev, Python for Data Science: A Hands-On Introduction, 2nd Edition, No Starch Press, 2024.
3. Gareth James,Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning, Springer, 2nd Edition, 2021.
4. Trevor Hastie,Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer, 2nd Edition, 2009.

WEB REFERENCES

1. https://onlinecourses.nptel.ac.in/noc23_cs116
2. https://www.python.org/doc/
3. https://pandas.pydata.org/docs/
4. https://numpy.org/doc/

ONLINE RESOURCES

1. https://www.youtube.com/playlist?list=PLZoTAELRMXVNUL99R4bDlVtR5Xl4cY1M

Recommended in Board of Studies (BoS) Meeting No. 8 **held on** 12.5.2024

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2. https://www.youtube.com/playlist?list=PL-osiE80TeTsqhIuOqKhwlXsIBIdSeYtc
3. https://www.youtube.com/playlist?list=PL9ooVrP1hQOEDSc5QEblhJWl2PyaO8R1n

OUTCOMES:

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

1. Apply fundamental concepts of data analytics and analytical approaches. (K3)
2. Apply Python programming constructs, functions, and NumPy operations to solve data analytics problems. (K3)
3. Apply Pandas-based techniques for data collection, cleaning, transformation, integration, and management of datasets. (K3)
4. Analyze datasets using exploratory data analysis techniques and statistical measures to discover patterns, trends, and relationships. (K4)
5. Analyze and interpret data using visualization techniques. (K4)
6. Analyze real-world datasets using statistical and machine learning techniques. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3
CO5	3	2	3	-	-	-	-	-	-	-	-	3	3
CO6	3	3	3	-	-	-	-	-	-	-	-	3	3

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PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ITEL509	BIG DATA ESSENTIALS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106104189	SYLLABUS VERSION 1.0	SDG NO. 4, 8				
PRE-REQUISITE COURSES	24ITPC301, 24ITPW301					

OBJECTIVES:

- To provide the knowledge in the basic and advanced methods of big data technology and tools, including Hadoop and its ecosystem.
- To understand the concepts of Hadoop and HDFS.
- To perform Map Reduce analytics using Hadoop Related tools.
- To illustrate and implement the SPARK programming.

MODULE - I UNDERSTANDING BIG DATA AND ITS APPLICATIONS 8

Evolution of Big Data – Characteristics of Big Data – Value of Big Data – Structured and Unstructured Data – Big Data Applications and Use Cases – Web Analytics – Big Data in Marketing, Healthcare, Finance, and Risk Management – Big Data Technologies – Big Data Storage and Analytics.

MODULE – II FUNDAMENTALS OF HADOOP 8

Introduction to Hadoop – Hadoop Ecosystem – Hadoop Distributed File System (HDFS) – HDFS Architecture and Components – HDFS Commands and Interfaces – Data Flow in HDFS – Data Ingestion using Flume and Sqoop – Hadoop I/O – Compression and Serialization – Avro and Hadoop File Formats.

MODULE - III MAP REDUCE FRAMEWORK 8

Developing a Map Reduce Application - How Map Reduce Works - Anatomy of a Map Reduce Job Run-Failures- Job Scheduling-Shuffle and Sort – Task execution – Map Reduce Types and Formats- Map Reduce Features- Hadoop Environment. YARN – Failures in Classic Map Reduce and YARN – job scheduling – Shuffle and sort – Task execution – Map Reduce types – Input formats–Output formats.

MODULE - IV HADOOP ECOSYSTEM AND TOOLS 7

Introduction to PIG-Execution Modes of Pig-Comparison of Pig with Databases- Grunt- Pig Latin- User Defined Functions- Data Processing

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Operators- Hive-Hive Shell-Hive Services- Hive Metastore- Comparison with Traditional Databases- HiveQL- Tables- Querying Data and User Defined Functions- Hbase-HBasics- Concepts- Clients-Hbase Versus RDBMS.

MODULE - V INTRODUCTION TO SPARK PROGRAMMING **7**

Introduction to Spark – Spark Architecture – RDDs – Transformations and Actions – DataFrames and Datasets – Spark SQL – Writing Spark Applications using Scala, Python, R and Java – Spark Shell – Spark Streaming (Basic Concepts) – Introduction to Mllib.

MODULE - VI GPU COMPUTING AND CUDA FOR BIG DATA **7**

Introduction to GPU Computing-CUDA Programming Model- CUDAAPI-Simple Matrix-Multiplication in CUDA- CUDA Memory Model- Shared Memory Matrix Multiplication- Additional CUDA API Features- Data Analysis with CUDA and Spark

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Tom White, Hadoop: The Definitive Guide, 5th Edition, O'Reilly Media, 2023.
2. Seema Acharya and Subhashini Chellappan, Big Data Analytics, 3rd Edition, Wiley India, 2024.
3. Bill Chambers and Matei Zaharia, Spark: The Definitive Guide – Big Data Processing Made Simple, O'Reilly Media, Reprint Edition, 2023.
4. Jason Sanders and Edward Kandrot, CUDA by Example: An Introduction to General-Purpose GPU Programming, Updated Reprint, Addison-Wesley, 2023.
5. Raj Kamal and Preeti Saxena, Big Data Analytics, 3rd Edition, McGraw Hill Education, 2024.

REFERENCES

1. Vignesh Prajapati, Big Data Analytics with Hadoop 3, Packt Publishing, 2022.
2. Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia, Learning Spark: Lightning-Fast Data Analytics, 3rd Edition, O'Reilly Media, 2024.
3. Eric Sammer, Hadoop Operations, 3rd Edition, O'Reilly Media, 2023.
4. John Cheng, Max Grossman, and Ty McKercher, Professional CUDA C Programming, Wiley, Reprint Edition, 2023.

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5. Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets, 3rd Edition, Cambridge University Press, 2024.

WEB REFERENCES

1. https://www.analyticsvidhya.com/resources-big-data/
2. https://www.tutorialspoint.com/big_data_analytics/index.html
3. https://nptel.ac.in/courses/106104189

ONLINE RESOURCES

1. https://www.analyticsvidhya.com/resources-big-data/
2. https://www.edureka.co/blog/big-data-tutorial

OUTCOMES:

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

1. Apply the fundamental concepts of Machine Learning to identify and classify appropriate types of Machine Learning for different real-world applications. (K3)
2. Implement data preprocessing techniques, including data cleaning, data transformation, and feature selection, to prepare a dataset for Machine Learning tasks. (K3)
3. Execute MapReduce applications using Hadoop and YARN for distributed data processing. (K3)
4. Analyze the use of Pig, Hive, and HBase in managing and processing Big Data workloads. (K4)
5. Analyze Spark components and develop scalable data processing applications using Spark frameworks. (K4)
6. Analyze CUDA-based GPU computing techniques and evaluate their integration with Spark for high-performance Big Data analytics. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	-	3	3
CO2	3	2	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3
CO6	3	3	2	-	-	-	-	-	-	-	-	3	3

Recommended in Board of Studies (BoS) Meeting No. _____ held on _____

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Information Technology

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PROFESSIONAL ELECTIVE - I

COURSE CODE: 24CIEL501	IOT CONCEPTS AND APPLICATIONS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105166	SYLLABUS VERSION 1.0	SDG NO. 9, 11, 12				
PRE-REQUISITE COURSES	24CIPC301					

OBJECTIVES:

- To provide fundamental knowledge of IoT architecture and design
- To understand communication models and protocols in IoT
- To explore technologies and platforms like Arduino and Raspberry Pi
- To develop IoT-based applications using real-time data

MODULE - I INTRODUCTION TO iNTERNET OF THINGS 8

Introduction to IoT: Sensing-Actuation- Basics of Networking-Wireless Sensor Networks-Machine-to-Machine Communications

MODULE - II FUNCTIONAL COMPONENTS AND DEVICE INTEGRATION 7

Sensors and Actuators – Smart Objects and Embedded Platforms – Control Units and Microcontrollers – Wireless Connectivity Technologies (BLE, ZigBee, Wi-Fi) – Positioning Systems (GPS/GNSS) – Cellular IoT Communication (GSM/4G/5G) – Device Interoperability and Resource Management.

MODULE - III PROTOCOLS AND TECHNOLOGIES BEHIND IOT 7

Communication Protocols -IoT Protocols: IPv6, 6LoWPAN – RFID – – Big Data Analytics – Cloud Computing – Cloud Connectivity-Sensor-Cloud -Fog Computing- Embedded Systems.

MODULE - IV OPEN PLATFORMS AND PROGRAMMING 8

Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT -Data Handling and Analytics -Architecture – Programming – Interfacing – GPIO Access – Signal Transmission

MODULE - V IOT APPLICATIONS 8

Business Models for IoT – Smart Mobility – Industrial IoT – Healthcare-Activity Monitoring-Environmental Monitoring – Home Automation

Recommended in Board of Studies (BoS) Meeting No. 6 **held on** 9.4.2026

IoT

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Computer Science and Engineering (Internet of Things)

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MODULE - VI IOT ANALYTICS, SECURITY AND EMERGING TRENDS 7

Data acquisition –Data Collection and Preprocessing Techniques- Stream analytics – Edge analytics – ML for IoT – Predictive analytics – Security challenges – Encryption – Authentication – API integration – AIoT – Digital Twin – 5G – Blockchain.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2nd Edition in 2021

REFERENCES:

1. Perry Lea, "IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security", Packt Publication, 2nd Edition (2020)
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, Kindle Edition (2016).
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105166
2. https://www.arduino.cc/ttps://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet
3. https://link.springer.com/chapter/10.1007/978-3-030-41110-7_1

OUTCOMES:

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

1. Build IoT Devices using IoT concepts and architecture (K3).
2. Develop communication models and IoT protocols (K3).
3. Apply IoT systems using Arduino/Raspberry Pi (K3).
4. Apply cloud computing and data analytics in IoT (K3).

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Computer Science and Engineering
(Internet of Things)

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5. Illustrate different IoT business models and their role in delivering smart services and solutions. (K3).
6. Implement IoT security and emerging technologies (K3).

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	1	1	-	-	1	2	3
CO2	3	3	-	-	-	-	1	1	-	-	2	3	3
CO3	3	3	-	-	-	-	1	1	-	-	2	3	3
CO4	3	3	-	-	-	-	1	1	-	-	3	3	3
CO5	3	1	-	-	-	-	1	1	-	-	3	3	3
CO6	3	1	-	-	-	-	1	1	-	-	3	2	3

PROFESSIONAL ELECTIVE - I

COURSE CODE: 24CIEL504	DATA SCIENCE FOR INTERNET OF THINGS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 117103488	SYLLABUS VERSION 1.0	SDG NO. 4, 7				
PRE-REQUISITE COURSES	24EEPC201, 24EEPC303, 24EEPC304					

OBJECTIVES:

- Understand the fundamental concepts of Data Science, IoT architecture, and data acquisition techniques for IoT applications.
- Apply machine learning algorithms, Python programming, and data visualization techniques to analyze IoT datasets.
- Analyze IoT security, privacy challenges, and real-time data processing frameworks for efficient data management.
- Develop analytical solutions using modern data science tools and stream analytics techniques for IoT-based applications.

MODULE - I INTRODUCTION TO DATA SCIENCE **8**

Introduction to Data Science, Data Science Life Cycle, IoT Architecture and Ecosystem, IoT Data Characteristics and Challenges, Data Acquisition from IoT Devices

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MODULE - II MACHINE LEARNING IN DATASCIENCE 7

Introduction to Machine Learning, Main Challenges of Machine Learning, Training and Testing Datasets, Support Vector Machines - SVM Classification, Decision Trees, Dimensionality Reduction Techniques

MODULE - III INTERACTIVE DATA VISUALIZATION FOR IOT 8

Principles of Interactive Data Visualization, Web Technologies for Visualization, Interactive Visualization Techniques, IoT Data Preparation and Visualization, D3 Techniques

MODULE - IV PYTHON FUNDAMENTALS FOR DATA ANALYSIS 7

Introduction to Python for Data Analysis – Python Programming Basics – Python Data Structures – Functions and Modules – NumPy Arrays and Vectorized Operations – Pandas Series and DataFrames – Data Import and Export – Basic Data Inspection and Manipulation.

MODULE - V SECURITY, PRIVACY & CHALLENGES 7

Security Principles (Confidentiality, Integrity, Availability) – Authentication, Authorization, and Access Control – IoT Threats and Vulnerabilities – Privacy Issues in IoT – Security Challenges in IoT Environments, Future trends in IoT with Data Science.

