KNOWLEDGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, Chennai.
Accredited by NBA (CSE, ECE, EEE & MECH), Accredited by NAAC with "A" GradeKIOT Campus,
Kakapalayam (PO), Salem – 637 504, Tamil Nadu, India.

Beyond Knowledge

B.E. / B.Tech. Regulations 2023

B.E. – Computer Science and Engineering

Curriculum and Syllabi

(For the Students Admitted from the Academic Year 2023-24 Onwards)

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Faculty of CSE & IT
Knowledge Institute of Technology
KIOT Campus, Kakapalayam,
Salem-637 504

Version: 1.0	**Date:** 09.09.2023

	KNOWLEDGE INSTITUTE OF TECHNOLOGY(AUTONOMOUS), SALEM -637504
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	Website: www.kiot.ac.in

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B.E. / B.Tech. REGULATIONS 2023 (R 2023)

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

B.E. COMPUTER SCIENCE AND ENGINEERING

VISION OF THE INSTITUTE
To be a world class institution to impart value and need based professional education to theaspiring youth and carving them into disciplined world class professional who have the questfor excellence, achievement orientation and social responsibilities.

MISSION OF THE INSTITUTE	
A	To promote academic growth by offering state-of-art undergraduate, postgraduate and doctoral programs and to generate new knowledge by engaging in cutting – edge research
B	To nurture talent, innovation, entrepreneurship, all-round personality and value systemamong the students and to foster competitiveness among students
C	To undertake collaborative projects which offer opportunities for long-term interaction withacademia and industry
D	To pursue global standards of excellence in all our endeavors namely teaching, research, consultancy, continuing education and support functions
VISION OF THE DEPARTMENT	
To create globally competent software professionals with social values to cater the ever-changingindustry requirements.	
MISSION OF THE DEPARTMENT	
M1	To provide appropriate infrastructure to impart need-based technical education througheffective teaching and research.
M2	To involve the students in collaborative projects on emerging technologies to fulfill theindustrial requirements.
M3	To render value based education to students to take better engineering decision with social consciousness and to meet out the global standards.
M4	To inculcate leadershipcompetent professional.
PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	To enable graduates to pursue Higher Education and Research or have a successful career in industries associated with Computer Science and Engineering, or as Entrepreneurs.
PEO 2	To ensure that graduates will have the ability and attitude to adapt to emerging technological changes.
PEO 3	To acquire leadership skills to perform professional activities with social consciousness.adaptability and lifelong learning

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PROGRAM OUTCOMES (POs)	
Engineering Graduates will be able to:	
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specifiedneeds with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, Resources, and modern engineering and IT tools including prediction andmodeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as amember or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities withthe engineering community and with society at large, such as, being able tocomprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understandingof the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and abilityto engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)	
After the successful completion of B.E. Programme in Computer Science and Engineering, the graduates will able to	
PSO 1	Analyse large volume of data and make business decisions to improve efficiency with different algorithms and tools.
PSO 2	Have the capacity to develop web and mobile applications for real time scenarios.
PSO 3	Provide automation and smart solutions in various forms to the society with Internet of Things

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B.E. COMPUTER SCIENCE AND ENGINEERING											
Courses of Study and Scheme of Assessment (Regulations 2023)											
Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
	SEMESTER III										
	THEORY										
1	BE23MA203	Discrete Mathematics	HS	3	2	1	0	3	40	60	100
	THEORY CUM PRACTICAL										
2	BE23CS402	Computer Networks	PC	5	2	1	2	4	50	50	100
3	BE23CS403	Python for Data Science	PC	5	2	1	2	4	50	50	100
4	BE23CS404	Data Structures and Algorithms	PC	5	2	1	2	4	50	50	100
5	BE23CS405	Database Management System	PC	5	2	1	2	4	50	50	100
6	BE23CS406	Operating Systems	PC	5	2	1	2	4	50	50	100
	PRACTICAL										
7	BE23EN103	Professional Communication Laboratory – I	HS	2	0	0	2	1	60	40	100
	EMPLOYABILITY ENHANCEMENT										
8	BE23PT805	Engineering Clinic – II	EEC	2	0	0	2	1	100	-	100
9	BE23PT807	Aptitude Skills - II	EEC	1	0	0	1	0.5	100	-	100
Total				33	12	6	15	25.5	550	350	900
SEMESTER IV											
	THEORY										
1	BE23MA206	Mathematics for Business Analytics	BS	3	2	1	0	3	40	60	100
2	BE23CS407	Design and Analysis of Algorithms	PC	3	2	1	0	3	40	60	100
3	BE23MC904	Environmental Science and Sustainability	MC	2	1.5	0.5	0	NC	100	-	100
	THEORY CUM PRACTICAL										
4	BE23CS315	Java Programming	ES	5	2	1	2	4	50	50	100
5	BE23CS408	Foundations of Artificial Intelligence and Machine Learning	PC	5	2	1	2	4	50	50	100
6	BE23CS409	Fundamentals of Web Development	PC	5	2	1	2	4	50	50	100
	PRACTICAL										
7	BE23EN104	Professional Communication Laboratory – II	HS	2	0	0	2	1	60	40	100
	EMPLOYABILITY ENHANCEMENT										
9	BE23PT808	Aptitude Skills – III	EEC	1	0	0	1	0.5	100	-	100
Total				26	11.5	5.5	9	19.5	490	310	800

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BE23MA203	DISCRETE MATHEMATICS	Version: 1.0				
Programme & Branch	Common to B.E. (CSE) and B.Tech. (IT, CSBS and AI&DS)	CP	L	T	P	C
		3	2	1	0	3

Course Objectives:

1.	To validate the arguments by using connectives and rules of inference.
2.	To develop the knowledge on the basics of counting, solving recurrence relations.
3.	To illustrate the functions, relations and Lattices.
4.	To familiarize the applications of algebraic structures.
5.	To apply the properties of graphs and trees to solve computing problems.

	INTRODUCTION (Not for Examination):	2

Importance:
Discrete mathematics forms the backbone of theoretical computer science and provides the essential mathematical tools and concepts for solving a wide range of problems in computer engineering. It helps computer engineers develop a deeper understanding of algorithms, Data structures, Logic design, Cryptography and Networking.

Real Life Example(s):
Railway planning - Cell phone communications – Delivery Route Problems – Electricity Board.

Linkages:
Pre-requisite: Calculus for Engineers.
Future Courses: Theory of Computation - Data structures – Computer Architecture.

UNIT–I	LOGICS AND PROOFS	6+3

Propositional logics – Propositional equivalences – Rules of inference – Introduction to proofs – Proof methods and strategy.

UNIT–II	COMBINATORICS	6+3

Mathematical induction – Strong induction and well ordering – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Inclusion and exclusion principle and its applications.

UNIT– III	SETS AND RELATIONS	5+3

Set – Properties, Relation – Properties of Binary Relations, equivalence, partial ordering relations, Hasse diagram, Lattices – Boolean algebra.

UNIT – IV	ALGEBRAIC SYSTEM	6+3

Algebraic system – Groups – Subgroups – Homomorphism – Lagrange's theorem. Vector space – Linear dependence and independence of vectors – bases and dimensions.

UNIT–V	GRAPH THEORY	5+3

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

Total : 45 Periods

OPEN ENDED PROBLEMS / QUESTIONS

Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.

Course Outcomes: Upon completion of this course, the students will be able to:		BLOOM'S Taxonomy
CO1	Apply the basic concepts needed to test the logic of a program.	L3 – Apply

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CO2	Demonstrate various proof techniques and application of principles.	**L3 – Apply**
CO3	Apply the basic concepts of sets, relation and apply them to situations involving inclusion and exclusion.	**L3 – Apply**
CO4	Use concepts of basis and dimension in vector spaces in solving problems.	**L3 – Apply**
CO5	Solve computing problems by applying graph theory techniques.	**L3 – Apply**

TEXTBOOKS:

1.	Veerarajan.T, "Linear Algebra and Partial Differential Equations", Second Edition, McGraw Hill Education, 2019.
2.	Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", First Edition (35th Reprint), Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2008.

REFERENCE BOOKS:

1.	Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2013.
2.	Kenneth H Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7th Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2011.
3.	Veerarajan T., "Discrete Mathematics with Graph Theory and Combinatorics", 3rd Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2013.

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	Brilliant	https://brilliant.org/wiki/discrete-mathematics/	Article
2.	Wikipedia	https://en.wikipedia.org/wiki/Outline_of_discrete_mathematics	Article

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video link
1.	NPTEL	Dr.Kamala Krithivasan / IIT Chennai	Lecture	https://youtu.be/xlUFkMKSB3Y?si=JX94vlnBuvRuHgPk
2.	NPTEL	Dr Sugata Gangopadhyay / IIT Roorkee	Lecture	https://youtu.be/fSHwjxsGsH4?si=2MPnHH3QLpcbgCLO
3.	NPTEL	Prof.Arabind Kumar Lal / IIT Kanpur	Lecture	https://youtu.be/9MCjyQSRmR8?si=MmJdDhW66eBI3foS

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
AVG	**3.0**	**2.0**													

1–Low, 2 –Medium, 3–High.

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BE23CS402	COMPUTER NETWORKS	Version: 1.0				
Programme & Branch	B.E. – COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		5	2	1	2	4

Course Objectives:

1.	To understand the fundamentals of networking concepts, protocols, architectures, and technologies.
2.	To understand the essential services provided by the link layer.
3.	To learn the functions of network layer and the various routing protocols.
4.	To visualize the end-to-end flow of information.
5.	To familiarize the functions and protocols of the Application layer.

	INTRODUCTION (Not for Examination)	**2**

Importance:
Understanding how data is exchanged and managed across various interconnected systems, as well as how to build and maintain reliable and secure communication infrastructures – Facilitates the development and maintenance of robust and secure communication infrastructures.

Real Life Example(s):
Home Networks – Educational Networks – Banking Networks – Corporate Networks – Industrial Networks – Public Wi-Fi Networks.

Linkages:
Pre-requisite: Basics and Applied Physics.
Future Courses: Cryptography and Cyber Security, Cloud Computing.

UNIT–I	**INTRODUCTION AND MEDIUM**	**5+3**

Building a Network – Network Edge and Core – Layering and Protocols – TCP/IP Protocol suite – OSI Reference Model – Network Topologies – Internet Architecture – **Physical Layer:** Signal Characteristics – Transmission media – Signal Encoding Techniques – Performance Metrics.

UNIT–II	**LINK LAYER SERVICES**	**5+3**

Link Layer Services – Framing – Flow Control – Error Control – Media Access Control – Ethernet – Wireless LAN – Introduction to Bluetooth – Zigbee.

