Bangalore University

University Visvesvaraya College of Engineering, Bengaluru

COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination for **III Semester B.Tech., CBCS - 2K18** Scheme

Sl. No.	Course Code	Title	Teaching Department	L	T	P	SS	Total hr/week	CIE Marks	*SEE Marks	Credits
1	18BSEM301	Engineering Mathematics –III	Mathematics	2	2	0	0	4	50	50	3
2	18CIPC302	Digital System Design	CSE/ISE	2	2	0	0	4	50	50	3
3	18CIPC303	Data Structures and Applications	CSE/ISE	2	2	0	0	4	50	50	3
4	18CIPC304	Computer Organization and Architecture	CSE/ISE	4	0	0	0	4	50	50	4
5	18CIPC305	Discrete Mathematical Structures	CSE/ISE	4	0	0	0	4	50	50	4
6	18CIPC306	Object Oriented Programming	CSE/ISE	2	2	0	0	4	50	50	3
7	18CIPC307	Digital System Design Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
8	18CIPC308	Data Structures and Application Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
9	18MCES309	Environmental Science	CIVIL	2	0	0	0	2	50	-	1
Total				**18**	**08**	**06**	**00**	**32**	**450**	**400**	**24**
Total Marks				**850**							

1	18BSBM310	Bridge Mathematics-I (Lateral Entry Students)	Mathematics	2	2	0	0	4	50	50	3

* SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

NOTE: For internships, guidelines and procedures of AICTE Internship Policy are to be followed.

COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination for **IV Semester B.Tech., CBCS - 2K18** Scheme

Sl. No.	Course Code	Title	Teaching Department	L	T	P	SS	Total hr/week	CIE Marks	*SEE Marks	Credits
1	18BSEM401	Engineering Mathematics –IV	Mathematics	2	2	0	0	4	50	50	3
2	18CIPC402	Finite Automata and Formal Languages	CSE/ISE	4	0	0	0	4	50	50	4
3	18CIPC403	Design and Analysis of Algorithms	CSE/ISE	2	2	0	0	4	50	50	3
4	18CIPC404	Microprocessor and Microcontroller	CSE/ISE	2	2	0	0	4	50	50	3
5	18CIPC405	Operating Systems	CSE/ISE	2	2	0	0	4	50	50	3
6	18CIPC406	Software Engineering	CSE/ISE	4	0	0	0	4	50	50	4
7	18CIPC407	Design and Analysis of Algorithms Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
8	18CIPC408	Microprocessor and Microcontroller Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
9	18MCCE409	Constitution of India and Professional Ethics	LAW	1	0	0	0	1	50	-	1
Total				**17**	**08**	**06**	**00**	**31**	**450**	**400**	**24**
Total Marks				**850**							

1	18BSBM410	Bridge Mathematics-II (Lateral Entry Students)	Mathematics	2	2	0	0	4	50	50	3

* SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination for **V Semester B.Tech., CBCS - 2K18** Scheme

Sl. No.	Course Code	Title	Teaching Department	L	T	P	SS	Total hr/week	CIE Marks	*SEE Marks	Credits
1	18CIPC501	Computer Networks	CSE/ISE	4	0	0	0	4	50	50	4
2	18CIPC502	Artificial Intelligence	CSE/ISE	4	0	0	0	4	50	50	4
3	18CIPC503	Database Management Systems	CSE/ISE	4	0	0	0	4	50	50	4
4	18CIPC504	Computer Graphics	CSE/ISE	2	2	0	0	4	50	50	3
5		Professional Elective-I	CSE/ISE	2	2	0	0	4	50	50	3
6		Open Elective-I	CSE/ISE	2	2	0	0	4	50	50	3
7	18CIPC507	Computer Graphics Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
8	18CIPC508	Database Management System Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
Total				**18**	**06**	**06**	**00**	**30**	**400**	**400**	**24**
Total Marks				**800**							

* SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

Sl. No.	Course Code	Professional Elective-I
1	18CIPE51A	Software Architecture and Testing
2	18CIPE51B	Probability and Stochastic Processes
3	18CIPE51C	Operations Research
4	18CSPE51D	Embedded Systems

Sl. No.	Course Code	Open Elective-I
1	18CIOE51A	Advanced Java and J2EE
2	18CIOE51B	Python Programming
3	18CSOE51C	Computer Organization and Architecture (Non CS/IS Students)

COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination for **VI Semester B.Tech., CBCS - 2K18 Scheme**

Sl. No.	Course Code	Title	Teaching Department	L	T	P	SS	Total hr/week	CIE Marks	*SEE Marks	Credits
1	18CIPC601	Compiler Design	CSE/ISE	4	0	0	0	4	50	50	4
2	18CIPC602	Cryptography and Network Security	CSE/ISE	4	0	0	0	4	50	50	4
3	18CIPC603	Unix System Programming	CSE/ISE	4	0	0	0	4	50	50	4
4		Professional Elective-II	CSE/ISE	2	2	0	0	4	50	50	3
5		Professional Elective-III	CSE/ISE	2	2	0	0	4	50	50	3
6		Open Elective-II	CSE/ISE	2	2	0	0	4	50	50	3
7	18CIPC607	Computer Networks Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
8	18CIPC608	Unix System Programming Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
Total				**18**	**06**	**06**	**00**	**30**	**400**	**400**	**24**
Total Marks				**800**							

* SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

Sl. No.	Course Code	Professional Elective-II
1	18CIPE62A	Software Defined Networks
2	18CIPE62B	Number Theory and Combinatorics
3	18CIPE62C	Wireless Networks
4	18CSPE62D	Decision Support System

Sl. No	Course Code	Professional Elective-III
1	18CIPE63A	System Software
2	18CIPE63B	Distributed Computing
3	18CIPE63C	Storage Area Networks
4	18CSPE63D	Optical Networks