MODULE - VI INTRODUCTION TO REAL-TIME DATA PROCESSING AND STREAM ANALYTICS FOR IOT 8

Introduction to Real-time Data Processing in IoT - Overview, Characteristics, Stream Processing Frameworks for IoT-Apache Kafka - Apache Flink, and Apache Storm, Techniques for Real-time Stream Analytics - Windowing techniques for processing streaming data - Aggregation and summarization.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. P. G. Madhavan, Ph.D., "Data Science for IoT Engineers A Systems Analytics Approach", MERCURY LEARNING AND INFORMATION 2nd Edition 2021.
2. Aurélien Géron, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow-O'Reilly Media, 3rd Edition 2023
3. Arshdeep Bahga and Vijay Madisetti, Internet of Things A Hand-on Approach, Universities press, 2015
4. Shilpi Saxena, Saurabh Gupta, Practical Real-Time Data Processing and Analytics-2017

Recommended in Board of Studies (BoS) Meeting No. 6 **held on** 9.4.2026.

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5. Murray, Scott, Interactive data visualization for the Web : an introduction to designing with D3 - 2017
6. Wes McKinney, Python for Data Analysis O'Reilly Media 2022

REFERENCES:

1. S.Smys, Tomonobu Senjyu, Pavel Lafata Editors, Sixth International Conference volumes, Springer, 2024
2. Data Science and Internet of Things: Research and Applications at the Intersection of DS and IoT, Springer, 2021.

WEB REFERENCES:

1. https://people.smp.uq.edu.au/DirkKroese/DSML/DSML.pdf
2. https://www.mdpi.com/2073-431X/12/2/34

OUTCOMES:

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

1. Apply the data science life cycle and IoT data acquisition techniques to collect and prepare data for analysis. (K3)
2. Utilize machine learning algorithms and dimensionality reduction techniques to determine their suitability for IoT data analytics. (K3)
3. Demonstrate the use of interactive visualization techniques and D3.js for representing IoT data..(K3)
4. Apply Python programming, NumPy, and Pandas libraries to preprocess, inspect, and manipulate IoT data. (K4)
5. Implement security mechanisms, including authentication, authorization, and access control, to enhance the security and privacy of IoT systems. (K3)
6. Examine real-time data processing frameworks and stream analytics techniques to determine their effectiveness in processing IoT data streams. (K4)

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Computer Science and
(Internet of Things)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	1	1	-	2	2
CO2	3	-	-	-	-	-	-	-	2	1	-	2	2
CO3	2		-	-	-	-	-	-	1	2	-	2	2
CO4	3	2	-	2	-	-	-	-	1	1	-	2	2
CO5	3	-	-	-	-	-	-	-	1	1	-	2	2
CO6	3	2	-	-	-	-	-	-	1	1	-	2	2

PROFESSIONAL ELECTIVE - I

COURSE CODE: 24CIEL503	DYNAMIC PARADIGM IN IOT	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 117103488	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24CIPC301, 24CIPT401, 24AIPT201					

OBJECTIVES:

- To understand the role of cloud computing and cloud platforms in enabling Internet of Things (IoT) applications.
- To apply machine learning algorithms for intelligent analysis and decision-making using IoT data.
- To explore IoT data analytics and visualization techniques for extracting actionable insights from sensor data.
- To develop the ability to integrate DevOps practices with IoT for efficient application development, deployment, and management.

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MODULE - I IOT AND CLOUD 8

Cloud Computing Concept–Grid – SOA and Cloud Computing – Cloud Middleware NIST's SPI Architecture and Cloud Standards – Cloud of Things – Architecture – Four Deployment Models–Foundational Technological Enabler Cloud Providers and Systems – Microsoft Azure IoT–Amazon Web Services–Google's cloud IoTs.

MODULE - II IOT AND MACHINE LEARNING 7

IoT and Machine Learning Integration – Feature Engineering for IoT - Implementation of Supervised Algorithm (Regression and classification applied to sensor - Implementation of Unsupervised Algorithm (anomaly detection and clustering for fault identification and predictive maintenance) Edge Machine Learning and Model Deployment - IoT security threats

MODULE - III IOT AND DATA ANALYTICS 7

Defining IoT Analytics–IoT Analytics challenges– IoT analytics for the cloud–Microsoft Azure overview– Strategies to organize Data for IoT Analytics– Linked Analytics Data Sets–Managing Data lakes– Dash boarding–Designing visual analysis for IoT data–creating a dashboard –creating and visualizing alerts–Study real time –case study on IoT Analytics.

MODULE - IV IOT AND IT'S SECURITY 8

Cyber security vernacular Attack and threat terms– Defense terms, Anatomy of IoT cyber attacks – Mirai, Stuxnet–Chain Reaction, Physical and hardware security– Root of Trust–Network stack – Transport Layer Security– Software defined perimeter– Software-Defined Perimeter architecture – OWASP – Existing Security attacks and its prevention methods.

MODULE - V IOT AND DEVOPS 7

Introduction to DevOps– DevOps application – business scenarios– DevOps process – Source Code Management (SCM)– Code review–Configuration Management– Build management–DevOps frameworks–DevOps maturity life cycle–DevOps maturity map– DevOps progression.

MODULE - VI IOT APPLICATIONS AND FUTURE PARADIGMS 8

Smart Cities and Smart Infrastructure – Industrial IoT (IIoT) – Healthcare IoT Systems – Smart Agriculture and Environmental Monitoring – Edge and Fog Computing in IoT – Digital Twin Concepts in IoT – AIoT (Artificial Intelligence Things) – Blockchain for IoT Security – Sustainable IoT aligned with SDG Goals.

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. IoT and Edge Computing for Architects, Perry Lea Packt Publication,2nd Edition(2020).
2. The Internet of Things in the Cloud A Middleware Perspective, Honbo Zhou – CRC Publication, 1st Edition (2012)
3. Analytics for the Internet of Things (IoT), Andrew Minteer, Packt Publication 1st Edition 2017
4. Hands-on DevOps, Sricharan Vadapalli, Packt Publication, 1st Edition 2017

REFERENCES:

1. Enterprise Cloud Computing, Gautam Shroff, Cambridge,2010
2. Mastering Cloud Computing -Foundations and Applications Programming, Raj Kumar Buyya, Christian Vecchiola, S. Thamarai Selvi, MK Publication, 2013.
3. Machine Learning in Action||, Peter Harrington, DreamTech Press,1st Edition (2012).
4. Introduction to Machine Learning||, Ethem Alpaydın, MIT Press, 4th Edition (2020)
5. Learning AWS IoT- Effectively Manage Connected Devices on the AWS Cloud Using Services Such as AWS Greengrass, AWS Button, Predictive Analytics and Machine Learning, Agus Kurniawan, Packt Publication,1st Edition (2018)
6. Practical Dev-Ops, Joakim Verona, Packt Publication, 2nd Edition (2018)

WEB REFERENCES:

1. https://hub.packtpub.com/25-datasets-deep-learning-iot/
2. https://data.world/datasets/iot
3. https://dashboard.healthit.gov/datadashboard/data.php
4. https://www.data.gov/
5. https://dev.socrata.com/data/
6. https://www.kaggle.com/

OUTCOMES:

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

1. Apply cloud computing concepts, deployment models, cloud service architectures, and cloud platforms to develop IoT-enabled cloud applications.(K3)

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2. Analyze machine learning algorithms, feature engineering techniques, and edge machine learning models to support intelligent IoT data processing and predictive decision-making. (K4)
3. Build IoT analytics solutions by utilizing cloud-based data management, visualization techniques, dashboards, and real-time analytics tools.(K3).
4. Examine IoT cybersecurity threats, attack models, security architectures, transport layer security, and defense mechanisms to enhance the security of IoT systems.(K4)
5. Utilize DevOps practices, source code management, configuration management, build management, and DevOps frameworks to streamline IoT application development and deployment. (K3)
6. Evaluate emerging IoT paradigms, including Industrial IoT (IIoT), AIoT, Digital Twins, Blockchain, Edge/Fog Computing, and sustainable IoT solutions for real-world applications. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	1	-	-	2	2
CO2	2	2	-	-	-	-	-	-	2	1	-	2	2
CO3	2	-	-	-	-	-	-	-	1	-	-	2	2
CO4	2	2	-	-	-	-	-	-	1	2	-	2	2
CO5	2	-	-	-	-	-	-	-	1	-	-	2	2
CO6	2	2	-	-	-	-	-	-	2	1	-	2	2

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PROFESSIONAL ELECTIVE - I

COURSE CODE: 24CBEL501	PEOPLE ANALYTICS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 110107492	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24ENTP101, 24CBMG301					

OBJECTIVES:

- To understand the evolution and importance of People Analytics in HR decision-making.
- To apply analytical tools in talent acquisition processes.
- To analyze strategies for effective talent sustenance through on boarding analytics, employee engagement measures, and training and development.
- To explore the application of analytics in talent retention and performance management.
- To leverage data analytics for future human capital strategies including succession planning, stress evaluation and mediation techniques.

MODULE - I INTRODUCTION 8

Introduction to People Analytics: Evolution of HR Analytics, HRIS/HRMS – Data Sources, HR Metrics and Analytics, Analytical thinking – Overview of Analytics framework models-LAMP,HCM.

MODULE - II TALENT ACQUISITION 8

Workforce Planning Analytics - Key Components - Best Practices - Diversity Analysis - Measuring diversity and inclusion - Testing the impact of diversity - Talent Sourcing Analytics – Talent Acquisition Analytics – Working Principles - Recruitment and Selection Analytics - Evaluating selection process -Types of Selection bias- Overcoming selection bias

MODULE - III TALENT SUSTENANCE 8

Organizational Culture - On-boarding and Culture Fit – On-boarding Process - Stages of On- boarding - OPEN Analytical Framework for Effective Onboarding- Time to Productivity and Other Outcome Measures - Create an On-boarding Predictive Model

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MODULE - IV TALENT ENGAGEMENT ANALYTICS 5

Talent Engagement Analytics - Importance of Employee Engagement - Employee Engagement Surveys - Moving Beyond the Survey: Employee Engagement - Measures - Training need identification and process - Evaluating effectiveness of training and development

MODULE - V TALENT RETENTION 8

Analytical Performance Management - Defining Performance Measures - Benefits of Analytical Performance Management - Best Practices - Optimizing Promotion Decision - Using Retention Analytics to Protect Talent, Deploying Retention Analytics - Implement Proactive Talent Retention Models - The Segmentation Strategy of Talent Retention Model

MODULE - VI DATA ANALYTICS TO FUTURE HUMAN CAPITAL 8

Succession Planning – Approaches to Succession Planning- Implementing Succession Planning -Evaluating stress levels - Strategies for managing stress - Result oriented strategies - Responsible investment - Need for Mediation – Steps in mediation - Job embeddedness - Interaction analysis.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Nishant Uppal, Human Resource Analytics: A Strategic Decision Making (2020), 1st Edition, Pearson
2. Swati Dhir & Suparna Pal, Human Resource Analytics: Theory And Application Techniques(2021), 1st Edition, Cengage
3. Rama Shankar Yadav, Sunil Maheshwari (2020), "HR Analytics - Connecting Data and Theory", Wiley

REFERENCE BOOKS:

1. Fitz-enz Jac, Mattox II John (2018), "Predictive Analytics for Human Resources", Wiley.
2. Edwards Martin R, Edwards Kirsten (2019),"Predictive HR Analytics: Mastering the HR Metric", Kogan Page Publishers.

OUTCOMES:

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

1. Make use of key HR metrics, data sources, and foundational analytics concepts.(K3)

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2. Identify the role and significance of HR analytics in strategic and operational decision-making.(K3)
3. Apply analytics tools and metrics in areas such as recruitment, onboarding, engagement, and retention.(K3)
4. Utilize HR models like LAMP, HCM, and onboarding frameworks to improve HR practices.(K3)
5. Make use of Talent Engagement Analytics and to identify effectiveness of Training(K3)
6. Identify the impact of HR analytics on organizational performance and talent management strategies.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	–	–	–	–	–	–	–	–	–	–	2
CO2	–	3	–	2	–	–	–	–	–	–	1	1	3
CO3	–	3	–	3	1	–	–	–	–	–	2	1	3
CO4	–	2	–	3	–	–	–	–	–	1	2	–	3
CO5	–	3	1	3	–	–	–	–	–	1	3	–	3
CO6	–	3	–	3	–	1	–	–	–	–	2	–	3

PROFESSIONAL ELECTIVE - I

COURSE CODE: 24CBEL502	MARKETING RESEARCH	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106108705	SYLLABUS VERSION 1.1	SDG NO. 4				
PRE-REQUISITE COURSES	24CBMG401, 24ENTP101					

OBJECTIVES:

- To provide students with a comprehensive understanding of market research concepts and processes in business decision making.
- To enable students to analyze consumer behaviour and market trends using research techniques.
- To equip learners with knowledge of research design, sampling, and data collection methods

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- To develop understanding of quantitative and qualitative analysis techniques for marketing decisions
- To familiarize students with report preparation and interpretation of market research findings
- To help students understand the application of market research tools and analytics in contemporary business environment

MODULE - I INTRODUCTION TO MARKET RESEARCH 7

Meaning and Scope of Market Research, Importance of Market Research, Role of Market Research in Decision Making, Marketing Information System, Types of Market Research, Market Research Process, Ethics in Market Research.