UNIT– III	**SWITCHING AND ROUTING**	**6+3**

Switching: Circuit Switching – Packet Switching – IPV4 – Global Address – Datagram Forwarding – Subnetting – CIDR – ICMP – Routing Algorithms: Distance Vector Routing and Link State Routing – IPV6 Addressing – IPV6 Protocol.

UNIT – IV	**CONNECTION-ORIENTED AND CONNECTION-LESS SERVICES**	**6+3**

Overview of Transport Layer – UDP – TCP – Reliable Byte Stream – Connection Management – Flow Control – Congestion Control – SCTP.

UNIT–V	**APPLICATION LAYER SERVICES**	**6+3**

Needs/Principles of Application Layer Protocols – Role of proxy, Web and HTTP – FTP – Electronic Mail (SMTP- POP3 - IMAP- MIME) – DHCP – DNS – DASH – QUIC – FIREWALL.

Total (LT) : 45 Periods

LIST OF EXPERIMENTS/EXCERCISES:

1.	Study of Network Components, Basic Network Commands and Network Configuration Commands.
2.	Chat Program using TCP Sockets using Java language.

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3.	DNS using UDP Sockets using Java Language.
4.	Capturing of packet header at each layer using Wireshark.
5.	Tracing of TCP and UDP Connection using Wireshark.
6.	Study of any Simulator Tool.
7.	Performance comparison of TCP and UDP protocols using Simulation tool.
8.	Set up a typical network in a Lab.
	Total (P) : 30 Periods
	Total: (LT+P) : 75 Periods

	OPEN ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.		
Course Outcomes: **Upon completion of this course, the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Apply networking concepts to design basic infrastructure models.	**L3 – Apply**
CO2	Apply link layer services in network design and troubleshooting.	**L3 – Apply**
CO3	Evaluate routing algorithms for efficient data forwarding in networks.	**L3 – Apply**
CO4	Describe protocols for various functions in the network.	**L3 – Apply**
CO5	Effectively manage and secure network applications and services.	**L2 – Understand**

TEXTBOOKS:

1.	Behrouz A. Forouzan, "Data Communications and Networking with TCP/IP Protocol Suite", Sixth Edition, Tata Mcgraw Hill, 2022.
2.	James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Eighth Edition, Pearson Education, 2021.

REFERENCE BOOKS:

1.	Prakash C Gupta, "Data Communication and Computer Networks", Prentice Hall of India, New Delhi, 2014.
2.	Achyut S Godbole, "Data Communication and Networking", 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.
3.	Andrew S Tanenbaum, David J Wetherall , "Computer Networks", 5th Edition, Prentice Hall of India/ Pearson Education, New Delhi, 2012.

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	GeeksforGeeks	https://www.geeksforgeeks.org/adaptive-streaming-and-dash/	Web Reference
2.	Javatpoint	https://www.javatpoint.com/computer-network-tutorial	Web Reference
3.	EMQ Technologies Inc.	https://www.emqx.com/en/blog/quic-protocol-the-features-use-cases-and-impact-for-iot-iov	Blog

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4.	Digi International Inc.	https://www.digi.com/solutions/by-technology/zigbee-wireless-standard	Web Reference

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video link
1.	NPTEL	Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty/ IIT Kharagpur	Lecture	https://onlinecourses.nptel.ac.in/noc22_cs19/preview
2.	Youtube	Ravindrababu Ravula	Lecture	https://www.youtube.com/playlist?list=PLEbnTDJUr_IegfoqO4iPnPYQui46QqT0j

Mapping of COs with POs and PSOs

COs	Pos												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2											3		
CO2	3	1			2							2		2	
CO3	3	2			3									3	
CO4	3			1	2					3					
CO5	3	3	2												3
AVG	**3.0**	**2.0**	**2.0**	**1.0**	**2.3**					**3.0**		**2.0**	**3.0**	**2.5**	**3.0**

1–Low, 2 –Medium, 3–High.

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BE23CS403	Python for Data Science	Version: 1.0				
		CP	L	T	P	C
Programme & Branch	Common to B.E. (CSE) and B.Tech. (IT and CSBS)	5	2	1	2	4

Course Objectives:

1.	To gain knowledge of fundamental programming concepts in python language.
2.	To learn the process of structuring the data using string, list, tuple, and dictionary.
3.	To understand the data science fundamentals and process.
4.	To utilize Python libraries for Data Wrangling.
5.	To use visualization libraries in Python to present and interpret data.

	INTRODUCTION (Not for Examination)	**2**

Importance:
Data science is revolutionizing industries by enabling organizations to extract actionable insights from data - Learning about decision control statements and functions provides the necessary groundwork for writing efficient and structured code - NumPy and Pandas are two powerful Python libraries that facilitate data manipulation and analysis - Matplotlib and Seaborn are popular Python libraries for creating static, animated and interactive visualizations.

Real Life Example(s):
Student Grade Calculator – To-Do List Manager – Test Score Analysis – Healthcare Analytics.

Linkages:
Pre-requisite: Problem Solving using C Programming, Object Oriented Programming using C++.
Future Courses: Mathematics for Business Analytics, Foundations of Artificial Intelligence and Machine Learning.

UNIT–I	**BASICS OF PYTHON PROGRAMMING, DECISION CONTROL STATEMENTS & FUNCTIONS**	**5 + 3**

Python Basics: Introduction – Features – Execution Environment – Indentation – Comments – **Basic Elements**: Data Types – Variables – Input/Output Statements – format() – **Sequential** – Basics of Conditionals – **Selection (Conditional)**: Simple if – if else – if elif else – Nested if – **Loops**: for – for else – while – while else – **Selection (Unconditional)**: break – continue – pass – **Nested Loops** – **Functions:** Introduction to Functions, Inbuilt functions, User defined functions, Passing parameters, Return values, Recursion, Lambda functions.

UNIT–II	**PYTHON DATA STRUCTURE, MODULES & PACKAGES**	**5 + 3**

Introduction to Python Data Structure – **String**: Introduction – Operations (Creation – Indexing – Delete – Traversal – Slices) – Built-in Methods – **List**: Introduction – Operations – Built-in Methods – Cloning – List Comprehension – map() – **Tuple**: Introduction – Operations – Built-in Methods – List vs Tuple – **Dictionary:** Introduction – Operations – Built-in Methods – **Modules & Packages**: Introduction – Built-in Modules – Import – User defined Modules – Packages.

UNIT– III	**INTRODUCTION TO DATA SCIENCE & DEPICTING RELATIONSHIPS**	**6 + 3**

Data Science: Benefits and uses – Facets of data – Data Science Life Cycle – **Describing Data:** Types of Data – Types of Variables – Describing Data with Tables and Graphs – Describing Data with Averages – Describing Variability – Normal Distributions and Standard(z) Scores – **Correlation** – Computational formula for correlation coefficient – Regression – Regression line – Least squares regression line – Standard error of estimate.

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UNIT – IV	PYTHON LIBRARIES FOR DATA WRANGLING – NUMPY, PANDAS	6 + 3
NumPy arrays: Creation of ndarray, Initializing, Accessing, Slicing, Joining, Splitting, Searching and Sorting – **Data manipulation with Pandas:** data indexing and selection – Operating on data – Missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – Pivot tables.		
UNIT–V	**DATA VISUALIZATION – MATPLOTLIB & SEABORN**	**6 + 3**
Matplotlib: Importing Matplotlib and its uses – Line plots – Scatter plots – Visualizing errors – Density and contour plots – Histograms – Legends – Colors – Subplots – Text and Annotation – Three-dimensional plotting – Seaborn: Visualization with Seaborn.		
		Total (LT) : 45 Periods

LIST OF EXPERIMENTS/EXCERCISES:	
1.	Implementation of various selection and control statements in Python.
2.	Implementation of string operations and functions in Python.
3.	Implementation of List, Tuples and Dictionary in Python.
4.	NumPy, Pandas, SciPy, Seaborn, Stats models, and Matplotlib packages can be downloaded and explored for their features.
5.	Working on NumPy Packages.
6.	Working on Pandas Packages.
7.	The following tasks can be done using the real-time data set from Kaggle a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis. b. Bivariate analysis: Linear and logistic regression modeling. c. Multiple Regression analysis. d. Also compare the results of the above analysis for any two data sets.
8.	Explore and apply various plotting functions to Kaggle real-time data sets a. Normal curves. b. Density and contour plots. c. Correlation and scatter plots. d. Histograms. e. Three-dimensional plotting.
	Total (P) : 30 Periods
	Total (LT+P) : 75 Periods

	OPEN ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.		

Course Outcomes: **Upon completion of this course, the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Demonstrate the understanding of fundamental concepts of python programming.	**L3 – Apply**
CO2	Demonstrate programming skills using list, tuples, dictionary, modules and packages.	**L3 – Apply**
CO3	Define the data science process.	**L3 – Apply**
CO4	Use the Python Libraries for Data Wrangling.	**L3 – Apply**

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CO5	Apply visualization Libraries in Python to interpret and explore data.	**L3 – Apply**

TEXTBOOKS:

1.	Reema Thareja, "Python Programming: Using Problem Solving Approach", 2nd Edition, Oxford University Press, 2023.
2.	Magnus Lie Hetland, "Beginning Python: From Novice to Professional", 3rd Edition, A Press, 2020.
3.	David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
4.	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
5.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

REFERENCE BOOKS:

1.	John V Guttag, "Introduction to Computation and Programming Using Python", 2nd Edition, PHI Learning Private Limited, 2021.
2.	Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", 1st Edition, Wiley India Edition, 2020.
3.	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2020.

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	W3Schools	https://www.w3schools.com/python/	Problem Solving
2.	Geeksforgeeks	https://www.geeksforgeeks.org/data-science-tutorial/	Web Reference
3.	Realpython	https://realpython.com/	Web Reference

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video link
1.	NPTEL	Prof. Raghunathan Rengaswamy, IIT Madras.	Lecture	https://youtu.be/2najYfEgwyM
2.	YouTube	Mr.Mosh	Lecture	https://www.youtube.com/watch?v=_uQrJ0TkZlc&t=17s&pp=ygUOTXIuTW9zaCBweXRob24%3D
3.	YouTube	SimpliLearn	Lecture	https://www.youtube.com/watch?v=ITSMDeOgXxw&t=1277s
4.	YouTube	Apna College	Lecture	https://youtu.be/ERCMXc8x7mc

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Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	2	2					2			2		
CO2	2	1		1	2					2			2		
CO3	2	2	1	2	2					2			2		
CO4	3	2	2	1	2					2			2		
CO5	2	2	1	2	2					2			2		
AVG	**2.2**	**1.8**	**1.2**	**1.6**	**2.0**					**2.0**			**2.0**		
1–Low, 2 –Medium, 3–High.															

