RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

COURSE HAND-OUT

KTU B.TECH. - SEMESTER III

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

RAJAGIRI SCHOOL OF ENGINEERING AND TECHNOLOGY (RSET)

VISION

TO EVOLVE INTO A PREMIER TECHNOLOGICAL AND RESEARCH INSTITUTION, MOULDING EMINENT PROFESSIONALS WITH CREATIVE MINDS, INNOVATIVE IDEAS AND SOUND PRACTICAL SKILL, AND TO SHAPE A FUTURE WHERE TECHNOLOGY WORKS FOR THE ENRICHMENT OF MANKIND

MISSION

TO IMPART STATE-OF-THE-ART KNOWLEDGE TO INDIVIDUALS IN VARIOUS TECHNOLOGICAL DISCIPLINES AND TO INCULCATE IN THEM A HIGH DEGREE OF SOCIAL CONSCIOUSNESS AND HUMAN VALUES, THEREBY ENABLING THEM TO FACE THE CHALLENGES OF LIFE WITH COURAGE AND CONVICTION

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CSE), RSET

VISION

TO BECOME A CENTRE OF EXCELLENCE IN COMPUTER SCIENCE & ENGINEERING, MOULDING PROFESSIONALS CATERING TO THE RESEARCH AND PROFESSIONAL NEEDS OF NATIONAL AND INTERNATIONAL ORGANIZATIONS.

MISSION

TO INSPIRE AND NURTURE STUDENTS, WITH UP-TO-DATE KNOWLEDGE IN COMPUTER SCIENCE & ENGINEERING, ETHICS, TEAM SPIRIT, LEADERSHIP ABILITIES, INNOVATION AND CREATIVITY TO COME OUT WITH SOLUTIONS MEETING THE SOCIETAL NEEDS.

B.TECH PROGRAMME

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates shall have up-to-date knowledge in Computer Science & Engineering along with interdisciplinary and broad knowledge on mathematics, science, management and allied engineering to become computer professionals, scientists and researchers.
2. Graduates shall excel in analysing, designing and solving engineering problems and have life-long learning skills, to develop computer applications and systems, resulting in the betterment of the society.
3. Graduates shall nurture team spirit, ethics, social values, skills on communication and leadership, enabling them to become leaders, entrepreneurs and social reformers.

PROGRAMME OUTCOMES (POs)

Graduates will be able to achieve

a. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems.

b. An ability to identify, analyse, formulate and solve technical problems by applying principles of computing and mathematics relevant to the problem.

c. An ability to define the computing requirements for a technical problem and to design, implement and evaluate a computer-based system, process or program to meet desired needs.

d. An ability to learn current techniques, skills and modern engineering tools necessary for computing practice.

e. An ability to carry out experiments, analyse results and to make necessary conclusions.

f. An ability to take up multidisciplinary projects and to carry out it as per industry standards.

g. An ability to take up research problems and apply computer science principles to solve them leading to publications.

h. An ability to understand and apply engineering solutions in a global and social context.

i. An ability to understand and practice professional, ethical, legal, and social responsibilities as a matured citizen.

j. An ability to communicate effectively, both written and oral, with a range of audiences.

k. An ability to engage in life-long learning and to engage in continuing professional development.

l. An ability to cultivate team spirit and to develop leadership skills thereby moulding future entrepreneurs.

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SCHEME: B.TECH 3RD SEMESTER

(Computer Science & Engineering)

Kerala Technological University Revised Scheme for B.Tech Syllabus Revision 2020

Course Code	Course Name	L-T-P	Credits	Exam Slot
100903/MA300A	DISCRETE MATHEMATICAL STRUCTURES	3-1-0	4	A
100902/C0300B	DATA STRUCTURES	3-1-0	4	B
100003/CS300C	LOGIC SYSTEM DESIGN	3-1-0	4	C
100003/CS300D	OBJECT ORIENTED PROGRAMMING USING JAVA	3-1-0	4	D
100908/CO900E	DESIGN AND ENGINEERING	2-0-0	2	E
100908/CO300F	SUSTAINABLE ENGINEERING	2-0-2	-	F
100003/CS322S	DATA STRUCTURES LAB	0-0-3	2	S
100003/CS322T	OBJECT ORIENTED PROGRAMMING LAB (IN JAVA)	0-0-3	2	T

Total Credits = 22 Hours: 26

Cumulative Credits= 60

100903/MA300A DISCRETE MATHEMATICAL STRUCTURES

COURSE INFORMATION SHEET

PROGRAMME:COMPUTER SCIENCE AND ENGINEERING	DEGREE: BTECH
COURSE: DISCRETE MATHEMATICAL STRUCTURES	SEMESTER: III CREDITS: 4
COURSE CODE: 100903/MA300A REGULATION: 2021	COURSE TYPE: CORE
COURSE AREA/DOMAIN: Logic Development	CONTACT HOURS: 3+1(Tutorial) hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME:

SYLLABUS:

UNIT	DETAILS	HOURS
I	Module- 1 (Fundamentals of Logic) Mathematical logic: Basic connectives and truth table. Statements –Logical Connectives – Tautology – Contradiction. Logical Equivalence: The Laws of Logic, The principle of duality- Substitution Rules – The implication-The Contrapositive- the Converse – the Inverse. Logical Implication - Rules of Inference, The use of Quantifiers: Open Statement-Quantifier- Logically Equivalent – Contrapositive –Converse –Inverse , Logical equivalences and implications for quantified statement- implications ,negation	9
II	Module 2:(Fundamentals of Counting Theory) The Rule of Sum – Extension of Sum Rule - The Rule of Product - Extension of Product Rule – Permutations Combinations, The Binomial Theorem (without proof),Combination with Repetition. The Pigeonhole Principle, The principle of Inclusion and Exclusion Theorem (Without Proof) Generalisation of the principle. Derangements-Nothing in it's right place.	9
III	Module 3 (Relations and Functions) Cartesian Product - Binary Relation, Function – domain – range, One to One function, Image restriction, Properties of Relations- Reachability Relations- Reflexive RelationsSymmetric Relations-Transitive relations – Antisymmetric, Relations, Partial Order relations, Equivalence Relation- irreflexive relations. Computer Recognition: Zero-one Matrices - Composite Relations- Zero One Matrix-Relation Matrix. Partially ordered Set –Hasse DiagramMaximal-Minimal Element-Least upper bound (lub)- Greatest Lower bound(glb) (From section 7.2, graph theory excluded .From 7.3,Topological sorting Algorithm- excluded) Equivalence Relations and Partitions - Equivalence Class, Lattice- Dual Lattice – Sub lattice – Properties of glb and lub – Properties of Lattice - Special Lattice : Complete Lattice	9

	– Bounded Lattice – Completed Lattice – Distributive Lattice	
IV	Module- 4 (Generating Functions and Recurrence Relations) Generating Function -First order linear recurrence relations with constant Coefficients-	9
	homogeneous nonhomogeneous- Solution. The second-order linear recurrence relation with Constant Coefficients - homogeneous- Nonhomogeneous – Solution.- Three cases, The Nonhomogeneous Recurrence Relation -First order- Second Order	
V	Module-5 (Algebraic Structures) Algebraic system-Properties- Homomorphism and Isomorphism. Semigroup and monoid– cyclicmonoid, sub semigroup and sub monoid- Homomorphism and Isomorphism of Semigroup and monoids. Group- Elementary properties- subgroup- symmetric group on three symbols-The direct product of two groups. Group Homomorphism- Isomorphism of groups, Cyclic group. Right coset left cosets- Lagrange's Theorem	9
	TOTAL HOURS	45

TEXT/REFERENCE BOOKS:

SL.NO	DESCRIPTION	Blooms' Taxonomy

Text Book

1. Discrete and Combinatorial Mathematics (An Applied Introduction), Ralph P Grimaldi, B V Ramana , 5th Edition, Pearson

Reference Books

- Kenneth H. Rosen, Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, Seventh Edition, MGH, 2011
- Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGrawHill Pub. Co. Ltd., New Delhi, 2003.
- Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Pearson Education Pvt Ltd., New Delhi, 2003
- Kenneth H.Rosen, "Discrete Mathematics and its Applications", 5/e, Tata Mc Graw Hill Pub.Co.Ltd, New Delhi 2003
- Richard Johnsonbaugh, "Discrete Mathematics", 5/e, Pearson Education Asia, New Delhi, 2002. 6) Joe L Mott, Abraham Kandel, Theodore P Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", 2/e, Prentice-Hall India, 2009.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
	Maths they studied at school level		

COURSE OBJECTIVES:

1	To introduce mathematical notations and concepts in discrete mathematics that is essential for computing
2	To train on mathematical reasoning and proof strategies.
3	To cultivate analytical thinking and creative problem solving skills

COURSE OUTCOMES:

		Level
C203.1	Students will be able to Learn the fundamentals of enumeration or counting techniques and methods of arrangements and derangements.	Apply (level 3)
C203.2	Students will be able to Learn the fundamentals of propositional logic and predicate calculus and apply to test the validity of statements	Validate (level 4)

C203.3	Students will be able to Learn the ideas of relations, functions equivalence relation and posets and it's applications	Construct (level 5)
C203.4	Students will Understand recurrence relation and apply the method of solving different type of recurrence relations using generating functions	Solve/Apply (level 3)
C203.5	Students will be able to Understand Fundamentals of Algebraic structures its properties such as monoids and groups	Solve/Apply (level 3)

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C203.1	3	2	3	2	1	_	_	_	_	2	_	1	2	_	_
C203.2	3	2	3	2	3	_	_	_	_	2	_	2	2	_	_
C203.3	3	2	2	_	2	_	_	_	_	2	_	2	-	_	_
C203.4	3	2	3	1		_	_	_	_	2	_	_	_	_	_
C203.5	3	2	2	1	1	_	_	_	_	2	_	1	-	_	_

JUSTIFICATIONS FOR THE MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
CS203.1-PO1	H	The arrangement and combinations of data to be taken for different problems can be identified
CS203.1-PO2	M	Counting techniques can be used to reach conclusions in the problems involving huge data
CS203.1-PO3	H	Counting techniques will help life-long learning in the broadest context of technological change.
CS203.1-PO4	M	Counting techniques can be Used research-based knowledge and research methods.
CS203.1-PO5	L	Used to select, and apply appropriate techniques with an understanding of the limitations.
CS203.1-PO10	M	Knowing Counting techniques will help in Communicating effectively on complex engineering activities with the engineering community and with society
CS203.1-PO12	L	Techniques will help life-long learning in the broadest context of technological change.