MODULE - II RESEARCH DESIGN AND DATA COLLECTION 8

Research Problem Identification, Research Objectives and Hypothesis Formulation, Research Design – Exploratory, Descriptive and Causal Research, Sources of Data – Primary and Secondary Data, Methods of Data Collection, Questionnaire Design, Scaling Techniques.

MODULE - III SAMPLING AND FIELD WORK 9

Sampling Concepts, Census versus Sampling, Sampling Process, Probability and Non Probability Sampling Techniques, Determining Sample Size, Field Work and Data Collection Procedures, Challenges in Data Collection, Online and Digital Research Methods, Case Studies in Market Research.

MODULE - IV DATA ANALYSIS AND INTERPRETATION 6

Data Processing and Preparation, Editing, Coding and Tabulation, Descriptive Statistics, Measures of Central Tendency and Dispersion, Correlation and Regression Analysis, Hypothesis Testing, Interpretation of Research Findings.

MODULE - V CONSUMER AND INDUSTRIAL MARKET RESEARCH 10

Consumer Behaviour Research, Product Research, Pricing Research, Advertising Research, Brand Research, Customer Satisfaction Research, Industrial Market Research, Competitive Analysis, Digital Market Research and Social Media Analytics, Emerging Trends in Market Research.

MODULE - VI REPORT WRITING AND RESEARCH APPLICATIONS 5

Research Report Structure, Writing Effective Research Reports, Presentation of Findings, Visualization Techniques, Managerial Implications of Research, Applications of Market Research in Business Decisions, Case Study.

TOTAL : 45 PERIODS

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TEXT BOOK:

1. Malhotra, N. K. (2020). Marketing Research: An Applied Orientation (7th ed.). Pearson Education.
2. Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2021). Business Research Methods (10th ed.). Cengage Learning.

REFERENCE BOOKS:

1. Aaker, D. A., Kumar, V., & Day, G. S. (2019). Marketing Research (12th ed.). Wiley India.
2. Churchill, G. A., & Iacobucci, D. (2018). Marketing Research: Methodological Foundations (12th ed.). Cengage Learning.
3. Burns, A. C., & Bush, R. F. (2020). Marketing Research (9th ed.). Pearson Education.

ONLINE REFERENCES

1. NPTEL – Marketing Research and Analysis
2. Coursera – Market Research Specialization
3. Coursera – Qualitative Research Methods
4. FutureLearn – Introduction to Market Research
5. Udemy – Market Research Courses
6. Google Analytics Academy

OUTCOMES:

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

1. Construct the concepts and process of market research(K3)
2. Apply research designs and data collection methods for marketing problems(K3)
3. Determine sampling techniques and market research data for decision making(K5)
4. Assess consumer and industrial market research practices in organizations(K5)
5. Appraise research findings and prepare effective market research reports(K5)
6. Assess the role of market research analytics in business strategy and competitive advantage(K5)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	–	–	–	–	–	–	–	–	1	–	2
CO2	2	3	1	2	–	–	–	–	–	–	1	1	2
CO3	2	3	2	2	1	–	–	–	–	–	2	1	2
CO4	1	3	1	2	–	–	–	–	–	–	2	–	3
CO5	1	2	1	2	–	–	–	–	–	2	1	–	3
CO6	1	3	2	3	2	–	–	–	–	1	2	1	3

PROFESSIONAL ELECTIVE - I

COURSE CODE: 24CBEL503	PERFORMANCE MANAGEMENT	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 110105137	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24CBMG301, 24HSMC301					

OBJECTIVES:

- Understand the concepts, significance, and strategic role of Performance Management Systems (PMS) in organizations.
- Analyze the process of performance planning, goal setting, and alignment of individual and organizational objectives.
- Examine traditional and modern methods of performance appraisal and their applications in organizations.
- Develop skills in performance monitoring, coaching, feedback, and employee development practices.

MODULE - I INTRODUCTION TO PERFORMANCE MANAGEMENT 7

Concept and evolution of Performance Management, Performance Management vs Performance Appraisal, Objectives, scope, and significance of PMS, Characteristics of effective PMS, Strategic Performance Management, Performance Management Process, Role of HR managers and line managers, Performance culture in organizations

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MODULE - II PERFORMANCE PLANNING AND GOAL SETTING 7

Performance Planning Process, Goal setting theory , SMART goals and KRAs, KPIs and competency frameworks, Aligning individual goals with organizational goals, Performance standards and expectations, Performance agreements, Role clarity and accountability

MODULE - III PERFORMANCE APPRAISAL METHODS 9

Traditional appraisal methods, Ranking and Rating scales, Essay method and Critical incident method, Modern appraisal methods, MBO and BARS, Assessment centers, 360-degree feedback, Psychological appraisal and self-appraisal

MODULE - IV PERFORMANCE MONITORING, COACHING AND FEEDBACK 8

Performance monitoring process, Continuous feedback systems, Coaching and mentoring, Performance counseling, Employee development plans, Managing poor performance, Performance review meetings, Communication techniques in PMS

MODULE - V COMPETENCY MAPPING AND CONTEMPORARY ISSUES 7

Competency mapping concepts , Competency models, Balanced Scorecard approach, HR analytics in performance management, Technology-enabled PMS, AI and digital performance systems, Employee engagement and productivity, Ethical and legal issues in appraisal

MODULE - VI REWARD MANAGEMENT AND PERFORMANCE IMPROVEMENT 7

Linking performance with rewards , Incentives and recognition systemsPerformance-based compensation , Career planning and succession planning, High-performance work systems, Measuring organizational effectiveness , Challenges in implementing PMS, Case studies in Performance Management

TOTAL : 45 PERIODS

TEXT BOOK:

1. Michael Armstrong – Performance ManagementKogan Page, - Business and Economics, 2022

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2. T. V. Rao – Performance Management and Appraisal Systems , published by Routledge India, with Nandini Chawla , 2024

REFERENCE BOOK

1. Gary Dessler – Human Resource Management, Pearson, 2023
2. Wayne Cascio – Managing Human Resources, Publisher, McGraw Hill ; Publication date, 2025

RECOMMENDED WEB LEARNING RESOURCES

1. SHRM – Performance Management Resources
2. Harvard Business Review – Performance Management Articles
3. Indeed Career Guide – Performance Management Explained
4. AIHR – Performance Management Guides
5. McKinsey – Organizational Performance Insights
6. Kogan Page – Armstrong's Handbook of Performance Management
7. Pearson – Performance Management by Herman Aguinis

OUTCOMES:

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

1. Examine the fundamentals, evolution, objectives, and importance of Performance Management Systems and their role in organizational effectiveness.(K4)
2. Apply performance planning techniques, SMART goals, KRAs, KPIs, and competency frameworks to align employee performance with organizational goals.(K3)
3. Compare and evaluate various traditional and modern performance appraisal methods used in organizations.(K4)
4. Experiment with the ability to use performance monitoring, coaching, counseling, and feedback techniques for employee development and performance improvement.(K3)
5. Analyze competency mapping, Balanced Scorecard, HR analytics, and technology-driven performance management practices while addressing ethical and legal concerns.(K4)
6. Conclude reward management systems, performance-based compensation, and strategies for improving organizational and employee performance.(K3)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	–	–	–	–	–	–	–	–	1	–	2
CO2	–	3	1	2	–	–	–	–	–	–	2	–	3
CO3	–	3	1	2	–	–	–	–	–	1	2	–	3
CO4	–	3	–	3	–	–	–	–	–	1	2	–	3
CO5	–	3	1	3	1	–	–	1	–	–	2	1	3
CO6	–	3	1	2	–	–	–	–	–	1	3	–	3

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PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL504	BUSINESS INTELLIGENCE	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106101224	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24CSPC301,24BSMA301					

OBJECTIVES:

- Understand the fundamentals, concepts, and architecture of Business Intelligence systems.
- Apply data analysis, visualization, and reporting techniques for business decision-making.
- Analyze business data using statistical and analytical tools.
- Develop dashboards, KPIs, and performance monitoring systems for organizations.
- Explore predictive analytics and intelligent business applications using BI tools.
- Apply Business Intelligence techniques to solve real-world business and industrial problems.

MODULE - I INTRODUCTION TO BUSINESS INTELLIGENCE 7

Introduction to Business Intelligence – Evolution and Importance of BI – BI Architecture and Components – Data, Information, and Knowledge – Business Analytics and Decision Support Systems – BI Process and Framework – Applications of BI in Finance, Marketing, Healthcare, Retail, Manufacturing, and Education – BI Tools and Technologies – Ethics, Privacy, and Security Issues in Business Intelligence.

MODULE - II DATA WAREHOUSING AND DATA MANAGEMENT 7

Data Warehousing Concepts – Data Sources and Data Integration – ETL (Extract, Transform, Load) Process – Data Cleaning and Data Preprocessing – Data Marts and Metadata – OLTP and OLAP Systems – Multidimensional Data Models – Star Schema and Snowflake Schema – Big Data Concepts in BI – Data Governance and Quality Management.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

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MODULE - III DATA ANALYTICS AND STATISTICAL TECHNIQUES 8

Introduction to Data Analytics – Descriptive, Predictive, and Prescriptive Analytics – Statistical Analysis for BI – Correlation and Regression Analysis – Classification and Clustering Techniques – Forecasting and Trend Analysis – Association Rule Mining – Text Analytics and Sentiment Analysis – Business Metrics and KPI Analysis – Data-driven Decision Making.

MODULE - IV DATA VISUALIZATION AND DASHBOARD DESIGN 8

Importance of Data Visualization – Principles of Effective Visualization – Types of Charts and Graphs – Interactive Dashboards – Dashboard Design Process – KPI Dashboards and Executive Dashboards – Storytelling with Data – Visualization Tools: Power BI, Tableau, Google Data Studio – Designing Reports and Infographics – Common Visualization and Dashboard Design Pitfalls.

MODULE - V BUSINESS INTELLIGENCE TOOLS AND APPLICATIONS 8

Business Intelligence Tools Overview – Microsoft Power BI – Tableau – Excel for Business Analytics – Creating Reports and Dashboards – Data Modeling using BI Tools – Real-time Business Monitoring – Cloud-based BI Systems – Mobile BI Applications – BI for Customer Relationship Management (CRM) and Supply Chain Management (SCM) – Case Studies in Business Intelligence Applications.

MODULE - VI EMERGING TRENDS IN BUSINESS INTELLIGENCE 7

Artificial Intelligence and Machine Learning in BI – Predictive Analytics and Forecasting – Self-service BI – IoT and Real-time Analytics – Data Mining Techniques – Natural Language Processing in BI – Intelligent Decision Support Systems – Blockchain and BI – Cybersecurity Analytics – Future Trends and Challenges in Business Intelligence Systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Efraim Turban, Ramesh Sharda, and Dursun Delen, "Decision Support and Business Intelligence Systems", Pearson Education, 10th Edition, 2017.
2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", Morgan Kaufmann Publishers, 2nd Edition, 2012.
3. Cindi Howson, "Successful Business Intelligence: Unlock the Value of BI and Big Data", McGraw Hill Education.

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REFERENCES:

1. Ralph Kimball and Margy Ross, "The Data Warehouse Toolkit", Wiley Publications.
2. Larissa T. Moss and Shaku Atre, "Business Intelligence Roadmap", Addison Wesley.
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications.
4. Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann.
5. Wayne Winston, "Microsoft Excel Data Analysis and Business Modeling", Microsoft Press.