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BE23CS404	DATA STRUCTURES AND ALGORITHMS	Version: 1.0				
Programme & Branch	Common to B.E (CSE) and B.Tech. (IT, CSBS and AI&DS)	CP	L	T	P	C
		5	2	1	2	4

Course Objectives:

1. To understand the types of data structures and implement list ADT.
2. To design algorithm using linear data structures like stack and queue.
3. To compare efficiency of various sorting and searching techniques.
4. To solve the problems using non-linear data structure tree.
5. To solve various problems using non-linear data structure graph.

	INTRODUCTION (Not for Examination)	2

Importance:
Efficiency in Data Management – Performance Optimization – Real-World Applications – Competitive Programming and Contest – Problem Solving Skills.

Real Life Example(s):
Arrays-Online Shopping Carts – Linked Lists-Music Playlists – Stacks-Web Browser History – Queues-Customer Service Systems – Trees-File Systems – Graphs-Social Networks and Google Maps.

Linkages:
Pre-requisite: Problem Solving using C Programming – Computer Organization – Design Thinking.
Future Courses: Design and Analysis of Algorithms – Coding Skills – I – Coding Skills – II.

UNIT–I	DATA STRUCTURES TYPES AND LIST ADT	5+3

Data Structure – Types – Abstract Data Types (ADTs) – **List ADT:** Array and Linked List implementation – Singly linked lists – Circular Singly linked list – Doubly linked lists – Circular Doubly linked list.

UNIT–II	STACK ADT AND QUEUE ADT	6+3

Stack ADT: Operations – Array and Linked List implementation – Applications: Expression Evaluation – Infix to Postfix conversion – Evaluation of Postfix Expression – **Queue ADT**: Operations – Array and Linked List implementation – Circular Queue – Deque – Priority Queue.

UNIT– III	SORTING, SEARCHING AND HASHING	6+3

Sorting: Introduction – Types – Bubble Sort – Selection Sort – Insertion Sort – Merge Sort – Quick Sort – **Searching**: Introduction – Linear Search – Binary Search – Applications – **Hashing**: Introduction – Hash Table – Hash function – Types – Collision – Collision Resolution Techniques: Separate Chaining – Open Addressing (Linear Probing, Quadratic probing) – Rehashing.

UNIT – IV	TREES	5+3

Tree Definition – Tree terminologies – General tree – Binary Tree – Tree traversal – Expression tree – Binary Search Tree – AVL Tree – Binary Heap.

UNIT–V	GRAPHS	6+3

Graph Definition – Graph terminologies – Representation of Graphs – Graph traversal – Topological sort – **Shortest Path algorithms:** Dijkstra's and Floyd's algorithms – **Minimum Spanning Tree:** Prim's and Kruskal's algorithms.

Total (LT) : 45 Periods

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LIST OF EXPERIMENTS/EXCERCISES:	
1.	Implement array and pointer-based list.
2.	Implement array and pointer-based stack.
3.	Implement array and pointer-based queue.
4.	Implement various sorting and searching.
5.	Implement binary tree traversals.
6.	Implement priority queue using heap.
7.	Implement Shortest Path algorithms.
8.	Implement Minimum Spanning Tree.
	Total (P): 30 Periods
	Total (LT + P): 75 Periods

	OPEN ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.		
Course Outcomes: **Upon completion of this course, the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Implement linear data structure operations using List.	**L3 – Apply**
CO2	Use Stack and Queue data structure operations for solving a given problem.	**L3 – Apply**
CO3	Compare efficiency of various sorting and searching techniques.	**L3 – Apply**
CO4	Solve problems using non–linear data structure tree.	**L3 – Apply**
CO5	Apply appropriate graph algorithms for graph applications.	**L3 – Apply**

TEXTBOOKS:

1.	Reema Thareja, "Data Structures Using C", Third Edition, Oxford University Press, 2023.
2.	Ritika Mehra, "Data Structures using C", First Edition, Pearson Education, 2021.

REFERENCE BOOKS:

1.	Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 1st edition, Pearson, 2009.
2.	Ashok N.Kamthane, "Introduction to Data Structures in C", 1st Edition, Pearson Education, 2007.
3.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2005.

WEB REFERENCES:

S. No.	Publisher	Website link	Type of Content
1.	Tutorialspoint	https://www.tutorialspoint.com/dsa_using_c/dsa_using_c_useful_resources.htm	Web Reference
2.	Hackerrank	https://www.hackerrank.com/domains/data-structures	Problem Solving
3.	Geeks for Geeks	https://www.geeksforgeeks.org/real-time-application-of-data-structures/	Web Reference

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VIDEO REFERENCES:				
S. No.	**Video Details**	**Name of the Expert**	**Type of Content**	**Video link**
1.	YouTube	K. Ravikumar	Lecture	https://www.youtube.com/@reachtutorravi3115
2.	YouTube	Jenny's Lectures	Lecture	https://www.youtube.com/watch?v=AT14lCXuMKI&list=PLdo5W4Nhv31bbKJzrsKfMpo_grxuLl8LU&pp=iAQB
3.	NPTEL	Sudarshan Iyengar	Lecture	https://onlinecourses-archive.nptel.ac.in/noc18_cs25/preview

Mapping of COs with POs and PSOs

COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	1	2	2	1	1		1	2	1	3	3	2	1
CO2	1	2	1	2	2				1	1	1	2	3	2	1
CO3	1	2	1	2	2	1	1		1	2	1	3	3	2	1
CO4	2	3	1	2	3				1	1	1	2	3	2	1
CO5	2	1		1	1				2	1	1	2	3	2	1
AVG	**1.6**	**2.2**	**1.0**	**1.8**	**2.0**	**1.0**	**1.0**		**1.2**	**1.4**	**1.0**	**2.4**	**3.0**	**2.0**	**1.0**

1–Low, 2 –Medium, 3–High.

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BE23CS405	DATABASE MANAGEMENT SYSTEMS	Version: 1.0				
Programme & Branch	Common to B.E. (CSE) and B.Tech. (IT, CSBS and AI&DS)	CP	L	T	P	C
		5	2	1	2	4

Course Objectives:

1.	To learn the fundamentals of data models, relational algebra and SQL.
2.	To design a database system using ER diagrams.
3.	To understand the concepts of transaction, concurrency and recovery processing.
4.	To analyze the internal storage structures to design physical database.
5.	To explore the knowledge of distributed databases, NOSQL and database security.

	INTRODUCTION (Not for Examination)	**2**

Importance:
Way to organize and manage large volumes of data efficiently, Prevent unauthorized access and ensure data consistency, Enable fast and efficient retrieval of data through querying languages like SQL, Manage concurrent access to the data by multiple users or applications, Ensure the data available and protect against loss or corruption, Supports decision-making process by providing tools for data analysis, reporting and visualization.

Real Life Example(s):
University Database – Library Management System – Inventory Management for EMart Grocery Shop – Banking System.

Linkages:
Pre-requisite: Problem Solving using C++.
Future Courses: Software Engineering – Data Science – Web Technologies – Cloud Computing – Big Data Analytics – Business Intelligence

UNIT–I	**INTRODUCTION TO RELATIONAL DATABASE**	**5+3**

Purpose of Database System – Views of data - Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Constraints – Relational Algebra. Overview of the SQL Query Language – Basic Structure of SQL Queries – DDL – DML – Keys.

UNIT–II	**DATABASE DESIGN**	**5+3**

Entity - Relationship model - E-R Diagrams – ER-to- Relational Mapping – Functional Dependencies – Non-loss Decomposition – First – Second – Third Normal Forms – Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form. SQL – Set Operations, Aggregate Functions – GROUPBY – HAVING, Joins, Sub queries, Views, Triggers.

UNIT– III	**TRANSACTION MANAGEMENT**	**6+3**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery – Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery – Backup and Recovery System – SQL – DCL – TCL commands.

UNIT – IV	**IMPLEMENTATION TECHNIQUES**	**6+3**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Query optimization using Heuristics and Cost Estimation.

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UNIT–V	ADVANCED TOPICS	6+3
Distributed Databases: Architecture – Types of distributed database – Transaction Processing – NOSQL Databases: Introduction – CAP Theorem – Document Based systems –Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Encryption and Public Key infrastructures – Challenges.		
		Total (LT) : 45 Periods

LIST OF EXPERIMENTS/EXCERCISES:	
1.	Design a Database and create required tables. For e.g. Bank, College Database.
2.	Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
3.	Create a set of tables, add foreign key constraints and incorporate referential integrity.
4.	Query the database tables using different 'where' clause conditions and also implement aggregate functions.
5.	Query the database tables and explore sub queries and simple join operations.
6.	Write SQL Triggers for insert, delete, and update operations in a database table.
7.	Create View and index for database tables with a large number of records.
8.	Execute complex transactions and realize DCL and TCL commands.
9.	Write a program to implement B+ tree.
10.	Create Document data using NOSQL database tools.
	Total (P) : 30 Periods
	Total (LT+P) : 75 Periods

	OPEN ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.		
Course Outcomes: **Upon completion of this course, the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Apply SQL for data management tasks.	**L3 – Apply**
CO2	Design a database using ER model and normalize the designed database.	**L3 – Apply**
CO3	Construct queries to handle transaction processing and maintain consistency of the database.	**L3 – Apply**
CO4	Identify the file organization techniques for an application.	**L3 – Apply**
CO5	Classify the advanced databases and find a suitable database for the given requirement.	**L2 – Understand**

TEXTBOOKS:	
1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Impression, McGraw Hill, 2023.
2.	Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventeenth Impression, Pearson Education, 2024.
REFERENCE BOOKS:	
1.	C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

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2.	Raghu Ramakrishnan,"Database Management System", Tata McGraw-Hill Publishing Company, 2014.
3.	Rajesh Narang, "Database Management systems", PHI Learning Pvt. Ltd, New Delhi,2011.