Sl. No	Course Code	Open Elective-II
1	18CIOE62A	Soft Computing
2	18CIOE62B	Cyber Law and Security
3	18CSOE62C	Simulation and Modeling

COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination for **VII Semester B.Tech., CBCS - 2K18 Scheme**

Sl. No.	Course Code	Title	Teaching Department	L	T	P	SS	Total hr/week	CIE Marks	*SEE Marks	Credits
1	18CIPC701	Internet of Things	CSE/ISE	2	2	0	0	4	50	50	3
2	18CIPC702	Machine Learning	CSE/ISE	2	2	0	0	4	50	50	3
3		Professional Elective-IV	CSE/ISE	2	2	0	0	4	50	50	3
4		Professional Elective-V	CSE/ISE	2	2	0	0	4	50	50	3
5	18CIPC705	Internet of Things Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
6	18CIPC706	Machine Learning Laboratory	CSE/ISE	0	0	3	0	3	50	50	1.5
7	18CIPC707	Preliminary Project	CSE/ISE	0	0	6	0	6	50	-	3
Total				**08**	**08**	**12**	**00**	**28**	**350**	**300**	**18**
Total Marks				**650**							

* SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

Sl. No.	Course Code	Professional Elective-IV
1	18CIPE74A	High Performance Computing
2	18CIPE74B	Mobile Computing
3	18CIPE74C	Social Networking Analysis
4	18CSPE74D	Digital Image Processing

Sl. No.	Course Code	Professional Elective-V
1	18CIPE75A	Cloud Computing
2	18CIPE75B	Big Data
3	18CIPE75C	Advanced Computer Architecture
4	18CSPE75D	Network Management

COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination for **VIII Semester B.Tech., CBCS - 2K18 Scheme**

Sl. No.	Course Code	Title	Teaching Department	L	T	P	SS	Total hr/week	CIE Marks	*SEE Marks	Credits
1	18CIPC801	Data Science	CSE/ISE	2	2	0	0	4	50	50	3
2		Professional Elective-VI	CSE/ISE	2	2	0	0	4	50	50	3
3	18MCIP803	Intellectual Property Rights	LAW	2	0	0	0	2	50	-	1
4	18CSPC804	Project Work	CSE/ISE	0	0	18	0	18	50	50	9
5	18CIIN805	Internship	CSE/ISE	-	-	6	-	6	100	-	3
Total				**06**	**04**	**24**	**00**	**34**	**300**	**150**	**19**
Total Marks				**450**							

* SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

Sl. No.	Course Code	Professional Elective-VI
1	18CIPE86A	Pattern Recognition
2	18CIPE86B	Green Computing
3	18CIPE86C	Natural Language Processing
4	18CSPE86D	Service Oriented Architecture

L – Lecture Hour, **T** – Tutorial Hour, **P** – Practical Hour, **SS** – Self Study.
CIE – Continuous Internal Evaluation, **SEE** – Semester End Examination.

NOTE: A student will be awarded **B.Tech. (Honours)** if he / she completes an additional **20 CREDITS**. These shall be acquired through Massive Open Online Courses (MOOCs), not already credited, and with the approval of the Department.

III SEMESTER CSE

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18BSEM301</td></tr>
<tr><td>Category</td><td colspan="6">Basic Sciences</td></tr>
<tr><td>Course title</td><td colspan="6">ENGINEERING MATHEMATICS-III</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - III CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable the students to

1. Understand the properties of Fourier series.
2. Study the applications of Fourier Transforms and *Z*-Transforms.
3. Understand what functionals are, and have some appreciation of their applications.
4. Introduce students to how to solve linear Partial Differential with different methods.
5. Appreciate the importance of probability and statistics in computing and research.

UNIT I: **09 Hours**

Fourier Series: Periodic functions, Fourier expansions, Half range expansions, Complex Fourier Series, Practical harmonic analysis, Applications.

UNIT II: **09 Hours**

Fourier Transforms: Finite and infinite Fourier Transforms, Fourier sine and cosine Transforms, Properties, Inverse Transforms. Z – Transforms: Definition, Standard Z-Transforms, Linearity property, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-Transforms. Application of Z-Transforms to solve difference equations.

UNIT III: **10 Hours**

Calculus of variations: Variation of a function and a functional. Extremal of a function, variational problems, Euler's equation, standard variational problems including Geodesics, Minimal surface of revolution, hanging chain, Brachistochrone problems.

UNIT IV: **10 Hours**

Partial Differential Equations (P.D.E.): Formulation of P.D.E., Solution of non-homogeneous P.D.E. by direct integration, Method of separation of variables (first and second order equations), Solution of Lagrange's linear P.D.E. of the type $Pp + Qq$=R, solution of standard types of non-linear P.D.E.- Char pit's method.

UNIT V: **10 Hours**

Statistics and probability: Curve fitting, fitting of a straight line, fitting of a curve of the firm $y = ab^x$, Fitting of a Parabola. Correlation. Regression. Basic concepts of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes' theorem. Random variables:

Discrete and continuous random variables – PDF, CDF. Binomial, Poisson, Exponential and Normal distributions. Joint Probability: Joint probability distributions, concept of joint probability, joint distributions, discrete and continuous, independent random variables, problems on expectation and variance.

TEXT BOOKS:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand and sons publishers.
3. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
4. P. V. O Neil, Advanced Engineering Mathematics, Pearson/Thomson.
5. G. B. Thomas and R. L. Finney, Calculas, Addison Wesley, 9th Edition, 1998.
6. Walpole and Myers, Probability and Statistics for Engineers and Scientist, 2007.
7. D. S. Chandrashekaraiah, "Engineering Mathematics-III", Prism Books Pvt. Ltd. 7th Edition, 2014.

REFERENCE BOOKS:

1. B.V. Ramana "Higher Engineering Mathematics" Tata Mc Graw-Hill, 2006
2. N P Bali and M. Goyal, "A text book of Engineering mathematics", Laxmi publications, latest edition.
3. H. K Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Write given function in terms of sine and cosine terms in Fourier series and also to get knowledge in Fourier transforms**.**

CO2: Calculate the Laplace transform of standard functions both from the definition and by using tables.