CS203.2-PO1	H	The validity of facts can be verified using predicate and propositional logic

CS203.2-PO2	M	The real life events can be represented and verified using Mathematical logic
CS203.2-PO3	H	Reasoning is made possible for engineering problems
CS203.2-PO4	M	Logic Uses research-based knowledge and research methods including design of experiments
CS203.2-PO5	L	Knowledge about logic can Create, select, and apply appropriate techniques with an understanding of the limitations.
CS203.2-PO10	M	Knowing logic will help in Communicating effectively on complex engineering activities with the engineering community and with society
CS203.2-PO12	M	Logic will help life-long learning in the broadest context of technological change.
CS203.3 - PO1	H	The reasoning and inferences made by them can be substantiated by the various proof techniques
CS203.3-PO2	M	The proof techniques can be used to verify the complex engineering solutions
CS203.3-PO5	M	The arrangement and combinations of data to be taken for different problems can be identified
CS203.3-PO10	M	discrete structures can be used to reach conclusions in the problems involving huge data
CS203.3-PO12	M	discrete structures will help life-long learning in the broadest context of technological change.
CS203.4-PO1	H	The concepts of discrete structures can be used to solve various complex engineering problems
CS203.4-PO2	M	The knowledge about the discrete computational structures will help them to reach conclusions about the complexity and methodologies for solving real life problems
CS203.4-PO3	H	Discrete structures can aid in the representation of various real life problems
CS203.4-PO4	L	The knowledge about the discrete computational structures Use research-based knowledge and research methods including design of experiments
CS203.4-PO10	M	Knowing Discrete structures will help to Communicate effectively on complex engineering activities with the engineering community and with society
CS203.5-PO1	H	Algebraic structures can be used to visualize the complex engineering problems involving sets of data
CS203.5-PO2	M	The similarity and characteristics of data can be analyzed using algebraic principles
CS203.5-PO3	M	It can be used to compare and contrast the complexity of algorithms that were developed
CS203.5-PO4	L	It helps to analyze the complexity and choose the best method for the particular problem

CS203.5-PO5	L	All algebraic structures can be compared using a single measure to identify the amount of computations involved in them so that the optimal one can be identified
CS203.5-PO10	M	The proof techniques can be used to verify the complex engineering solutions
CS203.5-PO12	L	Algebraic structures will help life-long learning in the broadest context of technological change

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

Si NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Graph Theory and its applications	Seminar	1	1
2	Plotting graph for a function	Class lecturing along with the topic of function	1	1

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURE/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Si NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Graph Theory	Class Assignment	1,3	1

WEB SOURCE REFERENCES:

1	http://web.stanford.edu/class/cs103x/cs103x-notes.pdf
2	https://www.tutorialspoint.com/discrete_mathematics/discrete_mathematics_recurrence_relation.htm
3	http://nms.lu.lv/wp-content/uploads/2016/04/21-linear-recurrences.pdf
4	http://wwwhome.cs.utwente.nl/~infrieks/MHMI/2005.jk.pdf
5	http://nicolas.thiery.name/macs358/Notes/AlgebraicStructures.pdf

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

CHALK & TALK	STUD. ASSIGNMENT	WEB RESOURCES	
LCD/SMART BOARDS	STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

ASSIGNMENTS	STUD. SEMINARS	TESTS/MODEL EXAMS	UNIV. EXAMINATION
STUD. LAB PRACTICES	STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON	☐ OTHERS		
COURSES			

ASSESSMENT METHODOLOGIES-INDIRECT

ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by

Approved by

Radhika Das

HOD

100902/C0300B DATA STRUCTURES

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE AND ENGINEERING**	**DEGREE: BTECH**
COURSE: **DATA STRUCTURES**	SEMESTER: III CREDITS: 4
COURSE CODE: 100902/C0300B REGULATION: 2020	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: PROGRAMMING	CONTACT HOURS: **3+1(Tutorial) hours/Week.**
CORRESPONDING LAB COURSE CODE (IF ANY): 100003/CS322S	LAB COURSE NAME: DATA STRUCTURES LAB

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Basic Concepts of Data Structures** System Life Cycle, Algorithms, Performance Analysis, Space Complexity, Time Complexity, Asymptotic Notation, Complexity Calculation of Simple Algorithms	5
II	**Arrays and Searching** Polynomial representation using Arrays, Sparse matrix, Stacks, Queues-Circular Queues, Priority Queues, Double Ended Queues, Evaluation of Expressions Linear Search and Binary Search	10
III	**Linked List and Memory Management** Self Referential Structures, Dynamic Memory Allocation, Singly Linked List-Operations on Linked List. Doubly Linked List, Circular Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List Memory allocation and de-allocation-First-fit, Best-fit and Worst-fit allocation schemes	12
IV	Trees and Graphs Trees, Binary Trees-Tree Operations, Binary Tree Representation, Tree Traversals, Binary Search Trees- Binary Search Tree Operations Graphs, Representation of Graphs, Depth First Search and Breadth First Search on Graphs, Applications of Graphs	8
V	**Sorting and Hashing** Sorting Techniques – Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort Hashing- Hashing Techniques, Collision Resolution, Overflow handling, Hashing functions – Mid square, Division, Folding, Digit Analysis	10
	TOTAL HOURS	45

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T/R	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Universities Press, Fundamentals of Data Structures in C
R	Samanta D., Classic Data Structures, Prentice Hall India.
R	Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, 2/e, Cengage Learning.
R	Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.
R	Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill.
R	Peter Brass, Advanced Data Structures, Cambridge University Press.
R	Lipschuts S., Theory and Problems of Data Structures, Schaum's Series.
R	Wirth N., Algorithms + Data Structures = Programs, Prentice Hall. Hugges J. K. and J. I. Michtm, A Structured Approach to Programming, PHI.
R	Martin Barrett, Clifford Wagner, C And Unix: Tools For Software Design, John Wiley

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
100908/CO200G	Programming in C	Fundamentals of C programming	S2

COURSE OBJECTIVES:

1	To mould the learner to understand the various data structures, their organization and operations.

2	To help the learners to assess the applicability of different data structures and associated algorithms for solving real world problem which requires to compare and select appropriate data structures to solve the problem efficiently.
3	To introduce abstract concepts for data organization and manipulation using data structures such as stacks, queues, linked lists, binary trees, heaps and graphs for designing their own data structures to solve practical application problems in various fields of Computer Science

COURSE OUTCOMES:

Students will be able to

100902/C0300B.1	Design an algorithm for a computational task and calculate the time/space complexities of that algorithm	Cognitive Knowledge Level: Apply
100902/C0300B.2	Identify the suitable data structure (array or linked list) to represent a data item required to be processed to solve a given computational problem and write an algorithm to find the solution of the computational problem	Cognitive Knowledge Level: Apply
100902/C0300B.3	Write an algorithm to find the solution of a computational problem by selecting an appropriate data structure (binary tree/graph) to represent a data item to be processed	Cognitive Knowledge Level: Apply
100902/C0300B.4	Store a given dataset using an appropriate Hash Function to enable efficient access of data in the given set	Cognitive Knowledge Level: Apply
100902/C0300B.5	Select appropriate sorting algorithms to be used in specific circumstances	Cognitive Knowledge Level: Analyze
100902/C0300B.6	Design and implement Data Structures for solving real world problems efficiently	Cognitive Knowledge Level: Apply

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
100902/C0300B.1	3	3	2	2	-	1	-	-	-	-	-	2	2	3	1
100902/C0300B.2	2	2	3	2	-	1	-	-	-	-	-	1	2	2	-
100902/C0300B.3	3	2	3	2	-	2	-	-	-	-	-	1	1	2	-
100902/C0300B.4	3	1	2	3	-	1	-	-	-	-	-	2	2	2	2
100902/C0300B.5	3	2	3	3	-	1	-	-	-	-	-	2	1	2	-
100902/C0300B.6	3	2	3	2	-	2	-	-	-	-	-	2	3	3	-

100902/C0300B	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**1**

1-LOW, 2-MEDIUM, 3-HIGH

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
100902/C0300 B.1-PO1	HIGH	The knowledge in designing an algorithm for a task and calculating the time space complexities of the algorithm helps in designing solutions for complex engineering problems.
100902/C0300 B.1-PO2	HIGH	The knowledge of analyzing the space and time complexities of the algorithm helps in analyzing complex engineering problems and reach substantiated conclusion.
100902/C0300 B.1-PO3	MEDIUM	The design of solutions for complex problems requires the knowledge to write an efficient algorithm and also to calculate the time and space complexities.
100902/C0300 B.1-PO4	MEDIUM	Conducting investigation of complex problems to reach valid conclusions require the skill of designing an efficient algorithm.
100902/C0300 B.1-PO6	LOW	The knowledge of calculating time and space complexities of the algorithm helps to design an efficient algorithm and thereby an efficient product useful to the society.
100902/C0300 B.1-PO12	MEDIUM	The technological changes that happen every day require the skill of writing / designing efficient algorithms and hence can be considered as a lifelong learning .
100902/C0300 B.1-PSO1	MEDIUM	The knowledge in designing algorithms and asymptotic notations help in designing solutions and analyzing its complexity.
100902/C0300 B.1-PSO2	HIGH	The ability to design an efficient algorithm and calculate its complexity helps to enhance the programming skills and develop efficient programs
100902/C0300 B.1-PSO3	LOW	These concepts of designing algorithms and calculating space and time complexities are fundamental to CS and can be used in research and other innovative ideas.
100902/C0300 B.2-PO1	MEDIUM	The knowledge of arrays, linked lists, stacks and queues can be applied to solve complex engineering problems.
100902/C0300 B.2-PO2	MEDIUM	The knowledge of arrays or linked list helps to use them appropriately in programs and observe the output of it thereby reaching substantiated conclusion.
100902/C0300 B.2-PO3	HIGH	The knowledge of arrays, linked lists, stacks and queues can be applied to design solutions to complex engineering problems.
100902/C0300 B.2-PO4	MEDIUM	The ability to use the data structure arrays, linked lists, stacks and queues help us to implement efficient algorithms, code efficient programs and thereby perform analysis and interpretation of data to reach valid conclusions.
100902/C0300 B.2-PO6	LOW	The use of arrays, linked lists help to design efficient algorithms useful to the society.
100902/C0300 B.2-PO12	LOW	The knowledge of using linked lists and arrays and appropriately choosing them based on the application helps to easily adapt to technological changes and thereby conduct lifelong learning.
100902/C0300	MEDIUM	The knowledge of arrays, linked lists, stacks and queues can be