WEB REFERENCES:

S. No.	Publisher	Website link	Type of Content
1.	MYSQL	https://dev.mysql.com/doc/	MYSQL Documentation
2.	W3Schools	https://www.w3schools.in/dbms	Tutorial
3.	IGI Global	https://www.igiglobal.com/journal/journal-database-management/1072	Articles on recent advancements

VIDEO REFERENCES:

S. No.	Video Details	Name of the Expert	Type of Content	Video link
1.	NPTEL	Prof. Arna Battacharya	Lecture	https://nptel.ac.in/courses/106104135
2.	Youtube	Edureka	SQL Course	https://www.youtube.com/watch?v=q_JsgpiuY98&list=PL9ooVrP1hQOG6DQnOD6ujdCEchaqADfCU
3.	Youtube	Prof Jenny's	Lectures	https://www.youtube.com/playlist?list=PLdo5W4Nhv31b33kF46f9aFjoJPOkdlsRc

Mapping of COs with POs and PSOs

COs	Pos												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	3				2	1		1	3	2	
CO2	2	2	3	1	3				2	1		1	3	2	
CO3	2	2	3	1	3				2	1		1	3	2	
CO4	2	2	3	1	3				2	1		1	3	2	
CO5	2	2	3	1	3				2	1		2	3	2	
AVG	**2.0**	**2.0**	**3.0**	**1.0**	**3.0**				**2.0**	**1.0**		**1.2**	**3.0**	**2.0**	

1–Low, 2 –Medium, 3–High.

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BE23CS406	OPERATING SYSTEMS	Version: 1.0				
Programme & Branch	Common to B.E. (CSE) and B.Tech. (IT, CSBS and AI&DS)	CP	L	T	P	C
		5	2	1	2	4

Course Objectives:

1. To understand the basic operations and operating systems services.
2. To understand various scheduling algorithms and importance of deadlock.
3. To implement various memory management techniques.
4. To learn and apply file management concepts and disk scheduling algorithms.
5. To learn the basics of Mobile OS and Linux OS.

	INTRODUCTION (Not for Examination)	2

Importance:

Software & Hardware Interface – The communication and interaction between software applications and the underlying hardware of a computer system - **Memory (Primary & Secondary)** – It facilitates efficient allocation, utilization, and abstraction of physical memory for software processes and system operations - **Processes** – Memory allocation, execution state, resource management, for efficient multitasking and concurrent operation.

Real Life Examples: Android OS

The mobile applications are downloaded from play store and installed, it will ask request to the user authorization for accessing the resources like camera, gallery, Bluetooth, contacts, etc., This is one of the services of Operating System.

Linkages:

Pre-requisite: Programming Languages (C, C++) – Data Structures and Algorithms.

Future Courses: Design and Analysis of Algorithms – Principles of Compiler Design – Computer Architecture.

UNIT–I	FUNDAMENTALS OF OPERATING SYSTEMS	5+3

Introduction to Operating Systems – Evolution – Operating System structure – Services – System Calls – System Boot - User-Operating System Interface – System programs - Protection and Security.

UNIT–II	PROCESS MANAGEMENT	5+3

Processes: Process Concept – Process States, Scheduling algorithms – CPU Scheduling – Threads and Threading issues – Process Synchronization – The Critical-Section problem – Semaphores, Monitors, Deadlock – Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT– III	MEMORY MANAGEMENT	6+3

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

UNIT – IV	STORAGE MANAGEMENT	6+3

File-System Interface – File concept – Access methods – Directory Structure – Protection. File System Implementation – File System Structure – File System Operations – Directory implementation – Allocation Methods – Free Space Management; Mass Storage system – Disk Structure – Disk Scheduling – Disk Management – Swap Space Management.

UNIT–V	MOBILE OS AND CASE STUDIES	6+3

Mobile OS – iOS and Android. The Linux System: Linux Architecture – Kernel Modules – Process Management – Scheduling – Memory Management – File Systems – Input and Output – Inter process communication.

Total (LT) : 45 Periods

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LIST OF EXPERIMENTS/EXCERCISES:	
1.	Installation of windows and Linux operating systems.
2.	UNIX commands and Basic Shell Programming.
3.	Write C programs to implement the various CPU Scheduling Algorithms.
4.	Implement mutual exclusion by Semaphore.
5.	Write C programs to avoid Deadlock using Banker's Algorithm.
6.	Write C program to implement Threading.
7.	Write C program to implement the paging Technique.
8.	Write C programs to implement the various Page Replacement Algorithms.
9.	Implement the following File Allocation Strategies using C programs: a. Sequential b. Indexed c. Linked
	Total (P) : 30 Periods
	Total (LT+P) : 75 Periods

	OPEN ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Explain the main concepts, key ideas, strengths and limitations of operating system services.	**L2 – Understand**
CO2	Demonstrate the CPU scheduling algorithms and methods for effective resource utilization.	**L3 – Apply**
CO3	Compare and contrast the different memory management techniques.	**L3 – Apply**
CO4	Solve the problems related to file management systems and Disk Scheduling.	**L3 – Apply**
CO5	Summarize the features of Mobile OS and Linux OS.	**L2 – Understand**

TEXTBOOKS:

1.	Silberschatz Abraham, Greg Gagne, Peter B. Galvin, "Operating System Concepts", 9th Edition, Wiley, 2018.
2.	Andrew S Tanenbaum, "Modern Operating Systems", Pearson Education, 5th Edition, 2022.

REFERENCE BOOKS:

1.	Ramaz Elmasri, A. Gil Carrick, David Levine, — Operating Systems – A Spiral Approach, Tata McGraw Hill,2019.
2.	William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Prentice Hall, 2018.
3.	Achyut S.Godbole, Atul Kahate, —Operating Systems‖, McGraw Hill Education, 2017.

WEB REFERENCES:

S. No.	Publisher	Website link	Type of Content
1.	Javatpoint	https://www.javatpoint.com/operating-system	Web Reference

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2.	Geeksforgeeks	https://www.geeksforgeeks.org/operating-systems/?ref=lbp	Web Reference
3.	Techtarget	https://www.techtarget.com/searchmobilecomputing/definition/mobile-operating-system	Web Reference

VIDEO REFERENCES:

S. No.	Video Details	Name of the Expert	Type of Content	Video link
1.	Youtube	Jenny's Lectures CS IT	Lecture	https://www.youtube.com/playlist?list=PLdo5W4Nhv31a5ucW_S1K3-x6ztBRD-PNa
2.	Coursera	Patrick Ester Chalece DeLaCoudray	Lecture	https://www.coursera.org/specializations/codio-introduction-operating-systems
3.	NPTEL	Prof. Santanu Chattopadhyay	Lecture/ Real – time applications	https://nptel.ac.in/courses/106105214

Mapping of COs with POs and PSOs

COs	Pos												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												1	2	
CO2	3	3	3	1										2	3
CO3	3	3	3	1	1										
CO4	3	3	3	1									1	2	1
CO5	3	1			3	2							1	3	1
AVG	**3.0**	**2.5**	**3.0**	**1.0**	**2.0**	**2.0**							**1.0**	**2.2**	**1.6**

1–Low, 2 –Medium, 3–High.

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BE23EN103	PROFESSIONALCOMMUNICATION LABORATORY - I	Version : 1.0				
Programme & Branch	Common to all branches except B.Tech. - CSBS	CP	L	T	P	C
		2	0	0	2	1

Course Objectives:

1.	To use language for employment and social interaction.
2.	To help learners frame sentences in correct context.
3.	To develop students' confidence for presentation.
4.	To strengthen students' business communication.
5.	To participate confidently and appropriately in a team conversation.

INTRODUCTION (Not for Examination)

Importance:

Provides a platform where students can enhance their language competence - helps students to acquire career skills sought by the industry for campus recruitment - Improves communication skills in formal and informal situations.

Real-life Example(s):

Writing letters - drafting e-mails - blog writing - writing abstracts - public speaking- presentation.

Linkages:

Pre-requisite: Communicative English - I, Communicative English - II.

LIST OF EXPERIMENTS

1.	Listening & Reading Comprehension
2.	Root words & Sentence formation
3.	Expressing oneself in everyday situation
4.	Conversation and Just a minutes talk
5.	Oral presentation – Long turn
6.	Group Discussion
7.	Creative Writing
8.	Business Letter Writing
9.	Giving constructive feedback and offering suggestions
10.	E-mail writing

Total: 30 Periods

Course Outcomes: Upon completion of this course, the students will be able to:		**BLOOM'S Taxonomy**
CO1	Use language effectively for employment.	**L3 - Apply**
CO2	Enhance writing skills for better communication.	**L3 - Apply**
CO3	Present ideas in public forum.	**L3 - Apply**

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CO4	Write business letters in a comprehensive manner.	**L3 - Apply**
CO5	Express opinions assertively in group discussions.	**L3 - Apply**

TEXTBOOKS:

1.	Richardson, Mathew. Advanced Communication Skills. Charlie CReative Lab, 2020.
2.	Rizvi, Ashrif. Effective Technical Communication, Tata McGrawhill, 2011.

REFERENCE BOOKS:

1.	Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
2.	Terk, Natasha. Reports, Proposals and Procedures: A write It well Guide. Gildan Media, 2015.
3.	Carnegie, Dale. The Art of Public Speaking. Prabhat Prakashan Pvt. Ltd. 1st Edition: New Delhi, 2016.

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	Leverageedu	https://leverageedu.com/blog/group-discussion-topics/	Others
2.	Forbes	https://www.forbes.com/advisor/in/business/business-letter-format/	Others

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video Link
1.	NPTEL	Dr.T.Ravichandran IIT, Kanpur	Lecture	https://nptel.ac.in/courses/109104031
2.	NPTEL	Dr.Binod Mishra IIT, Roorkee	Lecture	https://onlinecourses.nptel.ac.in/noc21_hs76/preview

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1										3		1			
CO2										3		1			
CO3										3		1			
CO4										3		1			
CO5										3		1			
AVG										**3.0**		**1.0**			

1–Low, 2 –Medium, 3–High.

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BE23PT805	ENGINEERING CLINIC – II	Version: 1.0				
Programme & Branch	Common to all branches	CP	L	T	P	C
		2	0	0	2	1

Course Objectives:

1.	To provide a platform for hands-on learning experiences in order to build relevant engineering skills.
2.	To enable students to learn and develop skills on designing of new product for real world application using 3D Printer and IOT.
3.	To take entrepreneurship, product development, startup-related activities and problem-solving skills in higher semesters and final semester project work.

	INTRODUCTION (Not for Examination)	**2**

Importance:

This course aims to enhance engineering knowledge and enabling students to become more creative and innovative. Students are actively involved in solving real-time problems as part of their curriculum and take part in extracurricular projects.

Real-life Examples:

Smart home automation, smart Healthcare, smart irrigation system, digital printing, Industrial Automation and vehicle tracking system.

Linkage:

Pre-requisites: Engineering Physics, Engineering Clinic – I.

The Engineering Clinic I & II course will provides the hands-on experience to develop the miniature model of doing by learning.