CO3: Describe the brachistochrone problem mathematically and solve it; solve isoperimetric problems of standard type.

CO4: To be able to solve linear ordinary differential equations, by using elementary methods in the case of constant coefficients.

CO5: Apply method of least squares to find the curve of best fit for the given data.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU

Course Code	**18CIPC302**					
Category	Engineering Science Courses : Professional Core					
Course title	**DIGITAL SYSTEM DESIGN - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - III CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

COURSE OBJECTIVES:

The course will enable the students to

1. Understand various digital logic gates along with their operations using truth table and logic diagram.
2. Apply minimization techniques for designing optimized digital circuits.
3. Analyze and design cost effective combinational and sequential circuits for given problems.
4. Analyze and design a counter based on shift registers.
5. Analyze and design a synchronous and asynchronous counter.

UNIT I: DIGITAL PRINCIPLES **09 Hours**

Overview of basic gates: NOT, OR, AND, universal gates: NOR NAND, AND-OR Invert Gates, Positive and Negative Logic, TTL AND, OR, NOT, NAND Gates. Definition of digital signal, Digital Waveforms, Digital Logic. Combinational Logic Circuits: Sum-of-Products Method, Product-of-Sum, Karnaugh Simplifications for 4 variables, Don't-care Conditions, NAND and NOR Implementation, Simplification using Quine McClusky Method.

UNIT II: DATA-PROCESSING CIRCUITS **09 Hours**

Multiplexers, Demultiplexers, Decoders, Encoders, Exclusive OR Gate, Magnitude Comparator, Adder (half and full), Subtractors (half and full).

UNIT III: FLIP-FLOPS **10 Hours**

Flip-flops: SR, JK, T, D; JK Master-slave Flip-flop, Flip flop Characteristic Equations, Edge Triggered Flip flop, Various Representation of Flip flop. Registers: Types of Registers, Serial-in-Serial-Out, Serial-in-Parallel-Out, Parallel-in-Serial-Out, Parallel-in-Parallel-out, Applications of Shift Registers.

UNIT IV: COUNTERS **10 Hours**

Asynchronous Counters, Synchronous Counters, Changing the counter modulus, Decade Counter, Counters Based on Shift Registers**,** Counter Design as a synthesis problem.

UNIT V: DESIGN OF SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS **10 Hours**

Design of Synchronous Sequential Circuit: Model Selection, State Transition Diagram, State Synthesis Table, Design Equations and Circuit Diagram, State Reduction Technique

TEXT BOOKS:

1. Donald P Leach, Albert Paul Malvino and Goutam Saha "Digital Principles and Applications", 8th Edition, Tata McGraw Hill, 2015.
2. K R Venugopal, Shaila K, "Digital Circuits and System", Tata McGraw Hill, 2011.

REFERENCE BOOKS:

1. RP Jaia, Digital Integrated Circuits Design, A Design Prospective, Second Edition Pearson, 2016.
2. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
3. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Thomson, 2004.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10th Edition, Pearson Education, 2007.
5. R D Sudhaker Samuel, *K.S. Nandini Prasad*: Logic Design, 1st edition, Elsevier Publication, 2013.

e-BOOKS/ONLINE RESOURCES:

1. Ramaswamy Palaniappan, "Digital Systems Design" 1st Edition, 2011. https://dvikan.no/ntnu-studentserver/kompendier/digital-systems-design.pdf.
2. Venkatesh, Ravindra P Rajput "Digital System Design" 1st Edition 2018.
3. D.A.Godse A.P.Godse, Digital System Design, 1st edition, Technical Publication. https://books.google.co.in/books?isbn=8184313594.
4. D. G. Wong, Digital System Design, E. Arnold, 1985. https://books.google.co.in/books?isbn=0713135395.

MOOCs:

1. https://nptel.ac.in/courses/117105080/.
2. https://www.classcentral.com/course/nptel-digital-system-design-619.
3. https://online.stanford.edu/courses/ee108-digital-systems-design.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Comprehend the fundamental concepts and principles of digital design.

CO2: Apply techniques of Boolean functions minimization and design and analyze cost effective combinational circuits.

CO3: Design, analyze and implement various data processing circuits.

CO4: Design and analyze synchronous and asynchronous counter using flipflops.

CO5: Design and analyze synchronous and asynchronous counter using shift register.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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</table>

Note: SEE shall be conducted for 100 Marks and the marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU

Course Code	**18CIPC303**					
Category	Engineering Science Courses: Professional Core					
Course title	**DATA STRUCTURES AND APPLICATIONS - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - III CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

COURSE OBJECTIVES:

The course will enable the students to

1. Learn program independent view of data structures, including its representation and operations performed on them.
2. Demonstrate the use of pointers and its application in various problems.
3. Analyse Linear and Non-linear Data structures.
4. Apply the appropriate data structures during program development.
5. Get an idea about the various types of data sorting, searching and indexing methods to increase the knowledge of usage of data structures in algorithmic perspective.

UNIT I: INTRODUCTION **10 Hours**

Introduction to Data Structures, Classifications (Primitive & Non Primitive), Storage class, bit fields, Structures and Unions: Array of Structures, Arrays within Structures, Structures within Structures, Structures and Functions, Self-referential Structures, Unions, Size of Structures and unions. Pointers: Pointers and Arrays, Pointers and Character Strings, Array of Pointers, Pointer as Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures. Dynamic Memory Allocation: Advantages and Disadvantages over static memory allocation, Dynamic Memory Allocation functions. Command line arguments: File management with command line arguments.

UNIT II: STACKS AND QUEUES **10 Hours**

Stacks: Definition, Stack Operations, Array Representation of Stacks, Stack Applications: Polish notation, Infix to prefix and Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, Binomial Co-efficient, GCD, Fibonacci Sequence, Tower of Hanoi. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Dequeues, Priority Queues, Multiple Stacks and Queues.