B.2-PSO1		applied to design solutions to complex engineering problems in multidisciplinary areas. They belong to the core concepts of CS.
100902/C0300 B.2-PSO2	MEDIUM	The knowledge of arrays, linked lists, stacks and queues can be applied to design solutions and thereby design good and efficient programs . This enhances the software skills of the students.
100902/C0300 B.3-PO1	HIGH	The knowledge of finding the solution of a computational problem by selecting non linear data structures like binary trees or graph can be applied to solve complex engineering problems.
100902/C0300 B.3-PO2	MEDIUM	The knowledge of finding the solution of a computational problem by selecting non linear data structures like binary trees or graph helps to use them appropriately in programs and observe the output of it thereby reaching substantiated conclusion.
100902/C0300 B.3-PO3	HIGH	The knowledge of finding the solution of a computational problem by selecting non linear data structure like binary trees or graph can be applied to design solutions to complex engineering problems.
100902/C0300 B.3-PO4	MEDIUM	The ability to use the data structure like binary trees and graphs help us to implement efficient algorithms, code efficient programs and thereby perform analysis and interpretation of data to reach valid conclusions.
100902/C0300 B.3-PO6	MEDIUM	The use of non linear data structures like binary trees and graphs helps the engineers design efficient algorithms useful to the society like storing huge databases and finding the shortest distance using graph algorithms
100902/C0300 B.3-PO12	LOW	The knowledge of using linked lists and arrays and appropriately choosing them based on the application helps to easily adapt to technological changes and thereby conduct lifelong learning.
100902/C0300 B.3-PSO1	LOW	The knowledge of non linear data structures like trees and graphs can be applied to design solutions to complex engineering problems.
100902/C0300 B.3-PSO2	MEDIUM	This knowledge helps in designing efficient algorithms using appropriate data structure.
100902/C0300 B.4-PO1	HIGH	The knowledge of storing and accessing data efficiently by using appropriate Hash functions plays a role in designing solutions to complex engineering problems.
100902/C0300 B.4-PO2	LOW	The knowledge of storing and accessing data efficiently by using appropriate Hash functions helps to formulate an efficient solution to complex engineering problems
100902/C0300 B.4-PO3	MEDIUM	The knowledge of storing and accessing data efficiently by using appropriate Hash functions helps to design solutions to complex problems thereby helping the society.
100902/C0300 B.4-PO4	MEDIUM	The knowledge of storing and accessing data efficiently by using appropriate Hash functions helps to store data for conducting experiments or analysis.
100902/C0300 B.4-PO6	LOW	The knowledge of storing and accessing data efficiently by using appropriate Hash functions helps to store data and use it for engineering practices in an efficient manner.
100902/C0300 B.4-PO12	MEDIUM	The knowledge of storing and accessing data efficiently by using appropriate Hash functions helps to easily adapt to technological changes and thereby conduct lifelong learning

100902/C0300 B.4-PSO1	MEDIUM	This basic knowledge of storing and accessing data efficiently by using appropriate Hash functions can be used in designing solutions to complex multidisciplinary engineering problems.
100902/C0300 B.4-PSO2	MEDIUM	This basic knowledge of storing and accessing data efficiently by using appropriate Hash functions is needed while designing solutions and thereby delivering quality products meeting the industry needs.
100902/C0300 B.4-PSO3	MEDIUM	This basic knowledge of storing and accessing data efficiently by using appropriate Hash functions are fundamental to the CS discipline and can be used in designing algorithms for complex problems.
100902/C0300 B.5-PO1	HIGH	The ability to select appropriate sorting algorithms helps in solving complex engineering problems.
100902/C0300 B.5-PO2	MEDIUM	The ability to select appropriate sorting algorithms and use it in specific environment helps to analyze various parameters needed to decide the efficiency of the solution to a complex problem.
100902/C0300 B.5-PO3	HIGH	The ability to select appropriate sorting algorithms helps to design solutions to complex engineering problems in an efficient manner.
100902/C0300 B.5-PO4	HIGH	The ability to select appropriate sorting algorithms and use it in specific environments helps to investigate complex problems and reach valid conclusions.
100902/C0300 B.5-PO6	LOW	The ability to select appropriate sorting algorithms helps to design and develop quality products that helps the society.
100902/C0300 B.5-PO12	MEDIUM	The ability to select appropriate sorting algorithms helps to easily adapt to technological changes and thereby conduct lifelong learning
100902/C0300 B.5-PSO1	LOW	The ability to select and use appropriate sorting algorithms is a computer science specific skill needed for designing solutions for complex engineering problems.
100902/C0300 B.5-PSO2	MEDIUM	The ability to select and use appropriate sorting algorithms helps to develop efficient algorithms and thereby solve complex problems.
100902/C0300 B.6-PO1	HIGH	The ability to design and implement data structures for solving real world problems efficiently is a specialization acquired by the programmers that enables them to develop efficient solutions to complex engineering problems.
100902/C0300 B.6-PO2	MEDIUM	The ability to design and implement data structures for solving real world problems efficiently helps to formulate and analyze complex problems and reach substantiated conclusions.
100902/C0300 B.6-PO3	HIGH	The ability to design and implement data structures for solving real world problems efficiently helps to design solutions to complex engineering problems that helps the society.
100902/C0300 B.6-PO4	HIGH	The ability to design and implement data structures for solving real world problems efficiently helps to design solutions, analyze and interpret data efficiently and provide valid conclusions.
100902/C0300 B.6-PO6	LOW	The ability to design and implement data structures for solving real world problems efficiently helps to develop quality and efficient products helpful to the society.

100902/C0300 B.6-PO12	MEDIUM	The ability to design and implement data structures for solving real world problems efficiently helps to easily adapt to technological changes and thereby conduct lifelong learning
100902/C0300 B.6-PSO1	HIGH	The ability to design and implement data structures for solving real world problems efficiently can be applied in designing solutions to complex multidisciplinary engineering problems.
100902/C0300 B.6-PSO2	HIGH	The ability to design and implement data structures for solving real world problems efficiently can be applied in designing algorithms for complex engineering problems and thereby develop quality and efficient products that meet industry standards

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	DESCRIPTION	PO Mapping	PROPOSED ACTIONS
1	Towers of Hanoi Problem(Example of recursion)	PO1,PSO1	Learning Materials provided.

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl.No	Description	PO mapping	Proposed Actions
1	AVL Trees	PO1,PO3,PSO2	Learning Materials provided

WEB SOURCE REFERENCES:

1	http://nptel.ac.in/courses/106103069
2	https://ocw.mit.edu/courses/electrical-engineering-and-computer science/6-006-introduction-to-algorithms-spring-2008/
3	http://web.stanford.edu/class/cs166/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES	
✓ LCD/SMART BOARDS	✓ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

✓ ASSIGNMENTS	☐ STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
✓ STUD. LAB PRACTICES	✓ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY	✓ STUDENT FEEDBACK ON FACULTY

FEEDBACK, ONCE)	(ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

Anita John. Jincy J Fernandez **HOD**

100003/CS300C LOGIC SYSTEM DESIGN

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE & ENGINEERING**	DEGREE: **BTECH (November2021-March 2022)**
COURSE: **LOGIC SYSTEM DESIGN**	SEMESTER: **III** CREDITS: **4**
COURSE CODE: **100003/CS300C** REGULATION: **2020**	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: COMPUTER HARDWARE	CONTACT HOURS: 3+1 (Tutorial) hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME:

SYLLABUS:

MODULE	DETAILS	HOURS
I	**Number systems, Operations & Codes** Decimal, Binary, Octal and Hexadecimal Number Systems- Number Base Conversions. Addition, Subtraction, Multiplication and Division of binary numbers. Representation of negative numbers- Complements, Subtraction with complements. Addition and subtraction of BCD, Octal and Hexadecimal numbers. Binary codes- Decimal codes, Error detection codes, Reflected code, Character coding schemes – ASCII, EBCDIC.	**7**
II	**Boolean Algebra** Postulates of Boolean Algebra. Basic theorems and Properties of Boolean Algebra. Boolean Functions - Canonical and Standard forms. Simplification of Boolean Functions- Using Karnaugh- Map Method (up to five variables), Don't care conditions, Product of sums simplification, Tabulation Method. Digital Logic Gates- Implementation of Boolean functions using basic and universal gates.	**9**
III	**Combinational Logic Circuits** Design Procedure & Implementation of combinational logic circuits- Binary adders and subtractors, Binary Parallel adder, Carry look ahead adder, BCD adder, Code converter, Magnitude comparator, Decoder, Demultiplexer, Encoder, Multiplexer, Parity generator/ Checker	**9**
IV	**Sequential logic circuits:** Flip-flops- SR, JK, T and D. Triggering of flip-flops- Master slave flip-flops, Edge- triggered flip- flops. Excitation table and characteristic equation. Registers- register with parallel load. Counter design: Asynchronous counters- Binary and BCD counters, timing sequences and state diagrams. Synchronous counters- Binary Up- down counter, BCD counter.	**9**
V	**Shift registers** Shift registers – Serial In Serial Out, Serial In Parallel Out, Bidirectional Shift Register with Parallel load. Ring counter. Johnson counter- timing sequences and state diagrams. **Arithmetic algorithms** Algorithms for addition and subtraction of binary numbers in signed magnitude and 2's complement representations. Algorithm for addition and subtraction of BCD numbers. Representation of floating-point numbers, Algorithm for addition and subtraction of floating point numbers.	**11**

	Programmable Logic devices ROM. Programmable Logic Array (PLA)- Implementation of simple circuits using PLA.	
	TOTAL HOURS	**45**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	M. Morris Mano, Digital Logic & Computer Design, 4/e, Pearson Education, 2013
T	Thomas L Floyd, Digital Fundamentals, 10/e, Pearson Education, 2009.
T	M. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2007.
R	M. Morris Mano, Michael D Ciletti, Digital Design with An Introduction to the Verilog HDL, 5/e, Pearson Education, 2013. Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003
R	Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003

COURSE PRE-REQUISITES: NIL

C.CODE	COURSE NAME	DESCRIPTION	SEM

COURSE OBJECTIVES:

1	To impart an understanding of the basic concepts of Boolean algebra and digital systems.
2	To impart familiarity with the design and implementation of different types of practically used sequential circuits.