A. CONCEPT

Engineering Clinic laboratory provides hands-on training for students to develop certain simple real-world products or applications with the help of faculty. It is a team activity consisting of maximum 3 students per team. A list of products or applications will be given. Engineering Clinic - II focus on product development involving interdisciplinary Engineering courses. Each team can choose one or more products for a given application. The students have to design, fabricate and demonstrate the working of the product.

B. EXECUTION

Day	Session	Course content / Activity	No. of Periods
1	S 1	Introduction to Embedded Systems and IoT.	2
	S 2	Hands-on Training to write a code for IOT Circuit design using open-source software.	4
	S 3	Demonstration and explanation of real-time IoT application circuits in various sectors.	6
2	S 4	Introduction to 3D Printing Technology.	2
	S 5	Hands-on Training to design 3D Printing model using open-source software.	4
	S 6	Fabrication of 3D Printing Models.	6
3	S 7	Demonstration of Sublimation and Vinyl cutter Machine.	3
	S 8	Demonstration of Wood router Machine.	3
		Total	**30 Periods**

A list of sample applications/products is attached.

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C. ASSESSMENT

i. Assessment is done by Internal mode only and there is no End Semester Examination.
ii. Sessions (S7 & S8) are intended for demonstration purposes only, not for assessment.
iii. Marks distribution for Infernal Assessment is,

Method	Review I	Review II	Review III	Review IV
Details	System description and Circuit design.	Testing, Validation and Demonstration.	Design of 3D Printing models.	Fabrication of 3D Printing models.
Marks	25	25	25	25

For Product/Application the student team can choose themselves.

Course Outcomes: Upon completion of this course, the students will be able to:		BLOOM'S Taxonomy
CO1	Understand the Basics of IOT components.	L2- Understand
CO2	Design and Demonstrate the prototype of expedient product using 3D Printer.	L4 -Analyze
CO3	Practice the culture of Innovation and Product Development towards Start-ups in an Institution.	L4 – Analyze

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2		2	2	2	2			
CO2	3	3	3	2	2	2	2		2	2	3	2			
CO3	3	3	3	2	2	2	2		2	3	3	2			
AVG	**3.0**	**3.0**	**3.0**	**2.0**	**2.0**	**2.0**	**2.0**		**2.0**	**2.3**	**2.6**	**2.0**			

1–Low, 2 –Medium, 3–High.

List of sample Applications / Products for Engineering Clinic II

1. Automated Irrigation System
2. Smart Home Automation
3. AI based Image Capturing Robot
4. Vehicle Tracking System
5. IoT based Smart Traffic Management
6. IoT based Smart Hybrid Energy Management System
7. IoT based Garbage Monitoring System
8. Miniature of Home / Buildings / Bridges
9. Miniature of Robot /Quad copter/Motor and Drives
10. Development of Wood Wall Art/logo pendant /Door design.

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BE23PT807	APTITUDE SKILLS - II	Version: 1.0				
Programme & Branch	Common to all branches	CP	L	T	P	C
		1	0	0	1	0.5

Course Objectives:

1. To acquire skills required to solve quantitative aptitude problems.
2. To enhance the logical reasoning skills and help them improve problem solving abilities.

	INTRODUCTION (Not for Examination)	1

Importance:
Logical thinking and Problem-solving skills are very important for solving engineering problems.

Linkages:
Pre-Requisite: Aptitude Skills I.
Future courses: Aptitude Skills III and Aptitude Skills IV.

UNIT–I	QUANTITATIVE APTITUDE	8

Number Systems – Averages – Percentage – Profit & Loss – Problems on Ages – Ratios & Proportions.

UNIT–II	LOGICAL REASONING	6

Venn Diagrams – Cubes & Cuboids – Data – Interpretation and Data – Sufficiency.

Total : 15 Periods

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Exhibit sound knowledge to solve problems of quantitative aptitude.	L3 – Apply
CO2	Demonstrate ability to solve problems using logical reasoning.	L3 – Apply

TEXT BOOKS:

1. Dr. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand and Company Ltd., 2022
2. Dr. R.S. Aggarwal, "A Modern Approach to Logical Reasoning", S.Chand and Company Ltd., 2022
3. FACE, "Aptipedia: Aptitude Encyclopedia", 2nd edition, Wiley India Pvt. Ltd., 2017

REFERENCE BOOKS:

1. Arun Sharma, "Quantitative Aptitude for the CAT" 10th edition, McGraw-Hill Publishing, 2022
2. Praveen R. V., "Quantitative Aptitude and Reasoning", 3rd edition, PHI Learning Pvt. Ltd., 2016

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	Indiabix	https://www.indiabix.com/online-test/aptitude-test/	Tests for Practice
2.	Placement preparation	https://www.placementpreparation.io/quantitative-aptitude/	Tests for Practice
3.	Geeks for geeks	https://www.geeksforgeeks.org/aptitude-for-placements/	Learning Resources and Tests for Practice

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VIDEO REFERENCES:				
S.No.	**Video Details**	**Name of the Expert**	**Type of Content**	**Video link**
1.	YouTube	CareerRide	Video Lectures	https://www.youtube.com/playlist?list=PLpyc33gOcbVA4qXMoQ5vmhefTruk5t9lt
2.	YouTube	Freshersworld.com	Video Lectures	https://www.youtube.com/playlist?list=PLjLhUHPsqNYkcq6YOfiywbTfnvf_TN7i9

Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3														
CO2	3														
CO3															
CO4															
CO5															
AVG	**3.0**														
1–Low, 2 –Medium, 3–High.															

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BE23MA206	MATHEMATICS FOR BUSINESS ANALYTICS	Version: 1.0				
Programme & Branch	Common to all branches	CP	L	T	P	C
		3	2	1	0	3

Use of Calculator - fx991ms are permitted and Statistical Tables

Course Objectives:

1.	To learn the Foundation of Data Science.
2.	To understand the Concepts of Probability Distributions.
3.	To apply Statistical Techniques for Decision Making.
4.	To apply Design of Experiments in Business Problem.
5.	To introduce basic concepts of Correlation and regression for business data Analysis.

	INTRODUCTION (Not for Examination):	**2**

Importance:
Business analytics has become one of the most important skills that every student of management and engineering must acquire to become a successful in the career. The analytics across industries for decision making, problem solving and for driving innovations makes analytics and essential skill for every student from management and engineering disciplines.

Real Life Example(s):
Amazon – festival offer, Flipkart – special offer (Data collection).

Linkages:
Pre-Requisite: Calculus for Engineers.

UNIT–I	**FOUNDATION OF DATA SCIENCE**	**6+3**

Introduction to Business Analytics – Foundation of Data Science - Axioms of probability – Conditional probability – Baye's theorem.

UNIT–II	**DISTRIBUTIONS**	**6+3**

Discrete and continuous random variables - Types of Distributions –Discrete Distributions: Binomial, Poisson, Geometric – Continuous Distribution: Uniform, Exponential and Normal distributions.

UNIT– III	**TESTING OF HYPOTHESIS**	**5+3**

Essential of Testing of Hypothesis -Sampling distribution - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi Square test for goodness of fit – Independence of attributes.

UNIT – IV	**DESIGN OF EXPERIMENTS**	**5+3**

Introduction of Design of Experiments - One-way and two-way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial designs.

UNIT – V	**CORRELATION AND REGRESSION**	**6+3**

Correlations – Pearson correlation coefficient - Spearman Rank Correlation – Regression Simple Linear Regression – SLR Models.

Total : 45 Periods

OPEN ENDED PROBLEMS / QUESTIONS

Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as Internal Assessment only and not for the End semester Examinations.

Course Outcomes: Upon completion of this course, the students will be able to:		**BLOOM'S Taxonomy**
CO1	Apply the probability concepts in business problems.	**L3 – Apply**

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CO2	Apply the Probability Distribution Function in Engineering Problems.	**L3 – Apply**
CO3	Apply hypothesis-testing techniques to interpret results.	**L3 – Apply**
CO4	Choose the appropriate test by various methods of Parametric tests.	**L3 – Apply**
CO5	Apply the Correlation and regression in Engineering and business Problems.	**L3 – Apply**

TEXTBOOKS:

1.	Dr.U.Dineshkumar IIM-B," Business Analytics", Second Edition, Wiley India Edition, 2022.
2.	Douglasc.Montgomery, Georgec.Runger, "Applied Statistics and Probability for Engineers", Seventh Edition, Wiley India Edition, 2018.

REFERENCE BOOKS:

1.	J.K. Sharma," Business Statistics",5th Edition, S. Chand, 2020.
2.	Ken Black, Business Statistics for contemporary decision making, 5th Edition, Wiley India Edition,2010.
3.	T.Veerarajan,"Probability -Statistics and Random variables", Third Edition,Mc Graw Hill Education, 2017.

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	Wikipedia	https://en.wikipedia.org/wiki/Probability	Article - Probability
2.	Wikipedia	https://en.wikipedia.org/wiki/Statistics	Article - Statistics

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video link
1.	NPTEL	Prof. Saji K Mathew - IIT Madras	Lecture	https://onlinecourses.nptel.ac.in/noc24_cs65/preview
2.	NPTEL	Prof. Rudra P Pradhan - IIT Kharagpur	Lecture	https://onlinecourses.nptel.ac.in/noc20_mg11/preview

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
AVG	**3.0**	**2.0**													

1–Low, 2 –Medium, 3–High.

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BE23CS407	DESIGN AND ANALYSIS OF ALGORITHMS	Version: 1.0				
Programme & Branch	Common to B.E.(CSE), B.Tech.(IT and CSBS)	CP	L	T	P	C
		3	2	1	0	3

Course Objectives:

1.	To learn and understand the algorithm analysis techniques and complexity notations.
2.	To analyze the efficiency of graph algorithms.
3.	To become familiar with the different algorithm design techniques for effective problem solving in computing.
4.	To solve problems using backtracking and branch & bound.
5.	To understand the basic concepts of NP completeness, approximation algorithms and randomized algorithms.

INTRODUCTION (Not for Examination)	2

Importance:
Problem Solving - Understanding Computational Limits - Comparative Analysis – Security - Improved User Experience.
Real-life Example(s):
Navigation Systems - E-commerce Recommendations - Google Search Engine - Social Media Feeds - Autonomous Vehicles - Financial Trading.
Linkages:
Pre-requisite: Data Structure and Algorithms.
Future courses: Coding Skills – I, Coding Skills – II.