UNIT III: LINKED LIST **10 Hours**

Linked List Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation.

UNIT IV: TREES **09 Hours**

Tress terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees, Construction and Evaluation of an Expression.

UNIT V: SORTING AND SEARCHING **09 Hours**

Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing.

TEXT BOOKS:

1. Data Structures: A Pseudo-code approach with C-Gilberg & Forouzan, 2nd edition, Cengage Learning, 2014.
2. Fundamentals of Data Structures in C-Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press, 2014.

REFERENCE BOOKS:

1. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014.
2. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013.
3. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014.
4. Data Structures and Program Design by C R.Kruse, C.L Tondo and B.Leung, Second Edition, Pearson Education, 2013.

e-BOOKS/ONLINE RESOURCES:

1. https://www.coursera.org/specializations/data-structures-algorithms.
2. https://www.udemy.com/data-structures-and-algorithms-deep-dive-using-java/.
3. https://www.geeksforgeeks.org/data-structures/.
4. https://www.amazon.co.uk/Algorithm-Design-Manual-Steven-Skiena/dp/1848000693.

MOOCs:

1. NPTEL: http://nptel.ac.in/courses/106102064/1.
2. UC Berkeley Data Structures: https://www.youtube.com/playlist?list=PLBB2FC97598A3B254.
3. Algorithms, Part I(Princeton University): https://www.coursera.org/course/algs4partI.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Explore various operations on different data structures.

CO2: Develop and Apply linear and non-linear data structures for solving computing problems.

CO3: Implement operations like searching, insertion, deletion, traversing mechanism on various Data structures.

CO4: Design and trace the programs for simple problems and for various operations on different Data structures studied.

CO5: Design solutions for applications using appropriate data structures.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC304</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">COMPUTER ORGANIZATION AND ARCHITECTURE - THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - III CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the various components and views of a computer system.
2. Learn the design of arithmetic logic unit, memory unit, processing unit and I/O unit.
3. Familiarize with the complexities involved in the design of a computer system.
4. Compare the various computer systems.
5. Design efficient computer systems.

UNIT I: INTRODUCTION 10 Hours

The General Purpose Machine: Structure of a Digital Computer, The general purpose machine, The Perspectives of a Computer System: The machine/assembly language programmer's view, The computer architect's view, The computer system logic designer's view, Historical perspective. Machines, Machine Languages and Digital Logic: Classification of computers and their instructions, Computer instruction sets. Informal description of the simple RISC computer SRC, Formal description of SRC using register transfer notation, RTN, Description of addressing modes with RTN, Register transfer and logic circuits : from behaviour to hardware.

UNIT II: COMPUTER ARITHMETIC AND ARITHMETIC UNIT 09 Hours

Number systems and radix conversion, Fixed-point arithmetic, Floating-point arithmetic.

UNIT III: MEMORY SYSTEM DESIGN 09 Hours

Components of the Memory System, Semiconductor RAM Memories, Read-only memories, Speed, Size and cost, Cache memories, Performance considerations, Virtual memories, Secondary Storage.

UNIT IV: PROCESSOR DESIGN 10 Hours

Some Fundamental Concepts, Execution of a complete Instruction, Multiple-Bus Organization, Hardwired Control, Microprogrammed Control. Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets, Datapath and Control Considerations, Superscalar Operation.

UNIT V: I/O AND PERIPHERAL DEVICES **10 Hours**

Accessing I/O devices, Interrupts, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces, Display devices, Printers, Input Devices.

TEXT BOOKS:

1. Vincent P Heuring & Harry F Jordan, T G Venkatesh, "Computer Systems Design and Architecture", 2014, Pearson Education Limited.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organisation, Fifth Edition, July 2017, McGraw Hill Education.

REFERENCES:

1. William Stallings, Computer Organization and Architecture, Fourth Edition, PHI.
2. M.Mano, Computer Architecture, Prentice Hall.
3. Hayes, Computer Architecture & Organization, Third Edition, TMH.
4. Patterson, Computer Architecture, PHI.

e-BOOKS/ONLINE RESOURCES:

1. www.freebookcentre.net/ComputerScience.../Computer-Organization-and-Architectur...
2. https://www.pdfdrive.com/computer-organization-and-architecture-books.html
3. www.freetechbooks.com/computer-organization-and-architecture-f56.html

MOOCs:

1. https://www.classcentral.com/course/nptel-computer-organization-and-architecture-a-pedagogical-aspect-9824

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand the design principles of a computer system.
CO2: Design and analyze the performance of the arithmetic logic unit, memory unit, input / output unit and processing unit of a computer system.
CO3: Compare the various computer systems and build an efficient computer system.
CO4: Analyse the bottlenecks in a computer system.
CO5: Modify the design to improve the performance of a computer system.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC305</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">DISCRETE MATHEMATICAL STRUCTURES – THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - III CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand and apply basic set theory, Permutations, Combinations, pigeon-hole principle and analyse the logic.
2. Solve the practical examples of sets, relations and functions.
3. Analyse the concept of Recurrence Relations to solve functions.
4. Recognize the patterns that arise in graph problems and apply the knowledge for constructing the trees and spanning trees.
5. Understand the concepts of Order Relations and Groups.

UNIT I: FUNDAMENTAL **10 Hours**

Sets and Subsets, Operations on Sets, Counting: Permutations, Combinations, Pigeonhole Principle, Recurrence Relations. Logic: Propositions and Logical Operations, Conditional Statements, Methods of Proof, Mathematical Induction.

UNIT II: RELATIONS AND DIGRAPHS **10 Hours**

Product Sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of Relations, Equivalence Relations, Data Structures for Relations and Digraphs, Operations on Relations, Transitive Closure and Warshall's Algorithm. Functions: Functions, Functions for Computer Science, Growth of Functions, Permutation Functions.