COURSE OUTCOMES:

Sl No	DESCRIPTION	Blooms' Taxonomy Level
100003/CS300C.1	Illustrate decimal, binary, octal, hexadecimal and BCD number systems, perform conversions among them and do the operations - complementation, addition, subtraction, multiplication and division on binary numbers.	Cognitive Knowledge level: Understand
100003/CS300C.2	Simplify a given Boolean Function and design a combinational circuit to implement the simplified function using Digital Logic Gates	(Cognitive Knowledge level: Apply)
100003/CS300C.3	Design combinational circuits - Adders, Code Convertors, Decoders, Magnitude Comparators, Parity Generator/Checker and design the Programmable Logic Devices - ROM and PLA.	(Cognitive Knowledge level: Apply)
100003/CS300C.4	Design sequential circuits - Registers, Counters and Shift Registers.	(Cognitive Knowledge level: Apply)
100003/CS300C.5	Use algorithms to perform addition and subtraction on binary, BCD and floating-point numbers	(Cognitive Knowledge level:

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
100003/ CS300C.1	3	2		_	_	_	_	_	_	_	_	2	-	_	_
100003/ CS300C.2	2	2	1	2	_	2	-	_	_	_	_	2	1	_	_
100003/ CS300C.3	3	2	3	2	_	2	-	_	_	_	_	2	_	_	2
100003/ CS300C.4	2	1	3	1	_	1	-	_	_	_	_	1	_	1	_
100003/ CS300C.5	2	2	2	_	_	_	_	_	_	_	_	2	-	_	_
100003/ CS300C	2	2	3	2	_	_	_	_	_	_	_		-	1	2

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SLNO	DESCRIPTION	PROPOSED ACTIONS
1	Applications of multiplexer and demultiplexer	Reading assignments
2	Advances in digital IC's.	Reading assignments

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/ GUEST LECTURER/NPTEL ETC

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/HIGH	JUSTIFICATION
100003/CS300C.1-PO1	H	Knowledge of number system helps the students in circuit designing.
100003/CS300C.1-PO2	M	Knowledge of number systems helps to understand the working of digital systems.
100003/CS300C.1-PO12	M	Use of number system in life-long learning
100003/CS300C.2-PO1	M	Knowledge of Boolean algebra helps the students in circuit designing.
100003/CS300C.2-PO2	M	Analysis of logic circuits provides students a better understanding of digital circuits.
100003/CS300C.2-PO3	L	Help the students in design of simple digital circuits using gates.
100003/CS300C.2-PO4	M	Analysis of the combinational circuits to provide simple conclusions.
100003/CS300C.2-PO6	M	Ability to choose a simplified circuit for implementing a combinational circuit using an appropriate simplification method.
100003/CS300C.2-PO12	M	Use of Boolean function in designing circuits.

100003/CS300C.2-PSO1	L	Acquire skills to easily simplify Boolean functions.
100003/CS300C.3-PO1	H	Knowledge of Combinational circuits helps the students in circuit designing.
100003/CS300C.3-PO2	M	Analysis of the combinational circuits to generate complex structures.
100003/CS300C.3-PO3	H	Designing of complex combinational circuits is achieved.
100003/CS300C.3-PO4	M	Ability to choose a simplified circuit for implementing a combinational circuit using an appropriate simplification method.
100003/CS300C.2-PO6	M	Ability to choose a simplified circuit for implementing a combinational circuit using an appropriate simplification method.
100003/CS300C.2-PSO1	L	Knowledge of Boolean algebra help in design of efficient circuits.
100003/CS300C.4-PO1	M	Knowledge of Sequential circuits helps the students in circuit designing.
100003/CS300C.4-PO2	L	Analysis of Sequential circuits provides students a better understanding of complex sequential circuits.
100003/CS300C.4-PO3	H	Knowledge of Flip flops could be used to reduce the complexity of the sequential circuits.
100003/CS300C.4-PO4	M	Having the knowledge in various sequential circuit design principles students could analyze the problem and come to a conclusion on which design principle to be used.
100003/CS300C.4-PO6	M	Ability to choose a simplified circuit for implementing a sequential circuit using an appropriate simplification method.
100003/CS300C.4-PSO3	M	Choosing the appropriate method to implement the sequential circuit will help in designing efficient circuits.
100003/CS300C.5-PO1	M	Knowledge in Engineering fundamentals to help the students to do mathematical calculations using various algorithms.
100003/CS300C.5-PO2	M	Knowledge of addition and subtraction helps to understand the operations on floating-point numbers.
100003/CS300C.5-PO3	M	Apply the algorithms on various number systems.
100003/CS300C.5-PSO1	M	Developing new algorithms for various numbers system manipulations.

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

1	Fault Tolerance

WEB SOURCE REFERENCES:

1	http://nptel.iitm.ac.in/video.php?subjectId=117106086
2	http://www.asic-world.com/digital/tutorial.html
3	http://www.technologystudent.com/elec1/dig1.htm
4	http://cusatbtechguru.blogspot.in/2012/06/eecs-303-digital-electronics-lecture.html

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☑ LCD/SMART BOARDS
☑ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by
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(HOD)

100004/CS300D OBJECT ORIENTED PROGRAMMING USING JAVA

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE & ENGINEERING**	DEGREE: **BTECH (JANUARY- MAY 2017)**
COURSE: **OBJECT ORIENTED PROGRAMMING USING JAVA**	SEMESTER: **III** CREDITS: **4**
COURSE CODE: **100004/CS300D** REGULATION:**2020**	COURSE TYPE:**CORE**
COURSEAREA/DOMAIN: **PROGRAMMING**	CONTACT HOURS: **3+1 (Tutorial) hours/week.**
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME: 100004/CS322T

SYLLABUS:

MODULE	DETAILS	HOURS
I	**Approaches to Software Design** - Functional Oriented Design, Object Oriented Design, Case Study of Automated Fire Alarm System. Object Modeling Using Unified Modeling Language (UML) – Basic Object Oriented concepts, UML diagrams, Use case	**10**

	model, Class diagram, Interaction diagram, Activity diagram, State chart diagram. **Introduction to Java** - Java programming Environment and Runtime Environment, Development Platforms -Standard, Enterprise. Java Virtual Machine (JVM), Java compiler, Bytecode, Java applet, Java Buzzwords, Java program structure, Comments, Garbage Collection, Lexical Issues.	
II	**Core Java Fundamentals:** Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class. Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence. Control Statements - Selection Statements, Iteration Statements and Jump Statements. **Object Oriented Programming in Java** - Class Fundamentals, Declaring Objects, Object Reference, Introduction to Methods, Constructors, this Keyword, Method Overloading, Using Objects as Parameters, Returning Objects, Recursion, Access Control, Static Members, Final Variables, Inner Classes, Command Line Arguments, Variable Length Arguments. Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, using final with Inheritance.	**10**
III	**More features of Java:** Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces. Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally. Input/Output - I/O Basics, Reading Console Input, Writing Console Output, PrintWriter Class, Object Streams and Serialization, Working with Files.	**8**

IV	**Advanced features of Java:** Java Library - String Handling – String Constructors, String Length, Special String Operations - Character Extraction, String Comparison, Searching Strings, Modifying Strings, using valueOf(), Comparison of StringBuffer and String. Collections framework - Collections overview, Collections Interfaces- Collection Interface, List Interface. Collections Class – ArrayList class. Accessing a Collection via an Iterator. Event handling - Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Model. Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.	**10**
V	**Graphical User Interface and Database support of Java**: Swings fundamentals - Swing Key Features, Model View Controller (MVC), Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings –JFrame, JLabel, The Swing Buttons, JTextField. Java DataBase Connectivity (JDBC) - JDBC overview, Creating and Executing Queries – create table, delete, insert, select.	**6**
	TOTAL HOURS	**44**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
T	Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.
R	Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013.
R	Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008.

R	Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
R	Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
R	Sierra K., Head First Java, 2/e, O'Reilly, 2005.
R	Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
100906/CS200G	Programmimg in C	Developing Programming Skills	**S2**

COURSE OBJECTIVES:

1	To introduce basic concepts of object oriented design techniques.
2	To give a thorough understanding of Java language.
3	To provide basic exposure to the basics of multithreading, database connectivity etc.
4	To impart the techniques of creating GUI based applications.