WEB REFERENCES:

1. Microsoft Power BI Documentation: https://learn.microsoft.com/power-bi/
2. Tableau Learning Resources: https://www.tableau.com/learn
3. IBM Business Analytics Resources: https://www.ibm.com/analytics

ONLINE RESOURCES:

1. Coursera – Business Intelligence Courses: https://www.coursera.org/
2. Google Looker Studio Documentation: https://support.google.com/looker-studio
3. NPTEL–Business Intelligence and Analytics Courses: https://nptel.ac.in/courses/110105089

OUTCOMES:

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

1. Apply Business Intelligence concepts, architectures, frameworks, and decision support systems to address business problems in diverse domains. (K3)
2. Analyze data warehousing architectures, ETL processes, multidimensional data models, and data management techniques for effective business intelligence solutions (K4)
3. Apply statistical and analytical techniques such as regression, classification, clustering, forecasting, and KPI analysis for data-driven decision making. (K3)
4. Analyze and design effective visualizations, dashboards, and reports using BI principles and modern visualization tools. (K4)

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5. Develop business intelligence solutions using contemporary BI tools such as Power BI, Tableau, and Excel for real-time monitoring and business analytics. (K3)
6. Analyze the impact of emerging technologies such as AI, Machine Learning, IoT, NLP, Blockchain, and cybersecurity analytics in next-generation business intelligence systems. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3
CO2	2	3	-	-	-	-	-	-	-	–	-	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	2	3
CO4	2	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	2	2
CO6	2	3		-	-	-	-	-	-	-	-	3	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL505	MACHINE LEARNING ESSENTIALS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106139	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24BSMA301, 24CSPC302					

OBJECTIVES:

- Understand the fundamental concepts, techniques, and applications of Machine Learning.
- Apply data preprocessing and feature engineering techniques for machine learning models.
- Analyze supervised and unsupervised learning algorithms for predictive analytics.
- Implement machine learning models using appropriate tools and frameworks.
- Evaluate and optimize machine learning models using performance metrics.

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- Apply machine learning techniques to solve real-world intelligent system problems.

MODULE - I INTRODUCTION TO MACHINE LEARNING **7**

Introduction to Artificial Intelligence and Machine Learning – Types of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning – Applications of Machine Learning – Machine Learning Workflow – Data Collection and Preparation – Training, Validation, and Testing Datasets – Introduction to Python Libraries for Machine Learning – Introduction to Scikit-learn – Challenges and Limitations of Machine Learning – Ethical Issues in Machine Learning.

MODULE - II `DATA PREPROCESSING AND FEATURE ENGINEERING **8**

Data Cleaning and Data Integration – Handling Missing Values and Outliers – Data Transformation Techniques – Feature Scaling: Normalization and Standardization – Feature Selection Methods – Dimensionality Reduction Techniques – Principal Component Analysis (PCA) – Encoding Categorical Variables – Data Visualization for Machine Learning – Introduction to Exploratory Data Analysis (EDA).

MODULE - III SUPERVISED LEARNING ALGORITHMS **7**

Introduction to Supervised Learning – Regression and Classification Concepts – Linear Regression – Logistic Regression – Decision Trees – Random Forest – Support Vector Machines – K-Nearest Neighbor Algorithm – Naive Bayes Classification – Model Training and Testing – Bias and Variance – Overfitting and Underfitting – Cross Validation Techniques – Performance Metrics: Accuracy, Precision, Recall, F1-Score, ROC Curve.

MODULE - IV UNSUPERVISED LEARNING AND CLUSTERING TECHNIQUES **8**

Introduction to Unsupervised Learning – Clustering Concepts and Applications – K-Means Clustering – Hierarchical Clustering – Density-based Clustering – Association Rule Mining – Market Basket Analysis – Dimensionality Reduction for Visualization – Anomaly Detection – Recommendation Systems – Applications of Unsupervised Learning in Business and Industry.

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MODULE - V NEURAL NETWORKS AND DEEP LEARNING FUNDAMENTALS **8**

Introduction to Artificial Neural Networks – Biological Inspiration of Neural Networks – Structure of Neurons and Layers – Activation Functions – Feed forward Neural Networks – Back propagation Algorithm – Deep Learning Concepts – Convolutional Neural Networks (CNN) – Recurrent Neural Networks (RNN) – Introduction to Tensor Flow and Keras – Applications of Deep Learning in Image Processing, Speech Recognition, and Natural Language Processing.

MODULE - VI MACHINE LEARNING APPLICATIONS AND EMERGING TRENDS **7**

Machine Learning for Predictive Analytics – Natural Language Processing Basics – Computer Vision Applications – Time Series Forecasting – Reinforcement Learning Fundamentals – Explainable AI and Responsible AI – Edge AI and IoT Applications – Machine Learning in Healthcare, Finance, Smart Manufacturing, and Cyber security – Model Deployment Concepts – Future Trends in Machine Learning and Intelligent Systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, International Edition.
2. Andreas C. Müller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media, 1st Edition, 2016.
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, 3rd Edition, 2022.

REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press.
4. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, "The Elements of Statistical Learning", Springer.
5. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", Packt Publishing.

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WEB REFERENCES:

1. Scikit-learn Official Documentation: https://scikit-learn.org/stable/
2. TensorFlow Official Documentation: https://www.tensorflow.org/
3. Keras Documentation: https://keras.io/

ONLINE RESOURCES:

1. Google Machine Learning Crash Course: https://developers.google.com/machine-learning/crash-course
2. Coursera – Machine Learning by Andrew Ng: https://www.coursera.org/learn/machine-learning
3. Kaggle Learn – Machine Learning Courses: https://www.kaggle.com/learn

OUTCOMES:

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

1. Apply machine learning concepts, workflows, data preparation techniques, and Python-based tools to develop basic machine learning solutions for real-world problems. (K3)
2. Analyze and preprocess datasets using data cleaning, feature engineering, dimensionality reduction, and exploratory data analysis techniques to improve model performance. (K4)
3. Apply supervised learning algorithms such as regression, classification, decision trees, random forests, and support vector machines for predictive modeling tasks. (K3)
4. Analyze unsupervised learning techniques including clustering, association rule mining, anomaly detection, and recommendation systems for pattern discovery and knowledge extraction. (K4)
5. Apply neural network architectures and deep learning frameworks to develop solutions for image, speech, and natural language processing applications. (K3)
6. Analyze emerging machine learning technologies, responsible AI practices, and domain-specific applications to address complex challenges in intelligent systems. (K4)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	-	-	-	-	-	-	-	-	2	3
CO5	3	-	-	-	-	-	-	-	-	-	-	2	3
CO6	2	3	-	-	-	-	-	-	-	-	-	3	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL506	DECISION SUPPORT SYSTEMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 110105147	SYLLABUS VERSION 1.0	SDG NO. 9, 11, 13				
PRE-REQUISITE COURSES	24CSPC301, 24BSMA301					

OBJECTIVES:

- Understand the fundamentals, concepts, and applications of Decision Support Systems (DSS).
- Analyze organizational decision-making processes and the role of DSS in improving business performance.
- Apply data management, model management, and knowledge-based techniques in DSS design.
- Develop skills in data analysis, visualization, and reporting for managerial decision-making.
- Explore intelligent and group decision support systems using modern analytical tools.
- Apply DSS concepts to real-world business, healthcare, industrial, and strategic decision-making scenarios.

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MODULE - I CLOUD ARCHITECTURE AND MODELS 7

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud Characteristics – Cloud deployment models – Cloud service models – Pros and Cons of Cloud.

MODULE - II INTRODUCTION TO VIRTUALIZATION 8

Basics of Virtualization – Virtualization Types – Implementation Levels of Virtualization – Virtualization Structures / Tools and Mechanisms – Virtualization of CPU, Memory, I/O Devices – Virtual Clusters and Resource management – Virtualization for Data-Center Automation – Virtualization Support and Disaster Recovery – Taxonomy of Virtual Machines – Create VM Cluster using VMWare or Virtual Box and deploy an application.

MODULE - III CLOUD INFRASTRUCTURE 8

Cloud Infrastructure: Architectural design of compute and storage clouds – Layered cloud architecture Development – Design Challenges – Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

MODULE - IV CLOUD DEPLOYMENT ENVIRONMENT 7

Parallel Programming Framework: Hadoop Map Reduce – Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack – OpenNebula – Aneka.

MODULE - V CLOUD SECURITY 7

Data Security and Storage; Identity and Access Management (IAM) – IAM Challenges – IAM Architecture and Practice; Security Management in the Cloud – Security Management Standards – SaaS, Paas and IaaS Availability Management – Access Control; Security-As-A-Service.

MODULE - VI CLOUD SIMULATOR & CLOUD APPLICATIONS 8

CloudSim – Architecture - Cloudlets – VM creation – Broker – VM allocation – Hosts – Data Center. Web Service Architecture – Web service APIs – Web service authentication - Web service authentication methods - Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages.

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. Efraim Turban, Ramesh Sharda, and Dursun Delen, "Decision Support and Business Intelligence Systems", Pearson Education, 10th Edition, 2017.
2. Marakas George M., "Decision Support Systems in the Twenty-First Century", Prentice Hall, 2nd Edition, 2003.
3. Power D.J., "Decision Support, Analytics, and Business Intelligence", Business Expert Press, 2019.

REFERENCES:

1. Daniel J. Power, "Decision Support Systems: Concepts and Resources for Managers", Greenwood Publishing.
2. Ralph H. Sprague and Hugh J. Watson, "Decision Support Systems: Putting Theory into Practice", Prentice Hall.
3. Sauter Vicki L., "Decision Support Systems for Business Intelligence", Wiley Publications.
4. James O'Brien and George Marakas, "Management Information Systems", McGraw Hill Education.
5. Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann.

WEB REFERENCES:

1. Decision Support Systems Journal – Elsevier: https://www.journals.elsevier.com/decision-support-systems
2. IBM Business Analytics Resources: https://www.ibm.com/analytics
3. Microsoft Power BI Documentation: https://learn.microsoft.com/power-bi/

ONLINE RESOURCES:

1. Tableau Learning Resources: https://www.tableau.com/learn
2. Coursera – Business Intelligence and Decision Support Courses: https://www.coursera.org/
3. Google Cloud Decision Intelligence Resources: https://cloud.google.com/solutions

OUTCOMES:

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

1. Analyze user-centered design principles to identify usability issues and recommend improvements in software applications. (K4)

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2. Utilize human-computer interaction concepts to design effective user interfaces. (K3)
3. Develop user requirements using UX research techniques such as personas and scenarios. (K3)
4. Examine interface prototypes to identify usability issues and recommend appropriate design enhancements. (K4)
5. Apply usability evaluation methods to assess and improve software interfaces. (K3)
6. Implement user-friendly software applications through iterative design and testing processes. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	3	-	-	-	-	-	-	-	–	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	-	-	-	-	-	-	-	-	2	3
CO5	3	-	-	-	-	-	-	-	-	-	-	2	3
CO6	2	3		-	-	-	-	-	-	-	-	3	3

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PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ITEL516	LEARNING ANALYTICS TOOLS	L	T	P	CP	C
		3	0	0	4	3
NPTEL CODE: 106101224	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24ESCS101, 24BSMA301, 24BSMA402					

OBJECTIVES:

- Understand the fundamentals, significance, and key terminologies of learning analytics in educational environments.
- Learn methods of educational data collection, preprocessing, summarization, and pattern identification techniques.
- Apply statistical and predictive modeling techniques to analyze educational data and support decision-making.
- Explore text analysis and advanced analytics techniques for extracting meaningful insights from educational data.