UNIT–I	INTRODUCTION TO ALGORITHM DESIGN	6+3

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties - Best case, Worst case and average case analysis - **Recurrence relation:** substitution method - **Searching:** linear search, binary search and Interpolation Search - **Pattern search:** The naïve string matching algorithm - Rabin Karp algorithm - Knuth Morris Pratt algorithm.

UNIT–II	GRAPH ALGORITHM	6+3

Graph algorithms: Representations of graphs - Graph traversal: DFS, BFS - applications Connectivity, strong connectivity, biconnectivity - **Minimum spanning tree:** Kruskal's and Prim's algorithm - **Shortest path:** Bellman Ford algorithm - Floyd Warshall algorithm - **Network flow:** Flow networks - Ford Fulkerson method.

UNIT– III	ALGORITHM DESIGN TECHNIQUES	6+3

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort - **Dynamic programming:** Elements of dynamic programming - Matrix-chain multiplication - Multi stage graph - Optimal Binary Search Trees - **Greedy Technique:** Elements of the greedy strategy - Activity selection problem - Optimal Merge pattern - Huffman Trees.

UNIT – IV	BACKTRACKING AND BRANCH & BOUND	5+3

Backtracking: nQueens problem - Hamiltonian Circuit Problem - Subset Sum Problem - Graph colouring problem - **Branch and Bound:** Solving 15 Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem.

UNIT–V	APPROXIMATION AND RANDOMIZED ALGORITHMS	5+3

NP Complete and NP Hard Problems: Basic Concepts – Non Deterministic Algorithms - Class of NP Complete and NP Hard - **Approximation Algorithms:** Travelling Salesman problem (TSP) - **Randomized Algorithms:** concept and application randomized quick sort - Finding k^{th} smallest number.

Total: 45 Periods

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	OPEN-ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.		
Course Outcomes: Upon completion of this course, the students will be able to:		**BLOOM'S Taxonomy**
CO1	Analyze the efficiency of algorithms using various frameworks.	**L2 - Understand**
CO2	Apply graph algorithms to solve problems and analyze their efficiency.	**L3 - Apply**
CO3	Apply Greedy and Dynamic Programming concept to solve a given problem.	**L3 - Apply**
CO4	Apply Backtracking, Branch and Bound concept to solve a given problem.	**L3 - Apply**
CO5	Implement different performance analysis methods for nondeterministic algorithms.	**L2 - Understand**

TEXTBOOKS:

1.	S. Sridhar, "Design and Analysis of Algorithms", 2nd Edition, Oxford university press, 2024.
2.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", 4th Edition, MIT Press, Cambridge, 2022.

REFERENCE BOOKS:

1.	By Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms" 1st Edition, Mc Graw Hill, 2023.
2.	Sandeep Sen, Amit Kumar, "Design and Analysis of Algorithms: A Contemporary Perspective", 1st Edition, Cambridge Press, 2019.
3.	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.
4.	By Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms" 1st Edition, Mc Graw Hill, 2023.
5.	Sandeep Sen, Amit Kumar, "Design and Analysis of Algorithms: A Contemporary Perspective", 1st Edition, Cambridge Press, 2019.

WEB REFERENCES:

	Publisher	Website link	Type of Content
1.	Geeksforgeeks	https://www.geeksforgeeks.org/designandanalysisofalgorithms/	Online Course
2.	Javatpoint	https://www.javatpoint.com/daatutorial	Online Course
3.	Open Course Ware	https://ocw.mit.edu/courses/6046jdesignanandanalysisofalgorithmsspring2015/	Online Course

VIDEO REFERENCES:

	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	Jennys lectures CS	Lecture	https://www.youtube.com/playlist?list=PLdo5W4Nhv31ZTn2P9vF02bkb3SC8uiUUn
2.	YouTube	Dr. Mohammed Javed	Lecture	https://www.youtube.com/watch?v=3udyFh_Dbbc
3.	YouTube	Rahul Madhavan	Lecture	https://www.youtube.com/playlist?list=PLEAYkSg4uSQ1YxqcmBjCdK9oX1mJDEx2

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Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			1							1	3	2	2
CO2	2	3	2	2	2		1					1	3	3	1
CO3	2	3	2	2	3		2					1	3	3	1
CO4	2	3	2	2	3							1	3	3	1
CO5	1	2	2	2	2							1	3	3	1
Avg.	**2.0**	**2.6**	**2.0**	**2.0**	**2.2**		**1.5**					**1.0**	**3.0**	**2.8**	**1.2**
1–Low, 2 –Medium, 3–High.															

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BE23MC904	Environmental Science and Sustainability	Version:1.0				
Programme & Branch	Common to all branches	CP	L	T	P	C
		2	1.5	0.5	0	0

Course Objectives:

1.	To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
2.	To impart knowledge on the causes, effects and control or prevention measures of environmental pollution.
3.	To facilitate the understanding of global and Indian scenario of energy resources, causes of their degradation and measures to preserve them.
4.	To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
5.	To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyzes the role of sustainable urbanization.

	INTRODUCTION: (Not for Examination)	1

Importance:

Engineering students studying environmental science explore the significance of ecosystems, human-nature dynamics, and global environmental challenges like climate change and biodiversity loss. They also grasp concepts of sustainable management and socio - economic goals such as carbon emission reduction and equitable resource access.

Real Life Example(s):

Sewage water treatment plant – Solar panel – Wildlife sanctuary

Linkages:

To all processes that generate pollution.

UNIT–I	ENVIRONMENT AND BIODIVERSITY	5 + 2

Definition, scope and importance of environment – need for public awareness. Eco-system 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.

Case study on Ecosystem at local level.

UNIT–II	ENVIRONMENTAL POLLUTION	5 + 2

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

Case study – Sources and remedy of water pollution, air pollution at industry level.

UNIT–III	ENERGY SCENARIO OF WORLD AND INDIA	4 + 1

Presents sources and distributions, related energy issues, future growth aspects and anticipated energy consequences – Need to form on environment friendly and renewable sources their potential and impact – Hardness in execution. Case study on available new energy resources in India.

UNIT–IV	SUSTAINABILITY AND MANAGEMENT	4 + 1

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- Concept of Carbon Credit, Carbon Footprint. Case study – Environmental issues and possible solutions for climate change.

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UNIT–V	SUSTAINABILITY PRACTICES	4 + 1
Zero waste and R concept, Circular economy, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Green Engineering - Sustainable urbanization Case study - Socio economical and technological change.		
		Total : 30 Periods

	OPEN-ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.		

Course Outcomes: Upon completion of this course, the students will be able to:		**BLOOM'S Taxonomy**
CO1	Understand the functions of environment, ecosystems and biodiversity and their conservation.	**L2 – Understand**
CO2	Measure causes of water, air, noise and soil pollutions and provide preventive solutions.	**L3 – Apply**
CO3	Understand the global and Indian scenario of energy resources and causes of their degradation.	**L2 – Understand**
CO4	Select suitable strategies for sustainable environment management.	**L3 – Apply**
CO5	Understand sustainability practices and green materials.	**L2 – Remember**

TEXT BOOKS:

1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.
2.	Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2016.
3.	Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.

REFERENCE BOOKS:

1.	R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media. 38.
2.	Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT. LTD, New Delhi, 2007
3.	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
4.	Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1	National Bureau of Animal Genetic Resources, Haryana	https://nbagr.icar.gov.in/en/home/	Database and policies
2	International Federation of the National Standardizing Associations	https://www.iso.org/standard/	Policies
3	Ministry of Environment, Forest and Climate Change, Govt. of India	https://cpcb.nic.in/	Standards and Polices

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VIDEO REFERENCES:				
S.No	**Video Details**	**Name of the Expert**	**Type of Content**	**Video link**
1	NPTEL	Dr. Samik Chowdhury , Dr. Sudha Goel, IIT Kharagpur	Lecture	https://nptel.ac.in/courses/109105203
2	NPTEL	Dr. Deepu Philip, Dr. Amandeep Singh, IIT Kanpur	Lecture	https://nptel.ac.in/courses/112104225
3	YouTube	Prof. Prasenjit Mondal, IIT Roorkee	Discussion	https://www.youtube.com/ watch? v=NRoFvz8Ugeo& list=PLLy_2iUCG87Cr __rs9sS1zSaR62imd0uB&index=1

Mapping of Cos with Pos and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1				2	3					2			
CO2	3	2				3	3					2			
CO3	3		1			2	2					2			
CO4	3	2	1	1		2	2					2			
CO5	3	2	1			2	2					1			
AVG	**2.8**	**1.7**	**1.0**	**1.0**		**2.2**	**2.4**					**1.8**			
1–Low,2–Medium,3–High.															

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BE23CS315	JAVA PROGRAMMING	Version:1.0				
Programme & Branch	Common to B.E. (CSE), B.Tech. (IT, CSBS and AI&DS)	CP	L	T	P	C
		5	2	1	2	4

Course Objectives:

1.	To understand the basic concepts of java programming.
2.	To realize and demonstrate the usage of OOPS concepts like object, classes and encapsulation.
3.	To implement the concept of inheritance, polymorphism and abstraction.
4.	To implement the concept of exception handling in Java, including the concept of generic programming and collections.
5.	To understand the concept of multi-threading and JDBC.

INTRODUCTION (Not for Examination)	**2**

Importance:
Platform Independence - Object-Oriented Programming - Enterprise Application - Android Application Development.

Real Life Example(s):
Online banking system - Mobile applications - E-commerce websites.

Linkages:
Pre-requisite: Data Structures and Algorithms, Database Management Systems.
Future Courses: Object Oriented Software Engineering, Web Technology.

UNIT–I	**INTRODUCTION**	**6+2**

Introduction to Java – JDK, JRE, JVM - Characteristics of Java– Environmental setup – Compiling and executing Java Program using command line – Java Tokens – Operators and Expressions – Type Conversions - Control Flow Statements – Read user input– Arrays – Functions - Compiling and executing Java Program using Eclipse IDE.

UNIT–II	**OBJECT, CLASSES AND ENCAPSULATION**	**6+3**

Introduction to Object and Class – Class declaration – Access Modifiers – Object Creation – Access class members – Array of Objects – Constructors – Garbage Collection – this – Static Block – Static Variables – Static Methods - Inner classes - Anonymous classes – Encapsulation – Getter and Setter Methods.

UNIT–III	**INHERITANCE, POLYMORPHISM AND ABSTRACTION**	**6+3**

Inheritance: Inheritance types, super keyword, preventing inheritance: final classes & methods. **Polymorphism:** Method overloading and method overriding, abstract classes and methods. **Interfaces:** Interfaces Vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface, inner class - Defining a Lambda Expression - Lambda Built-in Functional Interfaces - Lambda Operations.