COURSE OUTCOMES:

Sl No	**DESCRIPTION**	**Blooms' Taxonomy Level**
100004/CS300D..1	Write Java programs using the object oriented concepts - classes, objects, constructors, data hiding, inheritance and polymorphism	Apply(level 3)
100004/CS300D.2	Utilise datatypes, operators, control statements, built in packages & interfaces, Input/ Output Streams and Files in Java to develop programs	Apply(level 3)
100004/CS300D.3	Illustrate how robust programs can be written in Java using exception handling mechanism	Understand) (level 1)
100004/CS300D.4	Write application programs in Java using multithreading and database connectivity	Apply (level 3)

100004/CS300D.5	Write Graphical User Interface based application programs by utilising event handling features and Swing in Java	Apply(level 3)

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	3	_	_	_	_	_	_	_	_	_	_	1	_
CO2	2	2	2	_	_	_	_	_	_	_	_	_	2	2	2
CO3	2	3	3	_	_	_	_	_	_	_	_	_	2	2	1
CO4	3	2	2	_	_	_	_	_	_	_	_	_	_	_	1
CO5	1	2	2	_	2	_	_	_	_	_3	_	_	_	_	2

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SLNO	DESCRIPTION	PROPOSED ACTIONS
1	HTML	ASSIGNMENT

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/ GUEST LECTURER/NPTEL ETC

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/HIGH	JUSTIFICATION
CO1. PO2	L	By gaining the ability to apply object oriented principles in software design process, the students will be able to analyze complex engineering problems in the domain of software development with better effectiveness.
CO1- PO2	L	The students will get an insight into software design process and they would be able to apply standard practices in software project development to an extent.
CO1- PO3	H	By gaining the ability to develop Java programs for real applications, the students will be able to develop components of a system that meet the specified needs with appropriate consideration for the public health.
CO1-PSO2	L	Students are able to develop products that meet the societal needs.
CO2--PO1	M	The students will be able to build a strong foundation for java programming language but more training would be required to develop the ability to identify, analyze and design solutions for complex engineering problems.
CO2-PO2	M	The students will learn the programming language java and the practice of programming will help them to improve their programming skills to the next level.

CO2-PO3	M	The students will learn the programming language java which can be exploited to create innovative products for the society with limited support.
CO2-PSO1	M	Apply the knowledge of object oriented features to the solution of complex engineering problems.
CO2-PSO2	M	analyze complex engineering problems reaching substantiated conclusions using object oriented features
CO2-PSO3	M	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public safety
CO3-PO1	M	By understanding the object oriented features of java, the students will be able to apply the knowledge in java to derive solutions to computing problems.
CO3-P03	H	By understanding the object oriented features of java, the students will be able to apply the knowledge in java to derive solutions to environmental challenges
CO3-PO3	H	By understanding the object oriented features of java, the students will be able to design/develop system components of a system that meet the specified needs with appropriate consideration for the public health.
CO3- PSO1	M	The students will be able to develop a good idea on how to design a solution for computing problems by employing java programming language.
CO3- PSO2	M	By understanding and applying various object oriented features of java, the students will be able to improve their programming skills in java.
CO3- PSO3	L	By understanding and applying various object oriented features of java, the students will be able to initiate the process of developing innovative products using java.
CO.4-PO1	H	Exception Handling give better engineering solutions
CO.4-PO2	M	Robust solutions can be created for the society
CO.4-PO3	M	Exception handling provides robustness which improves the quality and reliability of the software solution.
CO4- PSO3	L	Students will be able to develop robust innovative products in java by implementing exception handing.
CO5-PO1	L	Event handling creates good engineering solutions
CO5-PO2	M	Event handling gives good natural solutions
CO5-PO3	M	Study on event handling enables students to design and develop solutions to problems.
CO5-PO5	M	Enables students to use modern tools to create and use GUI.
CO5- PSO3	M	The usage of graphical user interface and event handling in java will help the students to develop innovative products in java that will be of good market value and demand.
CO5-PO10	H	GUI enabled programs give better documentation and better reports and better instructions to the society

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SLNO	DESCRIPTION	PROPOSEDACTIONS
1	Familiarization of Eclipse	Lab sessions

WEB SOURCE REFERENCES:

1	https://docs.oracle.com/javase/tutorial/
2	http://www.javatpoint.com/java-tutorial
3	http://www.tutorialspoint.com/java/
4	https://www.youtube.com/channel/UC_c-e1vu4MBqOLY9WV1UrZw
5	https://www.youtube.com/watch?v=_3XiiNZYpAw
6	http://www.w3schools.in/java/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☑ LCD/SMART BOARDS
☑ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☑ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by
Dr. Dhanya P.M/ Mr.Biju AN/ Dr. Mary Priya S
(faculty)

Approved by
Dr.Dhanya P.M
(HOD)

100908/CO900E DESIGN AND ENGINEERING

COURSE INFORMATION SHEET

PROGRAMME: Computer Science & Engineering	DEGREE: B.Tech.
COURSE: **DESIGN AND ENGINEERING**	SEMESTER: S3 CREDITS: 2
COURSE CODE: 100908/CO900E REGULATION: 2019	COURSE TYPE: Core
COURSE AREA/DOMAIN: HUMANITIES	CONTACT HOURS: 2 (Lecture) + 0 (Tutorial) + 0 (Practical) Hours / Week
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	LAB COURSE NAME: NA

SYLLABUS:

Module	DETAILS	HOURS
I	Design Process:- Introduction to Design and Engineering Design, Defining a Design Process-:Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.	05
II	Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.	05
III	Design Communication (Languages of Engineering Design):- Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.	05
IV	Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design. Modular Design and Life Cycle Design Approaches. Application of Bio-mimicry, Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.	05
V	Expediency, Economics and Environment in Design Engineering:- Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design	05
	TOTAL HOURS	25

TEXT/REFERENCE BOOKS:

S. No.	T/R	AUTHORS/BOOK TITLE/PUBLICATION
1.	T	Yousef Haik, Sangarappillai Sivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning, 2003, Third Edition. ISBN-10: 9781305253285
2.	T	Voland. G., Engineering by Design, Pearson India 2014, Second Edition, ISBN: 9332535051

3.	R	Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.
4.	R	Clive L. Dym, Engineering Design: A Project based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
5.	R	Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361.
6.	R	Pahl. G., Beitz W., Feldhusen J., rote K. H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN: 978-1-84628-319-2.
7.	R	Jayasree PK, Balan K, Joy Varghese, Gouri P, Design and Engineering, Second Edition, CBS Publishers & Distributors Pvt Ltd., 2018.

COURSE PRE-REQUISITES:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

COURSE OBJECTIVES:

1	To introduce the undergraduate engineering students the fundamental principles of design engineering.
2	To make them understand the steps involved in the design process.
3	To familiarize them with the basic tools used and approaches in design.

COURSE OUTCOMES:

Ref. No.	DESCRIPTION	Blooms Taxonomy Level
EST200.1	Explain the different concepts and principles involved in design engineering.	Remember, Understand (Level 1 & 2)
EST200.2	Apply design thinking while learning and practicing engineering.	Apply (Level 3)
EST200.3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.	Apply (Level 3)

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EST200.1	2	1					1			1			2		2
EST200.2		2				1		1				2	2		2
EST200.3			2			1	1		2	2		1			2

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/HIGH	JUSTIFICATION
EST200.1-PO1	M	Students will be able to apply the concepts and principles of design engineering.
EST200.1-PO2	L	Students will be able to analyze and design complex engineering problems.
EST200.1-PO7	L	Students will be able to understand the impact of engineering designs in societal and environmental contexts.
EST200.1-PO10	L	Students will be able to communicate the designs effectively to engineering community and society at large.
EST200.1-PSO1	M	Students will be able to identify, analyze and design complex engineering problems in the area of computer science.
EST200.1-PSO3	M	Students will be able to design and develop innovative products to meet the societal needs and thereby emerge as eminent researcher and entrepreneur.
EST200.2-PO2	M	Students will be able to analyze and design complex engineering problems by applying design thinking approach.
EST200.2-PO6	L	Students will be able to apply design thinking approach considering the societal, health, safety, legal, and cultural issues.
EST200.2-PO8	L	Students will be able to apply design thinking approach while adhering to ethics and professional responsibility.
EST200.2-PO12	M	Students will be able to recognize the need for & engage in independent and life-long learning in the context of technological change.
EST200.2-PSO1	M	Students will be able to identify, analyze and design complex engineering problems in the area of computer science by applying design thinking approach.
EST200.2-PSO3	M	Students will be able to design and develop innovative products in the computer science area to meet the societal needs and thereby emerge as eminent researcher and entrepreneur.
EST200.3-PO3	M	Students will be able to design and develop solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
EST200.3-PO6	L	Students will be able to develop designs considering the societal, health, safety, legal, and cultural issues.
EST200.3-PO7	L	Students will be able to develop designs, understanding the impact of engineering designs in societal and environmental contexts.
EST200.3-PO9	M	Students will function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings while developing innovative designs.
EST200.3-PO10	M	Students will be able to communicate the designs they develop effectively to engineering community and society at large.
EST200.3-PO12	L	Students will be able to recognize the need for & engage in independent and life-long learning in the context of technological change while involving design and development.

EST200.3-PSO3	M	Students will be able to design and develop innovative products in the computer science area to meet the societal needs and thereby emerge as eminent researcher and entrepreneur.

INDUSTRY RELEVANCE:

Innovation and entrepreneurship has become a focus area in all universities and industry for more than a decade. We have seen many start-up companies and student entrepreneurs coming up with innovative products, disruptive technologies & businesses. Design and Engineering is a new course introduced by KTU in the B.Tech. programme (which was not there in MGU B.Tech. curriculum) with the intention of fostering innovation and entrepreneurship among engineering students. As students do this course, they may come up with innovative ideas & concepts, design and develop those concepts as marketable products and may become entrepreneurs by the time they complete B.Tech.

Also, as engineers/designers in software/IT industry where majority of our students are going work, they would help the businesses to grow by designing and developing innovative products and services.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS: None identified at this time.

S. NO	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING

PROPOSED ACTIONS: NA

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN: None thought about at this time.