MODULE - I INTRODUCTION TO LEARNING ANALYTICS 7

Role of Data Analytics in Education - Learning Analytics: Definition, Scope & Importance - Educational Data Mining (EDM) & Applications - Academic vs. Learning Analytics - Data, Information & Knowledge in Education - Four Levels of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive - Ethical Issues: Data Privacy & Security -Learning Analytics Tools & Platforms

MODULE - II DATA COLLECTION AND PREPROCESSING 7

Types of Educational Data (Behavior, Performance, Interaction) - Data Collection Methods: Surveys, LMS, MOOCs, OER - Data Cleaning: Handling Missing Values & Outliers - Data Transformation: Normalization, Aggregation, Standardization - Data Integration & Handling Multiple Formats - Feature Engineering for Learning Analytics - Tools: Weka, R, Python

MODULE - III DESCRIPTIVE AND DIAGNOSTIC ANALYTICS 7

Overview of Descriptive Analytics - Key Statistics: Mean, Median, Mode, Standard Deviation - Data Visualization: Histograms, Bar Charts, Box Plots - Diagnostic Analytics & Pattern Recognition - Correlation Analysis & Causal Relationships - Visualization: Scatter Plots, Heatmaps, Correlation Matrices - Advanced Analytics: Principal Component Analysis (PCA) - Case Studies

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MODULE - IV PREDICTIVE ANALYTICS 8

Introduction to Predictive Analytics - Supervised vs. Unsupervised Learning - Key ML Models: Linear & Logistic Regression, Decision Trees - Naïve Bayes for Classification - Model Evaluation: Accuracy, Precision, Recall, F1-Score - Tools: Weka, Orange, Scikit-learn

MODULE - V TEXT ANALYTICS AND ADVANCED TECHNIQUES 8

Introduction to Text Analytics - Text Mining: Tokenization, Lemmatization, Stopword Removal -Sentiment Analysis & Topic Modeling (LDA) - NLP for Educational Data - Process & Sequence Mining in Learning Paths - Advanced Models: Random Forest, SVM

MODULE - VI APPLICATIONS AND ETHICS 8

Real-World Learning Analytics Applications - Designing Data-Driven Interventions - Ethics & Legal Considerations in Education Data - Communicating & Visualizing Analytics Results - Case Studies on Effective Implementation

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Siemens, G., & Gasevic, D. (Eds.). (2017). Handbook of Learning Analytics (1st ed.). Society for Learning Analytics Research (SoLAR). ISBN: 978-0-9952408-0-3.
2. Romero, C., Ventura, S., Pechenizkiy, M., & Baker, R. S. J. (Eds.). (2010). Handbook of Educational Data Mining. CRC Press / Taylor & Francis Group. ISBN: 978-1-4398-0457-5.

REFERENCES:

1. Witten, I. H., Frank, E., Hall, M. A., & Pal, C. J. (2016). Data Mining: Practical Machine Learning Tools and Techniques (4th ed.). Morgan Kaufmann / Elsevier. ISBN: 978-0-12-804291-5.
2. Manning, C. D., Raghavan, P., & Schütze, H. (2008). Introduction to Information Retrieval. Cambridge University Press. ISBN: 978-0-521-86571-5.

WEB RESOURCES:

1. NPTEL Course Page – Learning Analytics Tools (106101224), IIT Bombay, Prof. Ramkumar Rajendran. https://nptel.ac.in/courses/106101224
2. Handbook of Learning Analytics (Free PDF) – SoLAR Community (2017). https://solaresearch.org/hla-17/
3. Weka Machine Learning Workbench – University of Waikato. https://www.cs.waikato.ac.nz/ml/weka/

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4. Orange Data Mining Tool – University of Ljubljana. https://orange datamining.com/
5. ProM Process Mining Tool – Eindhoven University of Technology. https://promtools.org/
6. Open University Learning Analytics Dataset (OULAD) – anonymized student data for EDM practice. https://analyse.kmi.open.ac.uk/open_dataset
7. LAK Conference Proceedings Archive – ACM Digital Library. https://dl.acm.org/conference/lak
8. EDM Conference Proceedings Archive – Educational Data Mining Society. https://educationaldatamining.org/EDM2024/proceedings/
9. Moodle Learning Analytics Documentation (data collection, dashboards). https://docs.moodle.org/en/Learning_analytics
10. Stanford NLP Group – Introduction to Information Retrieval. https://nlp.stanford.edu/IR-book/
11. Google Colab Tutorials for Data Analytics in Education – practical Python notebooks. https://colab.research.google.com/
12. Kaggle – Educational Data Mining & Student Performance Datasets (practice data). https://www.kaggle.com/datasets?search=student+performance

OUTCOMES:

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

1. Apply foundational concepts and techniques of learning analytics in educational contexts. (K3)
2. Use appropriate tools to collect and process educational data. (K3)
3. Execute statistical and machine learning techniques to extract insights from learning data. (K3)
4. Implement data-driven learning interventions based on analytical insights. (K3)
5. Practice ethical, privacy, and legal principles in learning analytics. (K3)
6. Illustrate learning analytics results effectively using visualizations and reports. (K3)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	2	1
CO2	2	2	–	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	3	2
CO4	2	3	3	2	-	-	-	-	-	-	-	2	3
CO5	1	2	–	–	-	-	-	-	-	-	-	1	1
CO6	–	–	–	1	-	-	-	-	-	-	-	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ITEL517	DATA SCIENCE FOR ENGINEERS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106179	SYLLABUS VERSION 1.0	SDG NO. 4, 8, 9				
PRE-REQUISITE COURSES	24AIPT201, 24BSMA301, 24CSPC301					

OBJECTIVES:

- To understand the fundamental concepts of data science and apply mathematical foundations such as linear algebra, probability, and statistics for data analysis.
- To develop skills in data preprocessing, feature engineering, and model selection for effective data-driven problem-solving.
- To implement and evaluate supervised and unsupervised machine learning techniques for extracting insights and making predictions from data.
- To apply Python-based data science tools and libraries, including time series analysis, to solve real-world engineering problems.

MODULE - I FOUNDATIONS OF DATA SCIENCE AND PYTHON ANALYTICS 7

Data Science overview and lifecycle – Applications in Engineering – Types of data – Python for Data Science (NumPy, Pandas, Matplotlib) – Data import/export – Exploratory Data Analysis (EDA) – Data cleaning and preprocessing – Data visualization techniques.

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MODULE - II MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE 7

Vectors and matrices – Matrix operations – Eigenvalues and Singular Value Decomposition (SVD) – Optimization fundamentals – Gradient and partial derivatives – Gradient Descent and variants – Convex functions – Applications in machine learning.

MODULE - III STATISTICAL METHODS AND DECISION THEORY 7

Vectors and matrices – Matrix operations – Eigenvalues and Singular Value Decomposition (SVD) – Optimization fundamentals – Gradient and partial derivatives – Gradient Descent and variants – Convex functions – Applications in machine learning.

MODULE - IV SUPERVISED MACHINE LEARNING TECHNIQUES 8

Linear and Logistic Regression – k-Nearest Neighbours (kNN) – Support Vector Machines (SVM) – Decision Trees – Model evaluation metrics – Cross-validation – Model selection and regularization techniques.

MODULE - V UNSUPERVISED LEARNING AND FEATURE ENGINEERING 8

Clustering techniques (k-Means, Hierarchical Clustering, DBSCAN) – Cluster validation – Dimensionality Reduction (PCA, LDA, t-SNE) – Feature engineering and selection – Ensemble learning methods (Random Forest, Boosting) – Bootstrapping and Cross-validation.

MODULE - VI ADVANCED ANALYTICS, DEEP LEARNING AND BIG DATA 8

Time Series Analysis and Forecasting – Artificial Neural Networks (ANN) – Convolutional and Recurrent Neural Networks (CNN, RNN) – Big Data fundamentals – Hadoop and Spark ecosystem – Data pipelines and cloud platforms – Engineering case studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Wes McKinney, "Python for Data Analysis", 3rd Edition, O'Reilly Media, 2022.
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 3rd Edition, O'Reilly Media, 2022.
3. Joel Grus, "Data Science from Scratch", 2nd Edition, O'Reilly Media, 2019.

REFERENCES

1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning with Applications in Python", Springer, 2023.

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2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
3. Douglas Montgomery, George Runger, "Applied Statistics and Probability for Engineers", 7th Edition, Wiley, 2018.
4. Gilbert Strang, "Introduction to Linear Algebra", 5th Edition, Wellesley-Cambridge Press, 2016.

WEB RESOURCES

1. https://nptel.ac.in/courses/106106179 – NPTEL Data Science for Engineers (IIT Madras)
2. https://scikit-learn.org/stable/user_guide.html – Scikit-Learn User Guide
3. https://pandas.pydata.org/docs/ – Pandas Documentation
4. https://www.kaggle.com/learn – Kaggle Learn (Practical Data Science)
5. https://archive.ics.uci.edu/ml/ – UCI Machine Learning Repository

OUTCOMES:

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

1. Apply Python and data science libraries for data preprocessing, analysis, and visualization. (K3)
2. Apply mathematical and optimization techniques in data science and machine learning. (K3)
3. Apply statistical methods and hypothesis testing for data-driven decision-making. (K3)
4. Analyze and evaluate supervised machine learning models using performance metrics. (K4)
5. Analyze data using clustering, dimensionality reduction, and feature engineering techniques. (K4)
6. Analyze advanced techniques such as ensemble learning, deep learning, time series analysis, and big data frameworks. (K4)

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CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	3	1
CO3	3	3	1	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3
CO6	3	3	3	-	-	-	-	-	-	-	-	3	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ITEL518	DATA MINING FOR DECISION MAKING	L	T	P	CP	C
		3	0	0	4	3
NPTEL CODE: 110104118	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ESCS101, 24BSMA301, 24ITPW301, 24BSMA402					

OBJECTIVES:

- To apply data-driven approaches and decision support systems for organizational decision-making.
- To analyze datasets using exploratory and predictive analytics techniques for decision modeling.
- To utilize multi-criteria decision-making methods for evaluating and selecting alternatives.
- To evaluate decision problems using hierarchical, ranking, and outranking techniques.

MODULE - I DECISION SUPPORT SYSTEMS AND DATA-DRIVEN DECISION MAKING **8**

Introduction to Decision Making – Types of Decisions and Decision-Making Process – Business Intelligence and Decision Support Systems – Role of Data Mining in Decision Making – Knowledge Discovery in Databases (KDD) Process – Data Mining Methodology for Decision Support – Data Warehousing Concepts for Analytical Decision Making – Exploratory Data Analysis (EDA) for

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Decision Support – Statistical Description of Data – Data Visualization Techniques for Decision Making – Correlation and Covariance Analysis – Ethical Issues and Challenges in Data-Driven Decision Making.

MODULE - II PREDICTIVE ANALYTICS AND DECISION MODELLING 8

Classification and Prediction for Decision Making—Decision Tree Induction—Bayesian Classification—Regression Analysis—Model Evaluation Techniques: Accuracy, Precision, Recall, F-Measure, and ROC Curve—Predictive Analytics and Decision Modelling—Principal Component Analysis (PCA) and Factor Analysis for Decision Support—Recommendation Systems—Business and Marketing Analytics—Time Series Forecasting for Strategic Decisions—Case Studies in Business Decision Making—Ethical and Privacy Issues in Predictive Modelling.

MODULE - III FOUNDATIONS OF DECISION MAKING AND DECISION ANALYSIS 8

Multi-Criteria Decision Making (MCDM): Concepts, Characteristics, and Applications – Multi-Attribute Utility Theory (MAUT) – Utility Functions and Preference Structures – Utility Theory and Risk Analysis – Pareto Optimality and Pareto Efficiency – Dominance Relationships – Decision Trees: Structure, Construction, Evaluation, and Applications in Decision Analysis.

MODULE - IV PERFORMANCE EVALUATION AND HIERARCHICAL DECISION MODELS 8

Data Envelopment Analysis (DEA): Concepts, Efficiency Measurement, CCR and BCC Models, Applications of DEA—Analytical Hierarchy Process (AHP): Pairwise Comparisons, Consistency Analysis, Priority Vector Estimation, Applications—Analytical Network Process (ANP): Network Structures, Dependency and Feedback Relationships, Supermatrix Concept—Comparative Analysis of AHP and ANP—Case Studies on Resource Allocation and Decision Prioritization.

MODULE - V RANKING AND OUTRANKING METHODS IN MCDM 8

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS): Concepts, Computational Procedure, Applications—ELECTRE Family of Methods: Concordance and Discordance Analysis, Outranking Relations—PROMETHEE Methods: Preference Functions, Positive and Negative Flows, Ranking Alternatives—MACBETH: Measuring Attractiveness by a Categorical-Based Evaluation Technique—Comparative Study of Ranking and Outranking Approaches—Decision Support Applications.

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MODULE - VI ADVANCED DECISION SUPPORT TECHNIQUES 8

SWOT Analysis: Internal and External Environmental Assessment—System Analysis and Systems Thinking in Decision Making—Other Decision-Making Tools: Weighted Scoring Models, Goal Programming, Decision Support Systems—Fundamentals of Fuzzy Sets and Fuzzy Logic—Fuzzy Membership Functions—Fuzzy MCDM Approaches—Applications of Fuzzy Logic in Engineering, Business, and Management Decisions—Integrated Decision-Making Frameworks and Case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jiawei Han, Jian Pei, and Hanghang Tong, "Data Mining: Concepts and Techniques," Fourth Edition, Elsevier, 2022.
2. Belton, V. and Stewart, T.J., "Multiple Criteria Decision Analysis: An Integrated Approach", Springer Science & Business Media, 2017.
3. Tzeng, G.H. and Huang, J.J., "Multiple Attribute Decision Making: Methods and Applications", CRC Press, 2011.
4. Figueira, J., Greco, S., and Ehrgott, M., "Multiple Criteria Decision Analysis: State of the Art Surveys", Springer, Second Edition, 2016.