UNIT III: RECURRENCE RELATION **09 Hours**

Generating functions, function of sequences calculating coefficient of generating function, recurrence relations, solving recurrence relation by substitution and generating functions, characteristics roots solution of homogeneous recurrence relation.

UNIT IV: TOPICS IN GRAPH THEORY **10 Hours**

Graphs, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Coloring Graphs. **Trees:** Trees, Labeled Trees, Tree Searching, Undirected Trees, Minimal Spanning Trees.

UNIT V: ORDER RELATIONS AND STRUCTURES 09 Hours

Partially Ordered Sets, Extremal Elements of Partially Ordered Sets, Lattices, Finite Boolean Algebras, Functions on Boolean Algebras. Semigroups and Groups: Binary Operations

Revisited, Semigroups, Products and Quotients of Semigroups, Groups, Products and Quotients of Groups.

TEXT BOOKS:

1. Bernard Kolman, Robert Busby, Sharon C. Ross, Discrete Mathematical Structures, 6th Edition, 2015.
2. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice Hall of India Learning Private Limited, New Delhi, India, 2nd Edition, 2010.

REFERENCES:

1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, 5th edition, 2017.
2. Richard Johnsonbaugh, Discrete Mathematics, Pearson, 8th edition, 2017.
3. Jean-Paul Tremblay, R Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Education, 2017.
4. C L Liu & D P Mohapatra, Elements of Discrete Mathematics: A Computer Oriented approach, Mc Graw Hill India, 4th edition, 2012.
5. Seymour Lipschutz, Marc Laras Lipson, Varsha H. Patil, Discrete Mathematics, Schaum's Outlines, 2017.

e-BOOKS/ONLINE RESOURCES:

1. https://www.scribd.com/document/369727151/Discrete-Mathematical-Structures-with-Applications-to-Computer-Science-by-J-P-Tremblay-R-Manohar-pdf
2. Stanford: http://web.stanford.edu/class/cs...
3. Berkeley: https://people.eecs.berkeley.edu...
4. UWash: https://acms.washington.edu/cont...
5. MiT: Mathematics for Computer Science

MOOCs:

1. IIT Discrete Mathematics Lectures: http://www.youtube.com/playlist?...
2. https://swayam.gov.in/courses/public.
3. https://www.class-central.com/course/nptel-discrete-mathematics-5217.
4. http://nptel.ac.in/courses/106106094/.
5. https://nptel.ac.in/courses/111107058/.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Verify the correctness of an argument using propositional and predicate logic with Basics of the Set theory.

CO2: Demonstrate the ability to solve problems using Relations and Functions.

CO3: Solve problems involving recurrence relations and generating functions.

CO4: Explain graphs and trees.
CO5: Differentiate the Order Relations and Structures.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC306**					
Category	Engineering Science Courses : Professional Core					
Course title	**OBJECT ORIENTED PROGRAMMING – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - III CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Learn fundamental features of object oriented languages C++ and JAVA.
2. Apply object oriented programming concepts to solve problems.
3. Introduce the principles of inheritance and polymorphism.
4. Introduce the implementation of packages and interfaces.
5. Introduce the concepts of exception handling, multithreading and applets in Java.

UNIT I: INTRODUCTION TO C++ 10 Hours

Basic Concepts of object oriented programming, Benefits of OOP's and its application. Procedure Oriented Programming V/S Object Oriented Programming (OOP). Introduction to C++, Differences between C and C++, Classes and Objects, Inline functions, function overloading, default arguments, friend function, static data members and member function, arrays of objects, object as function argument, returning objects from functions, const member function, pointer to object, namespace fundamentals.

UNIT II: CONSTRUCTOR, DESTRUCTOR AND INHERITANCE 10 Hours

Introduction to Constructor and Destructor, Types of constructors, Operator Overloading: Need of operator overloading, overloading unary operators, overloading binary operators, binary operator overloading using friend function, instream/outstream operator overloading. Inheritance: Introduction, defining a derived classes, single inheritance, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance, Virtual base classes, Constructors in derived classes, Member classes: Nesting of classes.

UNIT III: VIRTUAL FUNCTIONS AND POLYMORPHISM 09 Hours

Virtual Functions and Polymorphism: Virtual function, Calling a Virtual function through a base class reference, inheriting Virtual attribute and Virtual functions, Pure virtual functions, Early vs. late binding. **C++ I/O Stream Basics:** C++ streams, stream classes, Formatted I/O. **Templates:** Introduction to function templates function templates with multiple parameters.

UNIT IV: JAVA FUNDAMENTALS 10 Hours

Overview of Java, Data types, operators, Programming constructs, Simple Java programs, Introducing Classes, Objects, and Methods, Method overloading and Method overriding,

Inheritance, Packages and Interfaces, Exception Handling- Fundamentals of exception handling, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

UNIT V: MULTI THREADED PROGRAMMING AND APPLETS 09 Hours

Multithreaded Programming : Multithreading Fundamentals , The Thread Class and Runnable Interface, Creating a Thread, Life cycle of Thread, Creating Multiple Threads, Thread Priorities, Synchronization methods, Thread Communication Using notify( ), wait( ), and notifyAll( ), Suspending, Resuming, and Stopping Threads. Applets: Applet basics, Applet class, Applet Architecture, Life cycle, comparison of Applet and application, Images in applet.

TEXT BOOKS:

1. E. Balagurusamy, "Programming with C++", 7th Edition, McGraw Hill, 2017.
2. Herbert Schildt, JAVA The Complete Reference, 9th Edition, McGraw Hill, 2014.