UNIT–IV	**EXCEPTION HANDLING, GENERIC PROGRAMMING AND COLLECTIONS**	**6+3**

Exception handling: Benefits of exception handling, the classification of exceptions exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses - I/O Fundamentals – Files – Serialization – Directory - Using Stream API with NIO.2 - Defining a Simple Generic Class – Generic Methods – Bounds for Type Variables. **Collections:** Interfaces- Classes- Algorithms - Collections Streams and Filters.

UNIT–V	**MULTI THREADING AND JDBC**	**6+2**

Multi-threading: Concurrency - worker threads using runnable and Callable - Using the

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java.util.concurrent collections – Fork-Join Framework - Parallel Streams - Database Applications with JDBC - JDBC API - JDBC driver - CRUD operations.	
	Total (LT) : 45 Periods
LIST OF EXPERIMENTS/EXCERCISES:	
1.	Write a java program to find the Fibonacci series using recursive and non-recursive functions.
2.	Write a java program to multiply two given matrices.
3.	Write a java program that reads a line of integers and displays each integer and the sum of all integers use String Tokenizer.
4.	Write a java program that checks whether a given string is palindrome or not.
5.	Write a Java program for display the exception in a message dialog box.
6.	Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
7.	Write a Java program for handling mouse events and Key events.
8.	Write a Java program to create generic class.
	Total (P) : 30 Periods
	Total (LT+P) : 75 Periods

	OPEN ENDEDPROBLEMS/QUESTIONS	
Course Specific Open Ended Problems will be solved during classroom teaching. Such problems can be given as assignments and evaluated as Internal Assessment only and not for the End Semester Examinations.		
Course Outcomes: **Upon completion of this course, the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Impart understanding of basic programming concepts in Java language.	**L3 – Apply**
CO2	Apply code reusability through classes and encapsulation.	**L3 – Apply**
CO3	Solve problems using java collection framework and I/O classes in interface.	**L3 – Apply**
CO4	Integrate the learned and applied concepts into given java projects to produce real life solutions.	**L3 – Apply**
CO5	Develop efficient programs using multi-threading and JDBC.	**L3 – Apply**

TEXTBOOKS:	
1.	Cay S. Horstmann "Core Java: Volume I – Fundamentals", 12th Edition, Addison-Wesley Professional, 2021.
REFERENCE BOOKS:	
1.	Herbert Schildt, "Java: The Complete Reference", 12th Edition, McGraw Hill, 2022.
2.	E.Balagursamy- "Programming with Java", 6 Edition, McGrawHill Education, 2019.
3.	Deitel and Deitel, "Java How to Program", 11th Edition, Pearson, New Delhi, 2019.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	Web reference	https://webreference.com/ java/	Web Reference

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2.	w3schools	https://www.w3schools.com /java/	Web Reference
3.	Web based programming	http://www.webbased programming.com/ Java-Developers-Reference/	Web Reference

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video link
1.	NPTEL	Prof. Debasis Samanta IIT Kharagpur	Lecture	https://youtu.be/jdT2lEZJA?si=5NZZFjOcn1UCgSbj
2.	NPTEL	Prof. Debasis Samanta IIT Kharagpur	Lecture	https://youtu.be/ksxhzfD8kQ?si=4x6-z6zWxahTUeNP
3.	NPTEL	Prof. Debasis Samanta IIT Kharagpur	Lecture	https://www.youtube.com/playlist?list=PLfn3cNtmZdPOe3R_wO_h540QNfMkCQ0ho

Mapping of Cos with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	3							2	2	1	
CO2	3	2	1	2	3							2	3	2	
CO3	2	2	1	2	3							2	2	3	
CO4	3	2	1	2	3							2	3	3	
CO5	3	2	1	2	3							3	2	3	
AVG	**3.0**	**2.0**	**1.0**	**2.0**	**3.0**							**2.0**	**2.0**	**3.0**	

1–Low,2–Medium,3–High.

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BE23CS408	FOUNDATIONS OF ARTIFICIAL INTELLGENCE AND MACHINE LEARNING	Version: 1.0				
Programme & Branch	Common to B.E. (CSE) and B.Tech. (IT and CSBS)	CP	L	T	P	C
		5	2	1	2	4

Course Objectives:

1.	To understand the fundamental concepts of artificial intelligence.
2.	To demonstrate comprehension of AI techniques using various search algorithms.
3.	To apply problem-solving techniques to solve complex AI problem.
4.	To explore various supervised learning algorithms.
5.	To understand and build various unsupervised learning models.

	INTRODUCTION (Not for examination)	**2**

Importance:
AIML drives innovation by enabling the development of new products and services - It opens up possibilities for creating intelligent systems that can automate tasks make predictions and provide insights that were previously impossible.

Real Life Example(s):
Playing chess - Proving mathematical theorem - Driving a car - Diagnosis disease.

Linkages:

Pre-requisite: Data Structures and Algorithms - Python for Data Science.
Future Courses: Business Analytics - Deep Learning.

UNIT–I	**INTRODUCTION TO AI**	**5+3**

Introduction- Intelligent Agent- **Problem Solving:** Solving problems by searching-Classical search- Local search-Adversarial search- Alpha-Beta Pruning-Constraint Satisfaction Problem-Inference in CSP.

UNIT–II	**KNOWLEDGE, REASONING AND PLANNING**	**5+3**

Logical Agents: Knowledge based agent- proportional logic- **First Order Logic:** Representation-syntax and semantics of first order logic -**Inference in First Order Logic:** forward chaining and backward chaining-**Classical Planning:** state-space search- analysis of planning approaches - Planning and Acting in the Real World.

UNIT– III	**KNOWLEDGE REPRESENTATION**	**6+3**

Uncertain knowledge and reasoning: quantifying uncertainty- Bayes rule- inference using full joint distribution - **Probabilistic Reasoning**: semantics of Bayesian networks –exact inference in Bayesian networks – approximate inference in Bayesian networks.

UNIT – IV	**INTRODUCTION TO MACHINE LEARNING**	**6+3**

Introduction to machine Learning: Fundamentals of ML- Review of Linear Algebra for Machine Learning-Machine learning applications –Types of Machine Learning – **Supervised learning :** Linear Regression Models- Least squares, single & multiple variables- Bayesian linear regression-gradient descent- **Linear Classification Models**: Discriminant function – Probabilistic discriminative model - Logistic regression- Probabilistic generative model – Naive Bayes- Maximum margin classifier – Support vector machine-Decision Tree- Random forests.

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UNIT–V	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	6+3
Ensemble Learning: Model combination schemes- Voting– bagging- boosting-stacking- **Unsupervised learning:** K-means - **Instance Based Learning:** KNN, Gaussian mixture models and Expectation maximization.		
		Total (LT) : 45 Periods

LIST OF EXPERIMENTS/EXCERCISES:	
1.	Develop BFS and DFS for maze solving problems.
2.	Develop a A* algorithm for travelling salesman problems.
3.	Implementation of minimax algorithms for Tic-Tac-Toe application
4.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file.
5.	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
6.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
7.	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
	Total (P) : 30 Periods
	Total (LT+P) : 75 Periods

	OPEN ENDED PROBLEMS / QUESTIONS	
Course Specific Open Ended Problems will be solved during classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End Semester Examinations.		
Course Outcomes: **Upon completion of this course, the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Apply problem-solving strategies, and various search techniques to solve real world problems	**L3 -Apply**
CO2	Develop a comprehensive understanding of logical reasoning, knowledge representation and planning in artificial intelligence.	**L3 -Apply**
CO3	Develop uncertainty and making decisions using probabilistic reasoning and Bayesian methods.	**L3 -Apply**
CO4	Apply machine learning techniques to address the real time problems.	**L3 -Apply**
CO5	Implement unlabeled data makes it valuable in many practical applications across various domains.	**L3 -Apply**

TEXTBOOKS:	
1.	Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2.	Ethem Alpaydin, "Introduction to Machine Learning", Fourth Edition, MIT Press, 2020.

REFERENCE BOOKS:	
1.	Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008.
2.	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.

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3.	Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	Geeks for geeks	https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/	Web Reference
2.	Javatpoint	https://www.javatpoint.com/machine-learning	Web Reference

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video link
1.	NPTEL	Prof. Balaraman Ravindran	Lecture	https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2.	NPTEL	Prof. Mausam	Lecture	https://onlinecourses.nptel.ac.in/noc22_cs56/preview

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2							2	2		2
CO2	2	2	2	2	2							2	2		2
CO3	2	2	2	2	2							2	2		2
CO4	2	2	2	2	2							2	2		2
CO5	2	2	2	2	2							2	2		2
AVG	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**							**2.0**	**2.0**		**2.0**

1–Low, 2 –Medium, 3–High.

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BE23CS409	FUNDAMENTALS OF WEB DEVELOPMENT	Version: 1.0				
Programme & Branch	B.E.- Computer Science and Engineering	CP	L	T	P	C
		5	2	1	2	4

Course Objectives:

1.	To understand the foundational elements and evolution of web technology.
2.	To understand and apply the basic HTML elements and attributes.
3.	To utilize CSS design patterns, types, selectors, and pseudo-classes, and CSS3 properties.
4.	To develop an interactive web page using advanced JavaScript techniques.
5.	To develop the responsive webpage using Bootstrap grid system.

INTRODUCTION: (Not for an Examination)	**2**

Importance:

Real-Time Application - Business and Commerce - Education and Learning - User Interaction - Global Connectivity.

Real Life Example(s):

HTML, CSS, JavaScript: Event Booking Website - Bootstrap, Media Queries: Amazon Website - Form Validation: Naukri Website.

Linkages:

Pre-requisite: Computer Networks

UNIT–I	**FOUNDATIONS OF WEB TECHNOLOGY**	**5+3**

Computer Network Basics – Introduction to Internet – History – WWW – Evolution of Web – Web Browser – URI – Web Server – Website - Web System Architecture (Single Tier, Two Tier, Three Tier Architecture)– HTTP Request and Response – Port - DNS - Client-side and server-side scripting.

UNIT–II	**HTML ELEMENTS: BUILDING BLOCKS OF WEB PAGES**	**5+3**

Basic HTML Elements: Attributes - Hyperlinks and bookmarks – Images - favicon - emojis - List and table - Form Elements – Layouts - Other HTML5 Elements - Inline Vs Block level elements - Media and Graphics.

UNIT– III	**DESIGN PATTERNS AND BEST PRACTICES IN CSS**	**6+3**

Design Patterns: Basics of CSS – Types – Selectors - Pseudo classes - Core CSS3 Properties - CSS3 Features - Media Queries CSS Preprocessors (SASS, SCSS).