S. NO	TOPIC	PO MAPPING
1		
2		

WEB SOURCE REFERENCES:

1	
2	

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐ CHALK & TALK	☐ **STUD. ASSIGNMENT** √	☐ **WEB RESOURCES** √
☐ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ DISCUSSIONS/ DEBATES
☐ **ONLINE CLASSES** √	☐ **ONLINE QUIZ & POLLS** √	

ASSESSMENT METHODOLOGIES-DIRECT:

☐ **ASSIGNMENTS** √	☐ STUD. SEMINARS	☐ **TESTS/MODEL EXAMS** √	☐ **UNIV. EXAMINATION** √
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT:

☐ **ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)** √	☐ **STUDENT FEEDBACK ON FACULTY (ONCE)** √
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

Jyotsna A. **Dr. Dhanya PM**
(Faculty) **(HOD)**

100908/CO300F SUSTAINABLE ENGINEERING

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE AND ENGINEERING**	DEGREE: **B.TECH**
COURSE: SUSTAINABLE ENGINEERING	**SEMESTER:** 3 **CREDITS:** NIL
COURSE CODE: 100908CO300F **REGULATION:** 2019	**COURSE TYPE:** CORE
COURSE AREA/DOMAIN: ENGINEERING (All Branches)	**CONTACT HOURS:** 2(LECTURE) HOUR/WEEK
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME:** NIL

SYLLABUS:

MODULE	CONTENTS	HOURS
I	Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).	5
II	Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.	6
III	Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.	6

IV	Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.	4
V	Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.	4

TEXT/REFERENCE BOOKS:

T/R	***BOOK TITLE/AUTHOR/PUBLICATION***
T1	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
T2	Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
T3	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
T4	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.
T5	ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
T6	Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
T7	Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
T8	Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios publication

COURSE PRE-REQUISITES:

C.CODE	**COURSE NAME**	**DESCRIPTION**	**SEM**
	Science	Basic Knowledge	School Level

COURSE OBJECTIVES:

1	To have an increased awareness among students on issues in areas of sustainability.
2	To understand the role of engineering and technology within sustainable development.
3	To know the methods, tools, and incentives for sustainable product-service system development.
4	To establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems.

COURSE OUTCOMES:

Sl. NO	DESCRIPTION	Blooms' Taxomomy Level
100908CO300F.1	Understand the relevance and the concept of sustainability and the global initiatives in this direction	Knowledge (Level 1)
100908CO300F.2	Explain the different types of environmental pollution problems and their sustainablesolutions	Understand (Level 2)
100908CO300F.3	Discuss the environmental regulations and standards	Understand (Level 2)
100908CO300F.4	Outline the concepts related to conventional and non-conventional energy	Understand (Level 2)
100908CO300F.5	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles	Apply (Level 3)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
100908 CO300F.1	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
100908	**2**	**2**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

CO300F.2															
100908 CO300F.3	-	2	3	-	-	2	3	2	-	-	-	-	-	1	-
100908 CO300F.4	1	1	3	-	-	2	3	1	-	-	-	-	-	-	1
100908 CO300F.5	1	-	-	-	-	2	3	2	-	-	-	-	-	1	1
100908 CO300F	1.25	1.66	3	-	-	2	3	1.5	-	-	-	-	-	1	1

1- Low correlation (Low), 2- Medium correlation(Medium) , 3-High correlation(High)

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/ MEDIUM/HIGH	JUSTIFICATION
100908CO300F.1 – PO.1	L	Fundamental awareness about the concept and importance of sustainability is essential for the existence in future world
100908CO300F.1 – PO.6	M	Social sustainability is a major part of sustainable development
100908CO300F.1 – PO.7	H	Environmental sustainability is a major part of sustainable development
100908CO300F.2 – PO.1	M	Definition of pollution and its impacts
100908CO300F.2 – PO.2	M	Environmental pollution problems could be identified
100908CO300F.2 – PO.6	M	New designs should be developed such that the pollution is less.
100908CO300F.2 – PO.7	H	The environment will be sustainable if all types of pollutions are restricted within the carrying limit of the nature
100908CO300F.2 – PO.8	L	An engineer should not compromise his ethical values in environmental issues.
100908CO300F.3 – PO.2	M	The impacts on environment due to a product or process could be identified

100908CO300F.3 – PO.3	H	Best products or processes could be designed so that the impact is minimum.
100908CO300F.3 – PO.6	M	Social responsibility of an Engineer in designing the product
100908CO300F.3 – PO.7	H	The environment will be sustainable if the products or processes make minimum impact.
100908CO300F.3 – PO.8	M	Professional ethics and responsibilities for best sustainable practices.
100908CO300F.4 – PO.1	L	Definition of green buildings and sustainable habitat
100908CO300F.4 – PO.2	L	Identifying green materials for sustainable buildings
100908CO300F.4 – PO.3	H	Buildings designed green
100908CO300F.4 – PO.6	M	Green building materials are nontoxic and less polluting and long lasting
100908CO300F.4 – PO.7	H	Green building materials are sustainable & produce less environmental impact
100908CO300F.4 – PO.8	L	Green buildings & ethics
100908CO300F.5 – PO.1	L	Concept of renewability of energy sources
100908CO300F.5 – PO.6	M	Energy resources and social concerns
100908CO300F.5 – PO.7	H	Sustainability of energy sources
100908CO300F.5 – PO.8	M	Ethics in energy consumption
100908CO300F.6 – PO.1	L	Concept of green engineering
100908CO300F.6 – PO.2	L	Analysis of flaws in current industrial scenario and corrective measures

100908CO300F.6 – PO.3	H	Green solutions for engineering problems
100908CO300F.6 – PO.6	L	Industrialization & social concerns
100908CO300F.6 – PO.7	H	Environmentally sustainable production patterns
100908CO300F.6 – PO.8	L	Ethics and sustainable engineering

JUSTIFATIONS FOR CO-PSO MAPPING

MAPPING	LOW/MEDIUM/HIGH	JUSTIFICATION
100908CO300F .2 – PSO.1	L	Better effluent treatment methods could be adopted
100908CO300F .2 – PSO.2	L	New mechanical systems could be designed so that the waste generation is minimum
100908CO300F .3 – PSO.2	L	Best designs made after conducting LCA and EIA
C BE 103.4 – PSO.3	M	Green building designs & upgrading existing buildings to green
100908CO300F .5 – PSO.1	M	Improvement in energy extraction and high efficient appliances
100908CO300F .6 – PSO.2	M	Better designs and developments in industries to ensure social, environmental and economic sustain abilities

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SI NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	NIL	NIL	-	-

WEB SOURCE REFERENCES:

1	www.nptel.ac.in
2	file:///E:/SustainableEnggNew/PublishBook/SolidWaste/Keynote%20Address%20for%203rd%20Regional%203R%20Forum.pdf
3	https://synapse.bio/blog/10-biomimicry-examples
4	http://lokaa.in/blog/top-10-green-buildings-india/
5	http://www.gdrc.org/sustdev/concepts/16-l-eco.html
6	http://web.mit.edu/dorourke/www/PDF/IE.pdf

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES
✓ LCD/SMART BOARDS	✓ STUD. SEMINARS	✓ DISCUSSIONS/ DEBATES

ASSESSMENT METHODOLOGIES-DIRECT

✓ ASSIGNMENTS	✓ STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
☐STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

Dr. Varghese S Chooralil

Ms. Amitha Mathew **Dr. Dhanya P. M.**

100003/CS322S DATA STRUCTURES LAB

COURSE INFORMATION SHEET

PROGRAMME:**COMPUTER SCIENCE AND ENGINEERING**	DEGREE: **BTECH**
COURSE: **DATA STRUCTURES LAB**	SEMESTER: **III** CREDITS: **1**
COURSE CODE: **100003/CS322S** REGULATION: **2020**	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: **Programming, Data Structures and Algorithms**	CONTACT HOURS: **3 hours per week**

SYLLABUS:

DETAILS
1.Implementation of Polynomials and Sparse matrices using arrays** 2. Implementation of Stack , Queues, Priority Queues, DEQUEUE and Circular Queues using arrays** 3. Application problems using stacks: Conversion of expression from one notation to another notation . ** 4. Implementation of various linked list operations. ** 5. Implementation of stack, queue and their applications using linked list 6. Implementation of trees using linked list 7. Representation of polynomials using linked list, addition and multiplication of polynomials. ** 8. Implementation of binary trees using linked lists and arrays- creations, insertion, deletion and traversal. ** 9. Implementation of binary search trees – creation, insertion, deletion, search 10. Any application programs using trees 11. Implementation of sorting algorithms – bubble, insertion, selection, quick, merge sort and heap sort.** 12. Implementation of searching algorithms – linear search, binary search.** 13. Representation of graphs and computing various parameters (in degree, out degree etc.) - adjacency list, adjacency matrix. 14. Implementation of BFS and DFS for each graph representations.** 15. Implementation of hash table using your own mapping functions and observe collisions and overflow resolving schemes.** 16. Simulation of first-fit, best-fit and worst-fit allocations. 17. Simulation of a basic memory allocator and garbage collector using doubly linked list. ** mandatory.

Lab Cycle (2020-2021)

Day 1

1. Write a menu driven C program to implement polynomials using arrays and perform polynomial addition and multiplication.

Day 2

2. Write a menu driven C program to implement sparse matrices using arrays and perform the following operations
    a. Sparse Matrix Addition
    b. Sparse Matrix Transpose

Day 3

3. Write a menu driven C program to implement stack using one dimensional array. Perform the operations on the stack (i) Push (ii) Pop (iii) Peek (ii) Is empty (iv) Isfull (v) Display.

4. Write a menu driven C program to covert infix to postfix expression and evaluate it using stack.

Day 4

5. Write a menu driven C program to implement Queues and Circular Queue using arrays and perform the following operation (i) Insert (ii) Delete (iii)is empty() (iv) Is full() (v) Display

6. Write a menu driven C program to implement Priority Queues using arrays.

Day 5

7. Write a menu driven C program to implement DEQUEUE using arrays and perform the following operations
    a. Insert from the front
    b. Insert from rear
    c. Delete from front
    d. Delete from rear
    e. Display

Day 6

8. Write a menu driven C program to implement various linked list operations.
    (i) Insertion
        a. Insert at the beginning
        b. Insert at the end
        c. Insert after a specified node
    (ii) Deletion
        a. Delete from the beginning
        b. Delete from the end
        c. Delete a specified node
    (iii) Display

Day 7

9. Write a menu driven C program. to representation polynomials using linked list and perform (i) polynomial addition and (ii) polynomial multiplication.