REFERENCE BOOKS:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008.
2. K R Venugopal, Rajkumar and T Ravishankar, "Mastering C++", 2nd Edition, Tata McGraw Hill,2013.
3. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill, 2009.
4. E Balagurusamy, Programming with Java A primer, 4th Edition, McGraw Hill, 2010.

e-BOOKS/ONLINE RESOURCES:

1. C++ Tutorial , https://www.tutorialspoint.com/cplusplus/.
2. Free C++ Programming Book, https://books.goalkicker.com/CPlusPlusBook/.
3. C++ Programming –Computer Notes https://ecomputernotes.com/cpp.
4. Java Lectures, https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.

MOOCs:

1. C++ Programming, https://www.programiz.com/cpp-programming
2. C++ Programming, https://onlinecourses.nptel.ac.in/noc16_cs17
3. Programming in JAVA, https://onlinecourses.nptel.ac.in/noc19_cs07
4. Java Course, https://www.coursera.org/courses?query=java

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand the fundamentals of C++ and Java.

CO2: Explore the knowledge of the object-oriented concepts.

CO3: Develop computer programs to solve real world problems in C++ and Java.

CO4: Develop simple GUI interfaces for a computer program to interact with users.
CO5: Implement the event-based GUI handling principles using Applets.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC307</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses: Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">DIGITAL SYSTEM DESIGN – LABORATORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - III CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Acquire knowledge to design, analyze, and implement circuits with digital logic basic gates/universal gates.
2. Design and analyze combinational logic circuits.
3. Design and analyze sequential logic circuits.
4. Design counter using shift register and realize the operations of shift registers.
5. Understand various flip flop and represent flip flop operation using state transition diagram.

LIST OF EXPERIMENTS:

1. Design code conversion circuit that converts Binary to Gray using basic gates
2. Design and implement Excess-3 to BCD and vice-versa code converter circuit using 7483 and gates
3. Design and Implement half adder and full adder circuit using NAND gates
4. Design Full adder and Full subtractor circuit using 74153 IC
5. Design and Implement 4:1 Multiplexer circuit using NAND gates
6. Design and Implement SISO, SIPO, PISO and PIPO using 7495
7. Design and Implement BCD to seven segment display circuit using gates/IC
8. Design and Implement mod N using 7490 and 7493 IC
9. Design and Implement J-K Master/Slave Flip-Flop using NAND gates and verify its truth table
10. Comparison of two binary numbers using 7485 comparator
11. Design and implement a ring counter using 4-bit shift register.
12. Design and Implement Asynchronous counter using Decade counter IC

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Realize the basic operation using basic gates and universal gates o.

CO2: Design and implement full adder, full subtractor, 8:1, 16:1 multiplexer, 16:1 circuit.

CO3: Design and implement applications using shift registers.

CO4: Analyze the JK and Master Slave flip flop and design counter using JK flipflop.
CO5: Design and implement an asynchronous counter.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC308</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses: Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">DATA STRUCTURES AND APPLICATION – LABORATORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - III CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the implementation of various Data Structures.
2. Apply the Stack concepts for various applications such as Polish Notation and recursion.
3. Implement and analyse the various operations to be performed with linear and non-linear Data Structures.
4. Perform various operations on files.
5. Select the appropriate Data Structures for solving real world problems.

LAB PROGRAMS:

WRITE A PROGRAM IN C TO:

1. Implement the following using Arrays:
    a. Stack
    b. Queue
2. Use recursive program to implement:
    a. Tower of Hanoi.
    b. Insertion Sort.
3. Convert infix expression to prefix expression.
4. Implement Double ended queue using Singly linked list.
5. Implement Singly circular linked list with header node.
6. Perform various operations in Doubly linked list.
7. Create a binary tree and traverse in inorder, preorder, postorder.
8. Perform insert and delete operations in binary search tree.
9. Evaluate expression tree using binary tree.
10. Create right-in-threaded binary tree
11. Implement Hash Tables:
12. Implement Hashing using open addressing.
13. Write all the members of an array of structures to a file using fwrite(). Read the array from file and display on the screen.
14. Compare the contents of two files. Write the difference in another file.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Apply the Data Structures concepts to write a programs for a given problem.

CO2: Develop and Debug and Demonstrate various Data Structures such as Linked list, Stacks and Queues.

CO3: Perform various operations with Files**.**

CO4: Develop programs to create BST, Threaded Binary Tree and perform various operations with it.

CO5: Analyse and compare various linear and non-linear Data Structures.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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Course Code	**18MCES309**					
Category	Mandatory Course					
Course title	**ENVIRONMENTAL SCIENCE**					
Scheme and Credits	No. of Hours/Week					Semester - III CSE/ISE
	L	T	P	SS	Credits	
	2	**0**	**0**	**0**	**1**	
CIE Marks: 50	---		Total Max. Marks: 50			
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Gives better understanding about environment and their importance
2. Gives information about renewable and non-renewable resources
3. Helps in understanding the ecosystem
4. Helps to understand the consequences of environmental pollution.
5. Understand about disaster management.

UNIT I: THE MULTIDISCIPLINARY NATURE OF ENVIRONMENT STUDIES 04 Hours

Definition, Scope and importance of environment, Need for public awareness,

UNIT II: NATURAL RESOURCES 06 Hours

Renewable and Non-renewable resources

Natural Resources and Associated problems

a. Forest resources: Use and over exploitation, Deforestation, Case studies, Timber Extraction, Forest management.
b. Water resources: Use and over utilization of surface and ground water, floods, Drought, Conflicts over water, Dams, Benefits and problems.
c. Energy resources: Growing energy needs, renewable and non-renewable energy sources, Use of alternate energy sources, Case studies.
d. Role of an individual in conservation of natural resources.
e. Equitable use of resources for sustainable lifestyles

UNIT III: FUNDAMENTALS OF ECOLOGY: INTRODUCTION AND SCOPE 04 Hours

· Concept of an ecosystem.
· Structure and function of an ecosystem.
· Producers, consumers and decomposers.
· Energy flow in the ecosystem.
· Ecological succession.
· Food chains, food webs and ecological pyramids**.**

UNIT IV: TYPES OF ECOSYSTEM 04 Hours

· Introduction, type's characteristics feature structure and function of the following ecosystem.

a. Forest ecosystem
b. Grassland ecosystem

c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT V: ENVIRONMENTAL POLLUTION **06 Hours**

Definition
Causes, effects, and control measures of :-
Air pollution, Water pollution, Soil pollution, Noise pollution,
Solid waste management: Causes, effects and control measures of urban and industrial wastes, Wasteland reclamation.
Role of an individual in prevention of pollution.
Pollution case studies
Disaster management: floods, earthquake, cyclone, droughts, tsunami and landslides.