UNIT – IV	**CLIENT-SIDE PROGRAMMING**	**6+3**

Introduction to JavaScript - HTML Vs CSS Vs JavaScript -Syntax - First JavaScript – Keywords – Variables - Operators - Data Types - Type Conversion - Control Flow Statements – Functions - Event listener – Constructor - Prototypes - Objects: String, Array, Math, Date, Regular Expression.

UNIT–V	**JAVASCRIPT ADVANCED AND BOOTSTRAP**	**6+3**

Events – DOM - Form Validation – Canvas - Usage of Google APIs (Maps, Charts, Fonts, Forms, Calendar), ES6 Features - Introduction to JSON, Basics of Bootstrap - Features – Forms – Grid - Responsive Web Page Creation.

Total (LT) : 45 Periods

LIST OF EXPERIMENTS/EXCERCISES:

1.	Acquaintance with elements, Tags and basic structure of HTML files.

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2.	Practising basic and advanced text formatting.
3.	Designing of webpage - Document Layout, Forms, Layouts, Lists, Frames, Tables, Controls.
4.	Acquaintance with creating style sheet, CSS properties and styling.
5.	Working with HTML elements box, Positioning and Block properties in CSS
5.	Designing with cascading style sheet-Internal & External Style Sheet.
6.	JavaScript: Designing a Simple Project using Java Script.
	Total (P) : 30 Periods
	Total (LT+P) : 75 Periods

OPEN ENDED PROBLEMS / QUESTIONS

Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End Semester Examinations.

Course Outcomes: Upon completion of this course, the students will be able to:		**BLOOM'S Taxonomy**
CO1	Understanding of the foundational elements and historical evolution of web technology.	**L2 - Understand**
CO2	Demonstrate proficiency in understanding and applying basic HTML elements and attributes.	**L3 - Apply**
CO3	Developed the skills to create well-structured web pages using CSS.	**L3 - Apply**
CO4	Proficiency to develop the interactive webpage using JavaScript.	**L2 - Understand**
CO5	Capable of designing responsive web pages using the Bootstrap.	**L3 - Apply**

TEXTBOOKS:

1.	Philip Ackermann, "FULL STACK WEB DEVELOPMENT: THE COMPREHENSIVE GUIDE", Rheinwek Computing, First Edition, 2023.
2.	John Dean, "WEB PROGRAMMING with HTML5, CSS and JavaScript", First Edition, Jones & Bartlett Learning, 2018

REFERENCE BOOKS:

1.	Nabendu Biwas, "ULTIMATE FULL-STACK WEB DEVELOPMENT WITH MERN", Orange Education Pvt Ltd., 2023
2.	Jennifer Robbins, "LEARNING WEB DESIGN: A BEGINNER'S GUIDE TO HTML, CSS, JAVASCRIPT, AND WEB GRAPHICS", Fifth Edition, O'Reilly Publisher, 2018.
3.	A. Powell, "HTML & CSS: THE COMPLETE REFERENCE THOMAS" Fifth Edition, Tata McGraw Hill, 2010
4.	Lea Verou, "CSS SECRETS: BETTER SOLUTIONS TO EVERYDAY WEB DESIGN PROBLEMS", First Edition, O'Reilly Publisher, 2015.

WEB REFERENCES:

S. No.	Publisher	Website link	Type of Content
1.	Freecodecamp	https://shorturl.at/aa5aY	Article
2.	Web.dev	https://shorturl.at/IntBl	Article

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3.	w3schools	https://shorturl.at/fIfgp	Web Reference
4.	Hubspot	https://shorturl.at/7kCi6	Web Reference
5.	Valuecoders	https://shorturl.at/eNfFi	Article

VIDEO REFERENCES:

S. No.	Video Details	Name of the Expert	Type of Content	Video link
1.	YouTube (NPTEL)	Madhavan Mukund	Lecture	https://shorturl.at/3abn1
2.	YouTube	Zach Gollwitzer	Lecture	https://shorturl.at/S1sJj
3.	YouTube	Zach Gollwitzer	Lecture	https://shorturl.at/4hcUT

Mapping of COs with POs and PSOs

COs	Pos												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3				1	3	3	1	3	2	
CO2	3	2	3	3	3				1	3	3	1	3	2	
CO3	2	2	2	1	2				2	2	1	3	2	2	
CO4	1	2	3	2	2				2	1	3	1	1	1	
CO5	1	1	3	2	3				3	1	2	2	2	2	
AVG	**2.0**	**1.8**	**2.8**	**2.2**	**2.6**				**1.8**	**2.0**	**2.4**	**1.6**	**2.2**	**1.8**	

1–Low, 2 –Medium, 3–High

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BE23EN104	PROFESSIONALCOMMUNICATION LABORATORY – II	Version : 1.0				
Programme & Branch	Common to all branches except B.Tech. CSBS	CP	L	T	P	C
		2	0	0	2	1

Course Objectives:

1.	To train the students to gain proficiency in communication.
2.	To orient the students towards grooming as a professional
3.	To develop analytical thinking skills for problem-solving in communicative contexts.
4.	To make students employable graduates.
5.	To make presentation on a given topic in a formal context.

INTRODUCTION (Not for Examination)

Importance:

Enhances students' language competence - trains students to acquire career skills sought by the industry for campus recruitment - Improves communication skills in formal and informal situations.

Real-life Example(s):

Job Application & Resume - writing minutes - role play - presentation - writing case study

Linkages:

Pre-requisite: Communicative English - I, Communicative English - II.

LIST OF EXPERIMENTS

1.	Oral and visual presentation
2.	Interview skills
3.	Drafting Job application & Resume
4.	Mock Interview
5.	Writing minutes
6.	Speaking about specifications of a product (E.g., Home appliances)
7.	Persuasive Talk – Role play activity
8.	Verbal analogies
9.	Spotting errors
10.	Writing case study for given problem

Total: 30 Periods

Course Outcomes: Upon completion of this course, the students will be able to:		**BLOOM'S Taxonomy**
CO1	Use language effectively for presentation.	**L3 - Apply**
CO2	Utilize writing skills for better communication.	**L3 - Apply**
CO3	Construct ideas in both formal and informal conversation.	**L3 - Apply**
CO4	Develop writing skills for report writing.	**L3 - Apply**
CO5	Express opinions assertively in group discussions.	**L3 - Apply**

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TEXTBOOKS:	
1.	Richardson, Mathew. Advanced Communication Skills. Charlie CReative Lab, 2020
2.	Rizvi, Ashrif. Effective Technical Communication, Tata Mc Grahill, 2011.

REFERENCE BOOKS:	
1.	Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English.Cambridge University Press, Cambridge: Reprint 2011
2.	Terk, Natasha. Reports, Proposals and Procedures: A write It well Guide. Gildan Media, 2015.
3.	Carnegie, Dale. The Art of Public Speaking. Prabhat Prakashan Pvt. Ltd. 1st Edition: New Delhi, 2016

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	Mindtools	https://www.mindtools.com/a99xl9o/interview-skills	others
2.	Ecampusontario	https://ecampusontario.pressbooks.pub/writingcorrections/chapter/sample-chapter/	others

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video Link
1.	SWAYAM	Dr. Vibhuti Gaur Indira Gandhi National Open University (IGNOU)	English at the Workplace	https://onlinecourses.swayam2.ac.in/nou24_lg67/preview
2.	COURSERA	Brian McManus Language Specialist University of Pennsylvania	Writing Covering Letter, Resume	https://www.coursera.org/learn/careerdevelopment

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1										3		1			
CO2										3		1			
CO3										3		1			
CO4										3		1			
CO5										3		1			
AVG										**3**		**1**			

1–Low, 2 –Medium, 3–High.

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BE23PT808	Aptitude Skills - III	Version: 1.0				
Programme & Branch	Common to all branches	CP	L	T	P	C
		1	0	0	1	0.5

Course Objectives:

1.	To acquire skills required to solve quantitative aptitude problems.
2.	To enhance logical reasoning skills and help them improve problem-solving abilities.

	INTRODUCTION: (Not for Examination)	**1**

Importance:
Logical thinking and Problem-solving skills are very important for solving engineering problems.

Linkages:
Pre-Requisite: Aptitude Skills I and Aptitude Skills II.
Future course: Aptitude Skills IV.

UNIT–I	**Quantitative Aptitude**	**8**

Time & Work, Chain Rule, Permutations & Combinations, Probability, Boats & Streams and Pipes & Cisterns.

UNIT–II	**Logical Reasoning**	**6**

Non-verbal reasoning, Syllogisms, Critical Thinking and Statement & Conclusion.

Total: 15 Periods

Course Outcomes: Upon completion of this course, the students will be able to:		**BLOOM'S Taxonomy**
CO1	Exhibit sound knowledge to solve problems of quantitative aptitude.	**L3 – Apply**
CO2	Demonstrate ability to solve problems using logical reasoning.	**L3 – Apply**

TEXTBOOKS:

1.	Dr. R.S. Aggarwal., "Quantitative Aptitude for Competitive Examinations", S.Chand and Company Ltd., 2022.
2.	Dr. R.S. Aggarwal, "A Modern Approach to Logical Reasoning", S.Chand and Company Ltd., 2022.
3.	FACE, "Aptipedia: Aptitude Encyclopedia", 2nd edition, Wiley India Pvt. Ltd., 2017.

REFERENCE BOOKS:

1.	Arun Sharma, "Quantitative Aptitude for the CAT" 10th edition, McGraw-Hill Publishing, 2022.
2.	Praveen R. V., "Quantitative Aptitude and Reasoning", 3rd edition, PHI Learning Pvt. Ltd., 2016.

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	Indiabix	https://www.indiabix.com/online-test/aptitude-test/	Tests for Practice
2.	Placement preparation	https://www.placementpreparation.io/quantitative-aptitude/	Tests for Practice
3.	Geeksforgeeks	https://www.geeksforgeeks.org/aptitude-for-placements/	Content for Learning and Tests for Practice

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VIDEO REFERENCES:				
S.No.	**Video Details**	**Name of the Expert**	**Type of Content**	**Video link**
1.	YouTube	CareerRide	Video Lectures	https://www.youtube.com/list=PLpyc33gOcb VA4qXMoQ5vmhefTruk5t9lt
2.	YouTube	Freshersworld.com	Video Lectures	https://www.youtube.com/playlist?list=PLjLhUHPsq NYkcq6YOfiywbTfnvf_TN7i9

Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3														
CO2	3														
CO3															
CO4															
CO5															
AVG	**3.0**														
1–Low, 2 –Medium, 3–High.															

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