REFERENCES

1. Saaty, T.L., "Decision Making with the Analytic Hierarchy Process", RWS Publications, 2008.
2. Saaty, T.L., "Theory and Applications of the Analytic Network Process", RWS Publications, 2013.
3. Zimmermann, H.J., "Fuzzy Set Theory and Its Applications", Fourth Edition, Springer, 2011.
4. Cooper, W.W., Seiford, L.M., and Tone, K., "Data Envelopment Analysis: A Comprehensive Text with Models, Applications, References, and DEA-Solver Software", Second Edition, Springer, 2007.
5. Goodwin, P. and Wright, G., "Decision Analysis for Management Judgment", Sixth Edition, Wiley, 2020.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg121
2. Scikit-Learn Documentation
3. WEKA Data Mining Software
4. IBM Decision Support Systems Resources

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5. Oracle Business Intelligence Resources
6. INFORMS Decision Analysis Society
7. International Society on Multiple Criteria Decision Making

OUTCOMES:

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

1. Apply business intelligence, decision support systems, and data mining methodologies to solve decision-making problems. (K3)
2. Analyze datasets using exploratory data analysis and predictive analytics techniques for informed decision-making. (K4)
3. Utilize MCDM methodologies, including MAUT, utility theory, and decision trees for evaluating alternatives. (K3)
4. Analyze complex decision problems using DEA, AHP, and ANP models. (K4)
5. Apply ranking and outranking techniques such as TOPSIS, ELECTRE, PROMETHEE, and MACBETH for decision support. (K3)
6. Develop decision support solutions using fuzzy logic and advanced decision-making frameworks. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	2	-	-	-	-	-	-	-	-	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	2	3	2	-	-	-	-	-	-	-	-	-	2
CO5	3	2	-	3	-	-	-	-	-	-	-	2	3
CO6	2	-	3	2	3	-	-	-	-	-	-	3	3

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PROFESSIONAL ELECTIVE - II

COURSE CODE: 24CIEL504	WEB OF THINGS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 117103488	SYLLABUS VERSION 1.0	SDG NO. 7, 9, 11				
PRE-REQUISITE COURSES	24ESCS101, 24AIPT201, 24CIPT401					

OBJECTIVES:

- To understand the fundamentals and architecture of the Web of Things (WoT).
- To learn the reference models, design principles, and architectures of the Web of Things.
- To develop knowledge of programming frameworks, protocols, and technologies for implementing Web of Things applications.
- To acquire an understanding of Web of Things applications and their role in developing interoperable smart systems.

MODULE - I INTRODUCTION TO WoT AND TOOLS 7

Fundamentals of Internet of Things(IoT) and Web of Things (WoT) - Connected objects - Ontology of WoT - Context Modelling - Embedded devices - Introduction to Raspberry Pi - Node.js on RaspberryPi - Connecting sensors and actuators on Pi - Modeling REST full services

MODULE - II MASHUP TOOLS AND MODEL DRIVEN ENGINEERING 8

Mashup tools - Model driven engineering for WoT - Comparing mashup and Model driven tools - Modeling of RESTful services - Modeling WoT system with generic RESTful operations - Building network of things: Topologies - Classification models - Network protocols for things: spatial considerations, Internet protocols and IoT - IoT Personal Area Networks, IoT Wide Area Networks.

MODULE - III NETWORKING IN IOT

Application protocols: Zigbee, Bluetooth application stack - Application protocol for things: Apple home kit, Google weave - Message Queuing Telemetry Transport (MQTT) - Constraint application protocol - WoT 8

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architecture - Compose-Building IoT with Avatars: Avatar based IoT platform - Disruption tolerant communication-Context modeling and management - Social vision of WoT - Challenges of WoT - Testbed of WoT and IoT - Hardware of a WoT testbed - Software of WoT testbed.

MODULE - IV INTEGRATION IN WOT 7

Web API's for things: Devices & resources – Principles for web API's - Publish subscribe model – Web hooks, Comes and web sockets – Implementing web things - Connecting devices to the web - Direct integration pattern - REST on devices - Gateway integration pattern - CoAP - Cloud integration pattern - MQTT communication- - Discovering things - Describing web things - Implementing web thing model on Pi-Semantic WoT - Schema and JSON-LD.

MODULE - V REPRESENTATION AND STORAGE 8

Automatic integration and querying of semantic rich heterogeneous data: introduction - Semantic WoT(SWoT) - Semantic web assembler of SWoT-Case study: smart application-Building entity graphs for WoT - Background and methodology - Interoperability and cross domain applications – Trends and evolution - Challenges in interoperability - Contributions- M3 framework - Datastorage in WoT framework - Methods and challenges - Data storage in cloud platform - Tendency for data storage technology-Future directions.

MODULE - VI SECURITY IN WOT 7

Securing things – Open issues and challenges – Web of Topics (WoX) model–Design and implementation – Security from IoT to WoT – Existing models – Security in WoT: Encryption 101, TLS - Enabling HTTPS and WSS with TLS on Pi - Authentication and access control with REST and API tokens – Open Authorization – Social WoT authentication proxy – Implementing a social WoT authentication proxy - Social impact and vulnerable populations - WoT and health - Potential positive implications for health - Challenges from health perspective - Unintended consequences for social health - Implications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Dominique Guinard & Vlad Trifa, "Building the Web of Things", MIT Press, 2016.
2. Arshdeep Bahga & Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

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3. Adrian McEwen & Hakim Cassimally, "Designing the Internet of Things", Wiley, 2013.
4. Maneesh Rao, "Internet of Things with Raspberry Pi 3", Packt Publishing, 2018.

REFERENCES:

1. Andy King, "Programming the Internet of Things", O'Reilly Media, 2021.
2. Dean Allemang & James Hendler, "Semantic Web for the Working Ontologist", 2nd Edition, Morgan Kaufmann, 2011.
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete et al., "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases", Cisco Press, 2017.
4. Mario Casciaro & Luciano Mammino, "Node.js Design Patterns", 3rd Edition, Packt Publishing, 2020.
5. Leonard Richardson, Mike Amundsen & Sam Ruby, "RESTful Web APIs", O'Reilly Media, 2013.
6. Ali Ismail Awad & Jemal Abawajy (Eds.), "Security and Privacy in the Internet of Things", CRC Press, 2021.
7. Brian Russell & Drew Van Duren, "IoT Security: Fundamentals", Wiley, 2018.
8. Tom Heath & Christian Bizer, "Linked Data: Evolving the Web into a Global Data Space", Morgan & Claypool, 2011.

WEBREFERENCES:

1. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html
2. https://nptel.ac.in/courses/108102045
3. https://archive.nptel.ac.in/courses/106/105/106105193/
4. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

OUTCOMES:

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

1. Apply the principles of the Web of Things (WoT), context modelling, embedded platforms, and RESTful services to design and implement connected IoT applications using Raspberry Pi. (K3).
2. Analyze mashup tools, model-driven engineering techniques, network topologies, and IoT communication protocols to design scalable Web of Things systems.(K4)

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3. Examine application-layer protocols, Web of Things (WoT) architectures, context management techniques, and avatar-based IoT platforms to determine suitable networking solutions for Web of Things applications. (K4)
4. Identify appropriate Web APIs, REST, CoAP, MQTT, semantic web technologies, and integration patterns to build interoperable Web of Things (WoT) solutions.(K3).
5. Implement semantic data representation, interoperability frameworks, and cloud-based storage techniques to support heterogeneous Web of Things (WoT) data management. (K3)
6. Assess security mechanisms, authentication methods, encryption techniques, TLS, and access control models to ensure secure Web of Things (WoT) applications and evaluate their social and healthcare implications. (K4).

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	1	-	-	-	2	2
CO2	3	2	-	-	-	-	-	1	-	-	-	2	2
CO3	3	2	-	-	-	-	-	1	1	-	-	2	2
CO4	3	-	-	-	-	-	-	1	1	-	-	2	2
CO5	3	-	-	-	-	-	-	1	-	-	-	2	2
CO6	3	1	-	-	-	-	-	1	-	-	-	2	2

Recommended in Board of Studies (BoS) Meeting No. 6 **held on** 9.4.2026

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PROFESSIONAL ELECTIVE - II

COURSE CODE: 24CIEL505	WIRELESS TECHNOLOGIES IN INTERNET OF THINGS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105160	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24CIPC301,24CIPT401					

OBJECTIVES:

- To understand the fundamentals of wireless communication, IoT architecture, standards, and communication requirements for IoT systems.
- To study short-range, long-range, and cellular wireless technologies, protocols, and networking mechanisms used in IoT applications.
- To analyze mobility management, Quality of Service (QoS), advanced wireless communication techniques, and performance optimization in IoT networks.
- To examine security, energy-efficient communication strategies, deployment aspects, and emerging wireless technologies for real-world IoT applications.

MODULE - I INTRODUCTION TO WIRELESS IoT COMMUNICATIONS 8

Introduction to Internet of Things (IoT) – IoT Architecture and Communication Models – Wireless Communication Fundamentals – IoT Network Requirements – Wireless Spectrum and Frequency Bands – Evolution of Wireless Technologies: WiFi, Bluetooth, ZigBee, Cellular IoT, 5G – Wireless Standards and Design Challenges for IoT Applications.

MODULE - II SHORT RANGE AND LONG RANGE WIRELESS TECHNOLOGIES 8

Short-Range Wireless Technologies: Bluetooth/BLE, ZigBee, IEEE 802.15.4, RFID, NFC, Wi-Fi and Wi-Fi HaLow – Wireless Personal Area Networks (WPAN) – Long-Range Wireless Technologies: LPWAN, LoRa, LoRaWAN, Sigfox – Cellular IoT Technologies: LTE-M, NB-IoT, 4G/5G IoT Communication – Comparative Analysis of Wireless Technologies for IoT.

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MODULE - III WIRELESS CHANNELS, NETWORKING AND PROTOCOLS 7

Wireless Channel Characteristics – Propagation Models – Small Scale and Multipath Fading – IoT Communication Protocols: MQTT, CoAP, AMQP, DDS – IPv6 and 6LoWPAN for IoT – Routing Protocols for Wireless Sensor Networks – Adaptive Link and Network Layer Protocols – Edge, Fog and Cloud Connectivity in IoT.

MODULE - IV MOBILITY MANAGEMENT AND QUALITY OF SERVICE IN IOT NETWORKS 7

Mobility in Wireless IoT Networks – Cellular and Heterogeneous Network Architectures – Handoff Management – Roaming and Connectivity Management – Mobility Prediction in Smart Networks – QoS Challenges in IoT Systems – QoS Architecture, QoS Attributes and End-to-End QoS Management – Resource Allocation and Traffic Management in LTE/5G IoT Networks.

MODULE - V ADVANCED WIRELESS TECHNOLOGIES FOR IoT 7

MIMO Communication Systems – Diversity Techniques – Beamforming and Spatial Multiplexing – Massive MIMO for 5G IoT – Multi-User Communication Systems – Adaptive Wireless Communication Techniques – Channel Capacity and Performance Enhancement – Application of Optimization Techniques in Wireless Network Design.

MODULE - VI SECURITY, DEPLOYMENT AND IoT APPLICATIONS 8

Security Challenges in Wireless IoT Networks – Authentication, Access Control and Encryption Techniques – Secure Wireless Communication Protocols – Energy Efficient Wireless Communication and Power Management – IoT Device Deployment and Network Monitoring – Case Studies: Smart Homes, Smart Healthcare, Smart Agriculture, Smart Cities and Industrial

TOTAL : 45 PERIODS

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Cisco Press, 2017.
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things – A Hands-On Approach, Universities Press, 2015.
3. Andreas F. Molisch, Wireless Communications: From Fundamentals to Beyond 5G", Wiley-IEEE Press., John Wiley & Sons, 3rd Edition (2022).

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4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos and David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Academic Press, 2014.