TEXT BOOK:

1. J P Sharma, Environmental Studies 3rd edition, University Science Press, New Delhi, 2009.

REFERENCE BOOKS:

1. R. Rajagopalan - Environmental Studies 2nd edition, Oxford University Press, 2011.
2. Aloka Debi 2nd edition – Environmental Science and Engineering, Universities Press, 2012.
3. Erach Bharucha, Environmental Studies 2nd edition, Universities Press,2013

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Ability to reduce and control air, water and noise pollution.
CO2: Ability to understand individual ecosystem.
CO3: Ability to manage natural disasters.
CO4: Ability to ascertain natural resources and their scarcity.
CO4: Causes, effects and control measures of urban and industrial wastes, Wasteland reclamation.

SCHEME OF EXAMINATION:

CIE -50 Marks	Test I (UNIT I,II&III) -20 Marks	Quiz I - 5 Marks	25 Marks	Total:50 Marks
	Test II(UNIT IV &V) -20 Marks	Quiz II – 5 Marks	25 Marks	

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18BSBM310**					
Category	Basic Sciences					
Course title	**Bridge Mathematics-I**					
Scheme and Credits	No. of Hours/Week					Semester - III Lateral Entry Students
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

This course will enable all students to:

1. Study the applications of successive differentiation, Rolls and Mean value theorems.
2. Study the applications of curvature and radius of curvature.
3. Be skilled in computations and applications of partial differentiations and jacobians.
4. Be able to solve the three dimensional geometry problems which appear in engineering problems.
5. Be skilled in computations and applications of infinite series and sums and analyze a nature of the given series.

UNIT I: **09 Hours**

Successive differentiation: nth derivative of some standard function, Leibnitz theorem, and problems, polar curves and angle between the polar curves, Rolle's theorem, Lagrange and Cauchy Mean value theorem and applications, Applications of Taylor and McLaurin expansion for a single variable (without proof). Indeterminate forms, evaluation of limits by L-Hospital rule (without proof).

UNIT II: **09 Hours**

Derivative of an arc in Cartesian, parametric and polar forms. Curvature of plane curves-formula for radius of curvature in Cartesian, parametric, polar forms.

UNIT III: **10 Hours**

Partial differentiation: First and higher order derivatives, Euler theorem, Total differentiation, differentiation of implicit functions and composite functions, Jacobeans.

UNIT IV: **10 Hours**

Analytical geometry in three dimensions: Direction cosines and direction ratios, planes, straight lines. Angle between planes/ straight lines, coplanar lines, shortest distance between skew lines, right circular cone and right circular cylinder.

UNIT V: **10 Hours**

Sequence and series: Convergence, divergence and oscillation of an infinite series, comparison

tests, p series, D' Alembert's ration test, Rabees's test. Cauchy's root test, Cauchy's integral test (all tests without proof) for series of positive terms.

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
2. E. Kreyszig, "Advanced Engineering Mathematics" - Wiley, 2013.
3. D. S. Chandrashekaraiah, "Engineering Mathematics-I", Prism Books Pvt. Ltd. 7th Edition, 2014.

REFERENCE BOOKS:

1. B.V. Ramana "Higher Engineering Mathematics" Tata Mc Graw-Hill, 2006
2. N P Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi publications, latest edition.
3. H. K Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.

e-BOOKS/ONLINE RESOURCES:

1. http://tutorial.math.lamar.edu/Classes/CalcII/CalcII.aspx
2. http://www.ec.unipg.it/DEFS/upload.linalg_evals_evects.pdf
3. https://www.math.ku.edu/~lerner/LAnotes?LAnotes.pdf
4. https://ocu.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/vidoe-lectures/(Gilbert Strang vedio lectures)
5. http://nptel.ac.in/downloads/122101003(lecture notes)

MOOCs:

1. http://nptel.ac.in
2. http://academicearth.org

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Use of nth derivatives, Solve problems of Rolls and Means value theorems and indeterminate forms.

CO2: Finding the derivative of an arc in Cartesian, parametric, polar forms.

CO3: Use partial differentiation; determine Jacobins.

CO4: Three dimensional geometry problems and properties.

CO5: Compute infinite series, sum an infinite series, and analyze a nature of the given series.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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IV SEMESTER CSE

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18BSEM401</td></tr>
<tr><td>Category</td><td colspan="6">Basic Sciences</td></tr>
<tr><td>Course title</td><td colspan="6">Engineering Mathematics-IV</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - IV CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable all students to

1. To understand range of analytic functions and concerned results.
2. Understand and find Taylor series and determine their intervals of convergence.
3. Solve an algebraic or transcendental equation using an appropriate numerical method.
4. Solve boundary value problems using the finite difference method.
5. Being aware of exact, approximate and numerical methods to solve the resulting equations.

UNIT I: **09 Hours**

Sets in a complex plane - Functions of a complex variables. Limit, Continuity and differentiability (definitions only). Analytic function - Riemann equations in Cartesian and polar forms. Harmonic functions, Constructions of analytic functions (Cartesian and polar forms). Line integral - Cauchy's theorem-corollaries. Cauchy's integral formula for complex function and for derivatives, Conformal transformations: $1/z$, z^2, e^z and $z + \frac{a^2}{z}$ $(z \neq 0)$. Bilinear transformations.