Day 8

10. Write a menu driven C program to implement binary trees using linked lists and perform the following operations

a. Insert a new node.
b. Delete a specified node
c. Search a specified node

Day 9

11. Write a menu driven C program to implement binary trees using arrays and perform the following operations
    i) Insert a new node.
    ii) Delete a specified node
    iii) Search a specified node

Day 10

12. . Write a menu driven C program to implement a binary search tree using linked list and perform the following operations on it
    (i) Insertion.
    (ii) Deletion.
    (iii) Traversals.
    (iv) Search for a specified node

Day 11

13. . Write a menu driven C program to implement searching algorithms –
    a. Linear search
    b. Binary search.

14. Write a menu driven C program to implement the following sorting techniques
    a. Bubble Sort
    b. Insertion Sort
    c. Selection Sort

Day 12

15. Write a menu driven C program to implement (i) Quick sort. (ii) Mergesort

Day 13

16. Write a C program to implement heap sort

Day 14

17. Write a menu driven C program to perform the following operations on a directed graph
    (i) In degree of a particular node
    (ii) Out degree of a particular node
    (iii) DFS
    (iv) BFS
    (v) Display (using Adjacency List and Adjacency Matrix).

Day 15

18. . Write a menu driven C program to implement hash table and the following collision resolution techniques-(i) Linear Probing (ii) Quadratic Probing (iii) Chaining

TEXT/REFERENCE BOOKS:

Text Books

1. Horowitz and Sahni, Fundamentals of data structures - Computer Science Press
2. Gottfried B.S., Programming with C, Schaum Series, Tata McGraw Hill.

References:

1. Gary J. Bronson, ANSI C Programming, CENGAGE Learning India.
2. Stewart Venit and Elizabeth Drake, Prelude to Programming – Concepts & Design, Pearson.
3. Dromy R.G., How to Solve it by Computer, Pearson.
4. Kernighan and Ritche D.M., The C. Programming Language, PHI

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
100908/C00200G	Programming In C	The basics of C programming	S2

COURSE OBJECTIVES:

1	To give hands-on experience for Learners on creating and using different Data Structures

COURSE OUTCOMES:

SLNO	DESCRIPTION	Blooms' Taxonomy Level
100003/CS322S.1	Write a time/space efficient program using arrays/linked lists/trees/graphs to provide necessary functionalities meeting a given set of user requirements	**Cognitive Knowledge Level: Analyse**
100003/CS322S.2	Write a time/space efficient program to sort a list of records based on a given key in the record	**Cognitive Knowledge Level: Apply**
100003/CS322S.3	Examine a given Data Structure to determine its space complexity and time complexities of operations on it	**Cognitive Knowledge Level: Apply**
100003/CS322S.4	Design and implement an efficient data structure to represent given data	**Cognitive Knowledge Level: Apply**

100003/CS322S.5	Write a time/space efficient program to convert an arithmetic expression from one notation to another	**Cognitive Knowledge Level: Apply**
100003/CS322S.6	Write a program using linked lists to simulate Memory Allocation and Garbage Collection	**Cognitive Knowledge Level: Apply**

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
100003/ CS322S.1	3	2	3	3	-	2	-	1	-	1	-	2	3	3	2
100003/ CS322S.2	3	2	3	2	-	-	-	1	-	1	-	2	2	2	-
100003/ CS322S.3	2	2	3	2	-	-	-	1	-	1	-	2	2	2	-
100003/ CS322S.4	2	2	3	2	-	-	-	1	-	1	-	2	1	2	-
100003/ CS322S.5	1	1	2	-	-	-	-	1	-	1	-	1	-	2	-
100003/ CS322S.6	1	1	2	-	-	-	-	1	-	1	-	1	-	2	-
100003/ CS322S (overall)	2	2	2	2	-	2	-	1	-	1	-	2	2	2	2

1-Low(L) 2-Medium(M) 3-High(H)

JUSTIFICATIONS FOR THE MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
100003/ CS322S.1 -PO1	MEDIUM	The ability of students to identify a problem and finding a solution using C programming language is a core fundamental concept needed for any Computer programmer
100003/ CS322S.1 -PO2	LOW	The ability of implementing solutions helps the students to analyze and propose solutions to complex engineering problems.
100003/ CS322S.1 -PO3	HIGH	The ability to implement a solution using C program is necessary for design/development of soutions
100003/ CS322S.1 -PSO1	MEDIUM	The ability of students to identify a problem and finding a solution using C programming language is a Computer Science specific skill for complex engineering problems.
100003/ CS322S.1 -PSO2	MEDIUM	The knowledge of C programming helps in programming and software development skills

100003/ CS322S.1 -PSO3	MEDIUM	The ability of students to identify a problem and finding a solution using C programming language helps in research and also in developing innovative products.
100003/ CS322S. 2-PO3	HIGH	The knowledge about implementing user defined data types helps in development of solutions to complex application problems.
100003/ CS322S. 2-PSO1	MEDIUM	The basic knowledge of implementing user defined data types is a CS specific skill for solutions to problems in vivid areas.
100003/ CS322S. .2-PSO2	MEDIUM	The basic knowledge of implementing user defined data types is a fundamental concept that helps students to enhance programming efficiency and software development skills
100003/ CS322S. 3-PO1	MEDIUM	The knowledge about implementing programs using functions and pointers is fundamental in developing efficient solutions to complex problems.
100003/ CS322S. 3-PO3	HIGH	The knowledge about implementing programs using functions and pointers is helpful to design/develop efficient solutions to complex problems.
100003/ CS322S. .3-PSO2	MEDIUM	The knowledge about implementing programs using functions and pointers helps to improve the programming efficiency.
100003/ CS322S. .4-PO1	LOW	The ability of students to write programs using files and command line arguments is a fundamental concept in solving complex problems.
100003/ CS322S. .4-PO3	HIGH	The ability of students to write programs using files and command line arguments helps to design/ develop solutions to complex problems.
100003/ CS322S. .4-PSO1	LOW	The ability of students to write programs using files and command line arguments is a CS specific skill that helps students to write efficient C programs for solutions to various problems.
100003/ CS322S. .4-PSO2	MEDIUM	The ability of students to write programs using files and command line arguments enhances the students' programming efficiency.
100003/ CS322S. .5-PO1	LOW	The ability of students to implement fundamental sorting and searching techniques is a core fundamental concept which can be used for solving complex problems
100003/ CS322S. .5-PO2	LOW	The ability of students to implement fundamental sorting and searching techniques helps to analyze or compare solutions and reach conclusions.
100003/ CS322S. .5-PO3	MEDIUM	The ability of students to implement fundamental sorting and searching techniques helps in designing/ developing solutions to complex engineering problems.
100003/ CS322S.	MEDIUM	The ability of students to implement fundamental sorting and searching techniques helps in designing/ developing

.5-PSO2		solutions to complex engineering problems and thereby enhancing the programming efficiency.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
		Lab Sessions		

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Implementation of AVL Trees	Assign to a team of best performers as C programmers	PO3	PSO2

WEB SOURCE REFERENCES:

1	http://www.tutorialspoint.com/cprogramming/
2	http://www.programiz.com/c-programming
3	http://www.c4learn.com/
4	http://www.w3schools.in/c-programming-language/intro/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ CHALK & TALK	✓ HOME ASSIGNMENT	✓ WEB RESOURCES
LCD/SMART BOARDS	STUD. SEMINARS	ADD-ON COURSES

ASSESSMENT METHODOLOGIES-DIRECT

ASSIGNMENTS	STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
✓ STUD. LAB PRACTICES	✓ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
ADD-ON COURSES	OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

Dr.Sminu Izudheen(Lab Incharge: S3CSA) **Dr. Dhanya P.M.**

Ms.Seema Safar (Lab Incharge: S3CSB) **HOD, CSE**

Ms. Anita John(Lab Incharge: S3CSC)

100003/CS322T OBJECT ORIENTED PROGRAMMING LAB (IN JAVA)

COURSE INFORMATION SHEET

PROGRAMME: **COMPUTER SCIENCE & ENGINEERING**	DEGREE: **BTECH**
COURSE: **OBJECT ORIENTED PROGRAMMING LAB (IN JAVA)**	SEMESTER: III CREDITS: **2**
COURSE CODE: **100003/CS322T** REGULATION**: 2020**	COURSE TYPE: **LAB**
COURSE AREA/DOMAIN**: PROGRAMMING**	CONTACT HOURS: **3 Lab hours/Week**.
CORRESPONDING THEORY COURSE CODE (IF ANY): **100003/CS300D**	LAB COURSE NAME: **NA**

SYLLABUS:

The syllabus contains six sessions (A, B, C, D, E, F). Each session consists of three concrete Java exercises, out of which at least two questions are mandatory.

(A) Basic programs using data types, operators, and control statements in Java.

1. Write a Java program that checks whether a given string is a palindrome or not. (Ex : MALAYALAM is a palindrome.)
2. Write a Java program to find the frequency of a given character in a string. **
3. Write a Java program to multiply two given matrices.**

(B) Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection

4. Write a Java program which creates a class named 'Employee' having the following members: Name, Age, Phone number, Address, Salary. It also has a method named 'print-Salary( )' which prints the salary of the Employee. Two classes 'Officer' and 'Manager' inherits the 'Employee' class. The 'Officer' and 'Manager' classes have data members 'specialization' and 'department' respectively. Now, assign name, age, phone number, address and salary to an officer and a manager by making an object of both of these classes and print the same. (Exercise to understand inheritance). **
5. Write a java program to create an abstract class named Shape that contains an empty method named numberOfSides( ). Provide three classes named Rectangle, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method numberOfSides( ) that shows the number of sides in the given geometrical structures. (Exercise to understand polymorphism). **
6. Write a Java program to demonstrate the use of garbage collector.