REFERENCES:

1. Olivier Hersent, David Boswarthick and Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley, 2nd Edition, 2012.
2. Behrouz A. Forouzan, Wireless Communication and Networking, McGraw-Hill Education, 1st Edition (2015).
3. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw-Hill Education, 5th Edition, 2024.
4. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley, 1st Edition (2014)
5. Aldo Morabito, The Internet of Things: Architectures, Protocols and Standards, Springer, 2018.

WEB REFERENCES:

1. https://onlinelibrary.wiley.com/doi/10.1155/2016/8206548
2. https://arxiv.org/abs/1611.00861
3. https://www.sciencedirect.com/topics/engineering/wireless-technologies

OUTCOMES:

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

1. Apply IoT architectures, wireless communication principles, standards, and design requirements for IoT systems. (K3)
2. Utilize suitable short-range, long-range, and cellular wireless technologies for different IoT application scenarios. (K3)
3. Identify the wireless channels, communication protocols, networking approaches, and mobility management techniques in IoT environments. (K3)
4. Examine QoS requirements, advanced wireless communication methods, and optimization techniques for improving IoT network performance. (K4)
5. Analyze the security mechanisms, energy-efficient communication strategies, and deployment considerations in wireless IoT systems. (K4)

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6. Dissect the wireless IoT solutions for real-world applications using appropriate technologies, protocols, and emerging communication paradigms. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	2	-	1	1
CO2	2	-	-	-	-	-	-	-	1	1	-	1	1
CO3	2	-	-	-	-	-	-	-	1	1	-	1	2
CO4	2	2	-	-	2	-	-	2	2	2	-	1	1
CO5	2	2	-	-	1	-	-	-	1	1	-	2	2
CO6	3	3	-	-	-	-	-	-	1	1	-	1	2

PROFESSIONAL ELECTIVE - II

COURSE CODE: 24CIEL506	DESCRIPTIVE ANALYTICS FOR IOT	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 117103488	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ITPW302, 24CIPC301					

OBJECTIVES:

- To learn the basics of Data analytics
- To learn about big data analytics platforms.
- To understand about handling the data with machine learning.
- To acquire knowledge about MongoDB.

MODULE - I INTRODUCTION DATA ANALYTICS FOR IOT 8

Data Analytics - Structured data - Semi structured data - Unstructured data - Data in Motion vs Data at rest - Characteristics of Data - Evolution of Big data - Why Big Data - Importance of Big data - Big data applications - IoT Data Analytics Overview - IoT Data Analytics Challenges

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MODULE - II BIGDATA PLATFORMS FOR IOT 8

Massively Parallel processing databases - NoSQL - Definition - Types of NoSQL - Advantages of NoSQL - Use Of NoSQL in Industry - SQL vs NoSQL – New SQL- Comparison of NoSQL vs SQL vs New SQL - Hadoop - Features of Hadoop - Key advantages of Hadoop - Versions of Hadoop - Overview of Hadoop ecosystem - Hadoop distributions - Hadoop vs SQL - cloud based Hadoop solutions- Processing data with Hadoop-Map reduce Daemons-HDFS (Hadoop Distributed File Systems) - Hadoop to YARN-Interacting with Hadoop ecosystem-Pig-Hive-Sqoop-Hbase

MODULE - III HANDLING THE DATA WITH MACHINE LEARNING 8

Definition of Machine Learning - NumPy - Pandas - Matplot - SciPy - Data serialization - Regression Model - Clustering - Collaborative Filtering- Association Rule Mining - Decision tree - random forest - Supervised learning- Unsupervised learning - reinforcement learning - Support vector machine - KNN algorithm

MODULE - IV INTRODUCTION TO MONGODB 7

Definition - Need – Using JSON - Creating or generating a unique key - support for dynamic queries - Storing Binary data - Replication - Sharding -Updating information In place - Create database - Drop database - Insert method - Save() method - Update method - Remove method - Find method - Dealing with NULL values - Count, Limit, Sort and Skip-Arrays - Aggregate Function – Map Reduce Function - Java Script programming - Cursors in MongoDB - Indexes - Mongo Import - Mongo Export - Automatic generation of unique numbers for"_id field

MODULE - V BIGDATA TRENDS 7

Edge streaming analytics - Comparing Big Data and Edge Analytics - Distributed Analytics System - Network Analytics - Flexible Net Flow Architecture - FNF components

MODULE - VI CLOUD COMPUTING 7

Cloud computing - Massive Data challenges - Cloud Service Interactive Mode - Cloud Service Configuration Mode - Features, Scope, Role and modes of Industrial Cloud - Resource management in Cloud Computing - Data management in Cloud - Cloud Security - Open Source and commercial Cloud

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals Networking Technologies, Protocols and Use Cases for the Internet of Things "published by CISCO, 1st Edition (2017)
2. Kris MYLaw, Andrew WHIp,BrijBGupta, ShuangGeng,"Managing IoT and Mobile Technologies with Innovation, Trust and Sustainable Computing", CRC press, 1st Edition (2021)
3. Seema Acharya, Subashini Chellapan,"BigDataandAnalytics",2ndEdition by Wiley, 2nd Edition (2018 / 2019 Reprint).

REFERENCES:

1. Minteer ,Andrew, Analytics for the Internet of Things(IoT),Packt Publishing Ltd. July 2017, ISBN 9781787120730, 1st Edition (2017)
2. Kai Hwang, MinChen,Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley, 1st Edition (2017)
3. Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley, 1st Edition (2017)
4. Kristina Chodorow, "MongoDB: The Definitive Guide", 3rd Edition, O'Reilly Media, 3rd Edition (2020)
5. John Soldatos,Building Blocks for IoT Analytics Internet-of-Things Analytics,RivePublishers Gerardus Blokdyk, 1st Edition (2016)
6. Blokdyk, G. IoT Analytics A Complete Guide, (2021). 5StarCooks

WEBREFERENCES:

1. https://www.udemy.com/course/iot-data-analytics/?couponCode= KEEP LEARNING
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
3. https://onlinecourses.nptel.ac.in/noc22_cs18/preview
4. https://www.udemy.com/course/iot-data-analytics/?coupon Code=KEEP LEARNING

OUTCOMES:

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

1. Identify the key concepts and techniques used in data analytics processes.(K3)
2. Make use of Hadoop and Spark tools for distributed storage and data processing.(K3)

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3. Apply the process of data handling, preprocessing and preparation for machine learning models.(K3)
4. Utilize the fundamental concepts and operations of MongoDB (CRUD, aggregation, indexing).(K3)
5. Analyze and discuss the current trends and future directions in Big Data Analytics.(K4)
6. Examine Big Data solutions using cloud computing platforms and technologies.(K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	1	-	-	3	2
CO2	3	-	-	-	-	-	-	1	2	-	-	3	3
CO3	3	-	-	-	-	-	-	1	2	-	-	3	3
CO4	3	-	-	-	-	-	-	-	2	-	-	3	3
CO5	2	2	-	-	-	-	-	1	2	-	-	2	2
CO6	3	2	-	-	-	-	-	1	2	-	-	3	2

SEMESTER V

COURSE CODE: 24CBEL504	ORGANIZATIONAL BEHAVIOUR	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 110106145	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24CBMG301, 24HSMC301					

OBJECTIVES:

- To enhance the understanding of the dynamics of interactions between individuals and the organization.
- To describe how people behave under different conditions and understand why people behave as they do.

Recommended in Board of Studies (BoS) Meeting No. 8 **held on** 12.5.2024

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- To explain to students how to analyze and apply knowledge in understanding group behaviour.
- To develop practical insights and problem-solving capabilities for effectively managing the organizational processes.

MODULE - I FRAMEWORK OF ORGANIZATIONAL BEHAVIOUR 5

Organisational Behaviour – Nature – Need – Significance – Scope – Key Elements – Contribution of Behavioural Sciences to OB – Challenges for OB – Models of Organisational Behaviour – Case Studies.

MODULE - II INDIVIDUAL BEHAVIOUR 14

Personality – Personality Traits – Factors Influencing Personality – Personality Theories – Attitudes – Components – Sources – Functions – Job Related Attitudes – Job Satisfaction – Determinants – Values – Types – Sources – Learning – Nature – Theories of Learning – Learning Curve – OB Modification – Emotional Intelligence – Managing Emotions – Perception – Sensation – Perceptual Process – Factors Influencing Perception – Interpersonal Perception – Impression Management – Case Studies.

MODULE - III UNDERSTANDING GROUP DYNAMICS AND BEHAVIOUR 8

Organisational Structure – Group Dynamics – Formation of Groups – Types of Groups – Stages in Group Development – Teams Vs. Groups – Group Cohesiveness – Group Norms – Enforcing Norms – Informal Leaders – Group Decision Making – Techniques of Group Decision Making – Interpersonal Relations – Johari Window – Case Studies.

MODULE - IV LEADERSHIP AND POWER 8

Leadership – Significance of Leadership – Styles of Leaders – Theories of Leadership – Leaders Vs. Managers – Power – Sources of Power – Organizational Politics – Causes for Organizational Politics – Strategies for Handling Organisational Politics – Conflicts – Types – Levels – Strategies for Handling Conflicts – Case Studies.

MODULE - V ORGANIZATIONAL CLIMATE AND CULTURE 5

Organizational Climate—Organizational Culture—Dimensions of Climate – Factors Influencing Climate and Culture—Organizational Effectiveness Vs. Efficiency—Quality of Work Life—Work-Life Balance—Case Studies.

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Dr. K.MARAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India.

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MODULE - VI ORGANIZATIONAL DEVELOPMENT AND CHANGE MANAGEMENT 5

Organizational Change – Proactive Vs. Reactive Change – Reasons for Change – Resistance to Change – Overcoming Resistance to Change – Organisational Development – Characteristics – Process of OD – OD Intervention Strategies – Work Stress – Consequences of Stress – Types of Stressors – Managing Stress – Case Studies.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Stephen P Robbins, Organizational Behaviour, PHI Learning / Pearson Education,Latest revised Edition 19, 2022 (Global edition)
2. Fred Luthans, Organizational Behaviour, McGraw Hill, 13th Edition
3. BP Singh, TN Chabra, Organizational Theory&Behaviour, Dhanpatrai& Co, (P) Ltd. Latest Revised Edition, 2020

REFERENCE BOOKS

1. Aswathappa, Organizational Behaviour Text, Cases & Games, 13th Edition, 2020, Himalaya Publishing House
2. dai Pareek, Understanding Organizational Behaviour, Fourth Edition, Oxford Higher Education, 2018
3. erald Greenberg Behaviour in Organisation, PHI Learning, 10th Edition. 2011

ONLINE RESOURCES:

1. ps://www.economicsdiscussion.net/management/organisational-behaviour/31869
2. ps://sites.google.com/site/psy130organisationalbehaviour/home/chapter-1-1/4-types-o
3. ps://www.kbmanage.com/concept/group-dynamics
4. ps://www.skillsyouneed.com/leadership-skills.html
5. ps://www.igi-global.com/dictionary/organizational-dynamics/21485

MOOCS:

1. ps://www.mooc-list.com/tags/organizational-behaviour
2. ps://swayam.gov.in/nd2_cec20_mg03/preview
3. p://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_pg.php/384

Recommended in Board of Studies (BoS) Meeting No. 8 **held on** 12.5.2026

K.MAHAN, MBA., Ph.D.,
Professor & Director
Sai Ram Institute of Management Studies
Sri Sai Ram Engineering College
Chennai, Tamil Nadu, India

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OUTCOMES:

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

1. Demonstrate the concepts, scope, significance, models, and challenges of organizational behaviour in organizations
2. Identify the influence of personality, attitudes, learning, perception, and emotional intelligence on individual behaviour.
3. Analyze the application of group dynamics, team development, and interpersonal relationship concepts in organizational settings. (K3)
4. Utilize leadership, power, politics, and conflict management principles to address organizational issues. (K3)
5. Examine the impact of organizational climate and culture on employee behaviour and organizational performance. (K4)
6. Analyze organizational change, development interventions, and stress management practices for enhancing organizational effectiveness. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	2
CO2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO3	2	3	3	-	-	-	-	-	-	-	-	2	3
CO4	2	3	3	-	-	-	-	-	-	-	-	2	3
CO5	3	2	3	-	-	-	-	-	-	-	-	1	3
CO6	3	3	3	-	-	-	-	-	-	-	-	2	3

Recommended in Board of Studies (BoS) Meeting No. 8 **held on** 12.5.2024

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SEMESTER V

COURSE CODE: 24CBEL505	GEN AI FOR MARKETING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108106191	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24CBMG401, 24ENTP101					

OBJECTIVES:

- Understand the fundamentals of Generative AI and its applications in marketing.
- Apply prompt engineering techniques for marketing communication and customer analysis.
- Utilize AI-generated content for branding and digital marketing campaigns.
- Analyze the role of AI in personalization, customer engagement, and marketing analytics.
- Apply AI-powered automation tools and campaign optimization techniques.
- Examine ethical, legal, and governance issues related to AI in marketing.

MODULE - I INTRODUCTION TO GENERATIVE AI IN MARKETING 7

Introduction to Generative AI – Evolution of AI in Marketing – Traditional Marketing vs AI-driven Marketing – Overview of Large Language Models (LLMs) – Applications of Gen AI in Branding, Advertising, CRM, and Digital Marketing – AI Marketing Ecosystem – Popular AI Tools for Marketing (ChatGPT, Gemini, Jasper, Canva AI, Midjourney, Copy.ai) – Opportunities and Challenges of AI in Marketing.

MODULE - II PROMPT ENGINEERING AND CONSUMER INSIGHTS 8

Fundamentals of Prompt Engineering – Types of Prompts: Zero-shot, Few-shot, and Chain-of-Thought Prompting – Writing Effective Marketing Prompts – AI-assisted Market Research – AI for Customer Segmentation and Buyer Persona Development – Sentiment Analysis and Consumer Feedback Analysis – AI-based Competitive Intelligence – AI for Trend Identification and Consumer Behavior Analysis.

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MODULE - III AI GENERATED CONTENT AND BRAND COMMUNICATION **8**

AI-based Copywriting for Advertisements, Blogs, Emails, and Social Media – AI for Product Descriptions and SEO Content – AI in Visual Content Creation – Text-to-Image Generation Tools – AI-generated Video and Audio Content – Storytelling using Generative AI – Brand Consistency and Tone Management – Human-AI Collaboration in Creative Marketing.

MODULE - IV PERSONALIZATION, CUSTOMER EXPERIENCE AND SOCIAL MEDIA MARKETING **7**

Personalized Marketing using AI – AI-driven Recommendation Systems – AI in Customer Journey Mapping – Conversational AI and Chatbots – AI for Email Marketing and Campaign Personalization – AI in Social Media Content Strategy – Influencer Marketing with AI – AI-based Social Listening and Engagement Analytics.

MODULE - V AI FOR MARKETING ANALYTICS AND AUTOMATION **8**

AI-powered Marketing Analytics – Campaign Performance Measurement – Predictive Analytics in Marketing – AI for Lead Generation and Sales Forecasting – Marketing Automation Tools – AI Integration with CRM Platforms – AI-assisted A/B Testing – Workflow Automation using AI Tools – AI for Search Engine Optimization (SEO) and Answer Engine Optimization (AEO).

MODULE - VI ETHICS, GOVERNANCE AND FUTURE OF AI IN MARKETING **7**

Ethical Issues in AI Marketing – Bias and Fairness in AI-generated Content – Deepfakes and Synthetic Media Risks – Data Privacy and Consumer Protection – Intellectual Property and Copyright Issues – Responsible AI Usage in Marketing – Regulatory Frameworks – Future Trends in AI-driven Marketing – Careers in AI Marketing and Digital Strategy.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Miller, T. (2024), Generative AI for Marketers: A Strategic Guide, Wiley.
2. Gazzillo, J. (2023), AI-Powered Marketing, Kogan Page.
3. Venkatesan, R. (2021), The AI Marketing Canvas: A Five-Stage Roadmap, Stanford Business Books.

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REFERENCE BOOKS

1. Agrawal, A., Gans, J., & Goldfarb, A. (2022), Power and Prediction: The Disruptive Economics of AI, Harvard Business Review Press.
2. Wedel, M. & Kannan, P.K. (2020), Marketing Analytics for Data-Driven Decisions, Wiley.
3. Chui, M. (2023), The Economic Potential of Generative AI, McKinsey Global Institute.

OUTCOMES:

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

1. Use the fundamentals and applications of Generative AI in marketing. (K3)
2. Apply prompt engineering techniques for developing marketing communication content. (K3)
3. Examine AI-generated content for branding and digital marketing campaigns. (K4)
4. Analyze the role of AI in customer personalization and consumer engagement. (K4)
5. Examine AI-powered marketing analytics and automation tools for campaign optimization. (K4)
6. Analyze ethical, legal, and governance issues associated with AI in marketing practices. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	3	–	–	–	–	–	1	3	2
CO2	2	2	3	2	3	–	–	–	–	1	1	3	2
CO3	2	3	2	3	2	–	–	–	–	1	2	2	3
CO4	2	3	2	3	2	1	–	–	–	2	2	2	3
CO5	2	3	3	3	3	–	–	–	–	1	3	3	3
CO6	2	3	1	2	2	2	2	3	–	2	2	1	3

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SEMESTER V

COURSE CODE: 24CBEL506	INTERNATIONAL FINANCE & FOREIGN EXCHANGE	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 130107001	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24CBMG402, 24CBMG301					

OBJECTIVES:

- The objective of this course is to introduce the environment of international finance and its implications on international business.
- To analyze the nature and functioning of foreign exchange markets, determination of exchange rates and their forecasting.
- To study the foreign exchange risks and to identify risk management strategies and various risk adjusted models.
- To explore the international sources of long term finance, integrate the global developments with a competitive global environment.

MODULE - I INTERNATIONAL FINANCIAL ENVIRONMENT 8

International financial environment - Finance function in global business scenario - WTO and International Monetary System, International Financial Markets-equity, bond, Eurocurrency market, Currency basket, Foreign exchange reserve, Balance of payments, balance of trade, current account deficit - bilateral and multilateral agreements relating to financial transactions.

MODULE - II FOREIGN EXCHANGE MARKETS 7

Spot and Forward Foreign Exchange Markets - Quotations and Market Rules, direct and indirect quotes, bid and ask quote, spot and forward quote with live data interpretation - Cross rates, Speculation and Arbitrage in Foreign Exchange Markets- Case Study

MODULE - III FOREIGN EXCHANGE RATE EXPOSURE AND RISK MANAGEMENT 8

Transaction, Translation and Operating Exposure, Exposure from Equity and borrowing in International Financial Markets, Hedging tools for Management of Transaction Exposure, Currency Forwards, Currency Options, Currency

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Futures, Currency Swaps, Impact of technology likely to disrupt the forex market, risk adjusted models - Case Study.

MODULE - IV FOREIGN EXCHANGE RATE DETERMINATION **8**

Discussion on devaluation or depreciation of Rupee - Theories of Exchange Rate Determination, Fundamental International Parity Conditions – Purchasing Power and Interest Rate Parity, Forecasting Exchange Rates – Introduction to Technical Forecasting, Time Series Modelling, Fundamental Forecasting - Case studies.

MODULE - V INTERNATIONAL SOURCES OF FINANCE FOR THE FIRM & INTERNATIONAL FINANCING DECISION **7**

Sources of International Finance: Eurocurrency Markets, Eurobonds, Foreign Bonds, Multinational Capital Budgeting, Cost of Capital for Multinational Firms, Political and Country Risk Analysis.

MODULE - VI INTERNATIONAL FINANCIAL INSTITUTIONS AND MARKETS **7**

Global Financial Crises and Regulatory Frameworks,Role of IMF, World Bank, and Asian Development Bank, International Capital Markets: Features, Instruments, and Recent Developments.

TOTAL : 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES

1. Assign real-world case studies on currency crises, hedging strategies, or international mergers and acquisitions.
2. Use forex trading simulators or demo accounts to practice buying/selling currencies.
3. Conduct mock negotiations between multinational companies and foreign suppliers.
4. Assign research on recent trends in international finance, such as digital currencies or trade wars.
5. Invite industry experts to discuss practical aspects of forex management, regulations, and compliance.
6. Teach students to build models for currency risk exposure, cross-border investment decisions, and international cash flow projections.
7. Organize debates on topics like "Floating vs. Fixed Exchange Rate Systems" or "Impact of IMF on Developing Economies."

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8. Assign daily/weekly tasks to analyze how international news (political unrest, economic reports) affects currency values and global markets.

TEXTBOOKS:

1. Eun, C. S., & Resnick, B. G. (2024). International Financial Management (10th ed.). New York, NY: McGraw-Hill Education.
2. Madura, J. (2021). International Financial Management (14th ed.). Boston, MA: Cengage Learning.
3. Shapiro, A. C. (2019). Multinational Financial Management (11th ed.). Hoboken, NJ: Wiley.
4. Levi, M. D. (2020). International Finance (6th ed.). New York, NY: Routledge.
5. Apte, P. G. (2014). International Financial Management (7th ed.). New Delhi, India: McGraw-Hill Education.

REFERENCE BOOKS:

1. Madura, J. (2021). International Financial Management (14th ed.). Boston, MA: Cengage Learning.
2. Shapiro, A. C. (2019). Multinational Financial Management (11th ed.). Hoboken, NJ: Wiley.
3. Levi, M. D. (2020). International Finance (6th ed.). New York, NY: Routledge.
4. Apte, P. G. (2014). International Financial Management (7th ed.). New Delhi, India: McGraw-Hill Education.
5. Eun, C. S., & Resnick, B. G. (2024). International Financial Management (10th ed.). New York, NY: McGraw-Hill Education.
6. DeRosa, D. F. (2014). Foreign Exchange Operations: Master Trading Agreements, Settlement, and Collateral. Hoboken, NJ: Wiley.
7. Moffett, M. H., Stonehill, A. I., & Eiteman, D. K. (2017). Fundamentals of Multinational Finance (6th ed.). Boston, MA: Pearson.

WEB REFERENCES:

1. https://www.imf.org
2. https://www.worldbank.org
3. https://www.bis.org
4. https://www.fsb.org
5. https://www.khanacademy.org
6. https://www.bloomberg.com

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7. https://www.reuters.com
8. https://www.investing.com
9. https://www.forexfactory.com

MOOC COURSES:

1. https://nptel.ac.in/courses/110105031
2. https://onlinecourses.nptel.ac.in/noc24_mg19/preview
3. https://onlinecourses-archive.nptel.ac.in/noc19_me37/course
4. https://onlinecourses.nptel.ac.in/noc24_mg83/preview
5. Finance for Non-Finance Professionals on Coursera
6. International Business Essentials on edX
7. Forex Trading A-Z™ on Udemy

OUTCOMES:

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

1. Develop the structure, functions, and significance of international financial markets and foreign exchange systems.(K3)
2. Experiment with the various types of exchange rate systems and their impact on international business transactions. (K3)
3. Examine cross-currency conversions and apply appropriate methods for determining forward rates and arbitrage opportunities. (K4)
4. Demonstrate the use of financial instruments such as forwards, futures, and options to hedge foreign exchange risk in practical scenarios. (K3)
5. Analyze the effects of currency fluctuations on multinational corporations' financial performance and recommend suitable risk management strategies. (K4)
6. Evaluate international investment and financing decisions by assessing associated risks, returns, and regulatory requirements.(K4)

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CO - PO, PSO MAPPING:

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CO2	2	3	–	2	–	–	–	–	–	–	2	1	3
CO3	2	3	2	3	1	–	–	–	–	–	3	2	3
CO4	2	3	3	2	2	–	–	–	–	–	3	2	3
CO5	2	3	3	3	2	1	–	–	–	1	3	2	3
CO6	2	3	3	3	2	2	–	–	–	1	3	2	3

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Imagine the Future and

Make it happen!





Together let's build a better world where there is **NO POVERTY** and **ZERO HUNGER.**

We have **GOOD HEALTH AND WELL BEING** **QUALITY EDUCATION** and full **GENDER EQUALITY** everywhere.

There is **CLEAN WATER AND SANITATION** for everyone. **AFFORDABLE AND CLEAN ENERGY**

which will help to create **DECENT WORK AND ECONOMIC GROWTH.** Our prosperity shall be fuelled

by investments in **INDUSTRY, INNOVATION AND INFRASTRUCTURE** that will help us to

REDUCE INEQUALITIES by all means. We will live in **SUSTAINABLE CITIES AND COMMUNITIES.**

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing **LIFE BELOW WATER**, rich and diverse **LIFE ON LAND.**

We will enjoy **PEACE AND JUSTICE** through **STRONG INSTITUTIONS**

and will build long term **PARTNERSHIPS FOR THE GOALS.**

For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

Together we can...

Sai Prakash Leo Muthu

Chairman & CEO – Sairam Institutions

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Sri

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