(C) Handling different types of files as well as input and output management methods:

7. Write a file handling program in Java with reader/writer.
8. Write a Java program that read from a file and write to a file by handling all file related exceptions. **
9. Write a Java program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util). **

(D) Exception handling and multi-threading applications:

10. Write a Java program that shows the usage of try, catch, throws and finally. **
11. Write a Java program that implements a multi-threaded program which has three threads. First thread generates a random integer every 1 second. If the value is even, second thread computes the square of the number and prints. If the value is odd the third thread will print the value of cube of the number.
12. Write a Java program that shows thread synchronization. **

(E) **Graphics Programming:**

13. Write a Java program that works as a simple calculator. Arrange Buttons for digits and the + - * % operations properly. Add a text field to display the result. Handle any possible exceptions like divide by zero. Use Java Swing. **
14. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time. No light is on when the program starts. **
15. Write a Java program to display all records from a table using Java Database Connectivi- ty (JDBC).

(F)Standard Searching and Sorting Algorithms using data structures and algorithms learned from course Data Structures (CST 201):

16. Write a Java program for the following: **
a. Create a doubly linked list of elements.
b. Delete a given element from the above list.
c. Display the contents of the list after deletion.
17. Write a Java program that implements Quick sort algorithm for sorting a list of names in ascending order. **
18. Write a Java program that implements the binary search algorithm.

** **Mandatory**

LAB CYCLE:

(A) Basic programs using data types, operators and control statements in Java:

1. Write a Java program to find whether a number is perfect or not.

2. Write a Java program to find the frequency of a number in an array.

3. Write a Java program that checks whether a given string is a palindrome or not.

4. Write a Java program to multiply two given matrices.

(B) Object Oriented Programming Concepts: Problems on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection:

5. Write a Java program which creates a class named 'Employee' having the following members: Name, Age, Phone number, Address, Salary. It also has a method named 'Print-Salary()' which prints the salary of the Employee. Two classes 'Officer' and 'Manager' inherit the 'Employee' class. The 'Officer' and 'manager' classes have data members 'specialization' and 'department' respectively. Now assign name, age, phone number, address and salary to an officer and a manager by making an object of both of these classes and print the same. Use parameterized constructors to initialize the data members of classes 'Officer' and 'Manager'.

6. Write a Java program to create an abstract class named Shape that contains an empty method named numberOfSides(). Provide three classes named Rectangle, Triangle and Hexagon such that each one of these classes extends the class Shape. Each one of these classes contains only the method numberOfSides() that shows the number of sides in the given geometrical structures.

(C) File handling and Input-Output management:

7. Write a program that reads a text file and copies the content to another file that is identical except that every blank space is replaced by an underscore. Use proper exceptional handling if a file is not available.

8. Write a Java program that reads a line of integers and then displays each integer and the sum of all the integers (Use String Tokenizer class of java. util).

(D) Exception handling and multi-threading applications:

9. Write a Java program to implement an ATM for State Bank of India. The customers of the bank can withdraw and deposit money through the ATM. Customers can also view the available balance. The account balance of all customers are stored in a file having a file name same as their account number. Throw an exception during a withdrawal operation if sufficient balance is not available and use a catch statement to inform the customer about the same. Use the finally block to ensure that the available balance is displayed and that the file that stores the account balance of the customer is closed after every transaction even if an exception occurs or not during the transaction. Handle all the possible exceptions.

10. Write a Java program that shows thread synchronization and multithreading. Create an odd thread and even thread for printing odd and even numbers respectively. Both threads repeatedly call the same function print() that is defined in the class Display. The print() function accepts an integer as its argument and prints that integer twice. The print() function

ensures that the thread that calls it will sleep for 1000 ms after printing the integer (which was passed as argument) for the first time but before printing that integer for the second time. The odd thread calls the print() function by passing an odd number as the argument and the even thread calls the print() function by passing an even number as the argument.

(E) Graphics Programming and JDBC

11. Write a Java program that works as a simple calculator. Arrange buttons for digits and + - * % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero. Use Java Swing.

12. Write a Java program to create a GUI based application that contains two text fields and one button. The application receives an integer through the first text field, computes the factorial of that integer and displays it in the second text field when the button "Compute" is clicked. Use Java Swing.

13. The account number, customer name & account balance of all the customers of South Indian Bank are stored in a table. Write a Java program using JDBC to display the details of all the customers in the descending order of their account balance.

(F) Standard Searching and Sorting Algorithms.

14. Write a menu-driven Java program with the following options:

a) Create a doubly linked list of elements.

b) Delete a given element from the above list.

c) Display the contents of the list after deletion.

15. Write a Java program that implements a Quick sort algorithm for sorting a list of names in ascending order.

Home Assignment

1. Write a Java program to create a package named mypack, containing a class Factorial in which a method getFactorial( ) is defined that returns the factorial of a given number. Import the package mypack into a class Calculator which belongs to the package demo and call the method getFactorial( ) from the class Calculator.

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
T2	Paul Deitel, Harvey Deitel, Java How to Program, Early Objects, 7th Edition, Pearson.
R1	Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013
R2	Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts, 9/e, Wiley India, 2015.
R3	Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008.

R4	Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
R5	Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
R6	Sierra K., Head First Java, 2/e, O'Reilly, 2005.
R7	Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEM
100003/CS300D	Object Oriented Programming Using Java	Syntax of Java, Object Oriented Concepts	3
100003/CS300B	Data Structures	Data Structures, Algorithms	3
100908/C00200G	Programming in C	Introduction to Programming	2

COURSE OBJECTIVES:

1	To introduce Object Oriented Concepts-constructors, inheritance, method overloading, & overriding and polymorphism in Java.
2	To introduce programs in Java which use data types, operators, control statements, built in packages * interfaces, Input/output streams and Files.
3	To practice robust application programs in Java using exceptional handling and threads.
4	To design and deploy applications using Java.

COURSE OUTCOMES:

Students will be able to

SNO	DESCRIPTION
CIS_100003/ CS322T.1	Implement the Object Oriented concepts- constructors, inheritance, method overloading and overriding and polymorphism in Java.
CIS_100003/ CS322T.2	Implement Programs in Java which use datatypes, operators, control statements, built in packages, interfaces, Input/Output streams and Files.
CIS_100003/ CS322T.3	Implement robust application programs in Java using exceptional handling.
CIS_100003/ CS322T.4	Implement application programs in Java using multithreading and database connectivity.
CIS_100003/ CS322T.5	Implement GUI based application programs by utilizing event handling features and Swing in Java.

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIS_100003/CS322T 1	3	3	3	-	-	-	-	2	-	-	-	2	3	-	-
CIS_100003/CS322T.2	3	3	3	-	-	-	-	2	-	-	-	2	3	-	-
CIS_10000	3	3	3	-	-	-	-	2	-	-	-	2	3	-	-

3/CS322T.3															
CIS_100003/CS322T.4	3	3	3	-	-	-	-	2	-	-	-	2	2	-	-
CIS_100003/CS322T.5	3	3	3	-	-	-	-	2		-	-	2	1	-	-
CS 231 (overall level)	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	-	**-**	**-**	**1**	**2.3**	**-**	**-**

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW/MEDIUM/HIGH	Justification
C	H	The knowledge about system calls helps to find the solution of complex engineering problems related to OS.
CIS_100003/CS322T.1-PO1,CS203.2-P01,CS203.3-P01,CS203.4-P01,CS203.5-P01	H	Engineering tools can be created and applied to complex engineering activities using Java concepts
CIS_100003/CS322T1-PO2,CS203.2-P02,CS203.3-P02,CS203.4-P02,CS203.5-P02	H	Analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of Java
CIS_100003/CS322T.1-PO3,CS203.2-P03,CS203.3-P03,CS203.4-P03,CS203.5-	H	The knowledge about process helps to choose the suitable algorithm to solve complex problems.

P03		
CIS_100003/CS322T.1-PO8,CS203.2-P08,CS203.3-P08,CS203.4-P08,CS203.5-P08	M	Analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of application programs.
CIS_100003/CS322T.1-PO12,CCIS_100003/CS322T.2-P012,CS203.3-P012,CS203.4-P012,CS203.5-P012	M	The knowledge about Java Multithreading and database connectivity to find the solution of complex engineering problems related to network.
CIS_100003/CS322T.1-PSO1	H	Knowledge about Java database connectivity helps to identify, formulate and analyze database applications.
CIS_100003/CS322T2-PS01	H	Familiarization of Swing components helps to model complex engineering activities related to network simulation.
CIS_100003/CS322T.3-PS01	H	Individual and team work effectively help to understand the Java application programs associated to it.
CIS_100003/CS322T.4- -PS01	M	Communication can be made possible by demonstrating the use of Java programming.
CIS_100003/CS322T.5-PS01	L	Analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of networking

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS: NIL

SNO	DESCRIPTION	PO MAPPING
1	Knowledge about Java networking.	PO1 PO2 PO3 PO5 PO10
3	Package	PO1 PO2 PO3 PO5 PO10

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

No	Topic	PO Mapping
1	Applets	PO1 PO2 PO5 PO10 PO11
2	Android Programming	PO1 PO2 PO3 PO5 PO10

WEB SOURCE REFERENCES:

1	https://nptel.ac.in/courses/106/105/106105191/
2	https://www.guru99.com/java-tutorial.html
3	https://www.smartzworld.com/notes/data-communication-and-computer-networks-notes-pdf-dccn
4	https://www.programiz.com/java-programming
5	https://www.w3schools.com/java/default.asp
6	https://onlinecourses.nptel.ac.in/noc19_cs84/preview

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES	
✓ LCD/SMART BOARDS	STUD. SEMINARS	ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

ASSIGNMENTS	STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
✓ STUD. LAB PRACTICES	✓ STUD. VIVA	MINI/MAJOR PROJECTS	CERTIFICATIONS
ADD-ON COURSES	OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	OTHERS

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