UNIT II: **09 Hours**

Power series, convergence, radius of convergence, Taylor's and Laurent's theorems (Statements only) Singularities. Poles Calculation of residues. Residue theorem (without proof)–problems. Evaluation of Contour integrals.

UNIT III: **10 Hours**

Numerical solution of algebraic and transcendental equations-solution by Bisection, Ramanujan method, linear iteration and Newton-Raphson methods. Solution of linear simultaneous equations: Gauss elimination method, Gauss Jordan method, Gauss Seidel methods, LU decomposition method, methods of Crout, Doolittle and Cholesky.

UNIT IV: **10 Hours**

Finite differences (Forward and backward differences), Interpolation, Newtons forward and backward interpolation formulae, Central difference formulae: stirlings and Bessels formula. Interpolation with unequal spaced points: Lagarange interpolation formula, and inverse interpolation formulae. Divided differences and their properties: Newtons general interpolation

formula. Interpolation by iteration, Numerical differentiation using Newtons forward and backward interpolation formulae, Numerical integration: Trapezoidal method, Simpson 1/3 rule Simpons3/8th rule.

UNIT V: **10 Hours**

Numerical solution of ordinary differential equations: Solution by Taylor's series, Picard's method of successive approximation, modified Euler's method, Runge Kutta methods of second and fourth order, Predictor and corrector methods – Adams – Bashforth method, Adams-Moultons method.

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
2. E. Kreyszig, "Advanced Engineering Mathematics" - Wiley, 2013.

REFERENCE BOOKS:

1. B.V. Ramana "Higher Engineering Mathematics" Tata Mc Graw-Hill, 2006
2. N P Bali and M. Goyal, "A text book of Engineering mathematics", Laxmi publications, latest edition.
3. H. K Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.
4. S. S. Sastry, Introductory methods of Numerical Analysis, 3rd edition, Prentice-Hall India.
5. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical methods for scientific and Engineering computation, New Age international Publishers.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understanding necessary and sufficient condition for analytic function and Cauchy' integral formula.

CO2: Express the length of a curve as a (Riemann) sum of linear segments, convert to definite integral form and compute its value.

CO3: Approximate a function using an appropriate numerical method.

CO4: Solve boundary value problems using the finite difference method.

CO5: Being aware of exact, approximate and numerical methods to solve the resulting equations.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC402**					
Category	Engineering Science Courses : Professional Core					
Course title	**FINITE AUTOMATA AND FORMAL LANGUAGES – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - IV CSE/ISE
	L	T	P	SS	Credits	
	4	0	0	0	4	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Design Deterministic finite automata, Nondeterministic finite automata, conversion of NFA to DFA, design of E- NFA and regular expressions.
2. Obtain minimized DFA and convert automata to regular expressions and regular expression to automata and proving languages are not regular.
3. Writing CFG's, Construction of parse trees, understand ambiguity in grammars, designing problems on Pushdown Automata.
4. Conversion of grammar to Chomsky Normal Form, Greibach normal form and conversion of grammar to PDA. Prove that languages are not context free using pumping lemma.
5. Designing turing machines, understanding the working of turing machines and solving post correspondence problems.

UNIT I: INTRODUCTION TO FINITE AUTOMATA 10 Hours

The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata An application of finite automata; Finite automata with Epsilon transitions; Regular expressions.

UNIT II: REGULAR EXPRESSIONS & REGULAR LANGUAGES 10 Hours

Finite Automata and Regular Expressions; Applications of Regular Expressions. Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata.

UNIT III: CONTEXT-FREE GRAMMARS AND LANGUAGES, PUSH DOWN AUTOMATA 10 Hours

Context–free grammars; Parse trees; Applications; Ambiguity in grammars and Languages. Definition of the Pushdown automata; The languages of a PDA.

UNIT IV: PROPERTIES OF CONTEXT-FREE LANGUAGES 09 Hours

Equivalence of PDA's and CFG's; Deterministic Pushdown Automata., Normal forms for

CFGs; The pumping lemma for CFGs; Closure properties of CFLs.

UNIT V: TURING MACHINE & UNDECIDABILITY **09 Hours**

The Turing machine; Programming techniques for Turing Machines; Extensions to the basic Turing Machines; A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem.

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson education, 2007.

REFERENCE BOOKS:

1. Raymond Greenlaw, H.James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
2. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.
3. Daniel I.A. Cohen: Introduction to Computer Theory, 2nd Edition, John Wiley & Sons, 2004.
4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.

e-BOOKS/ONLINE RESORCES:

1. Foundations of Computation-CAROL CRITCHLOW, DAVID ECK.

MOOCs:

1. www.nptel/videos.in/2012/11/theory-of-computation.html.
2. nptel.ac.in/courses/106104028/theory of computation.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Design finite automata and NFA for given languages.
CO2: Write regular expressions for given languages and properties of regular languages.
CO3: Convert finite automata to regular expressions and vice versa.
CO4: Design context free grammar for specified language and Design Push Down Automata.
CO5: Analyze Turing Machine and undecidability problem.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC403</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">DESIGN AND ANALYSIS OF ALGORITHMS – THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - IV CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the importance of algorithm and need for finding the time complexity of an algorithm.
2. Learn the algorithms under Brute force, Divide and Conquer, Greedy and Dynamic programming concepts.
3. Compute the time complexity of various algorithmic techniques.
4. Acquire the Knowledge of P, NP and NP Hard problems.
5. Learn to apply the algorithmic techniques to real world problems.

UNIT I: INTRODUCTION **09 Hours**

The Notion of Algorithm, Fundamentals of algorithmic Problem Solving. The Analysis of Framework. Asymptotic Notations and Standard Efficiency Classes. Mathematical analysis of Non-Recursive Algorithms. Mathematical Analysis of recursive algorithms. An Example: the Fibonacci Numbers. Empirical Analysis of Algorithms. Algorithm Visualization.

UNIT II: BRUTE FORCE AND DECREASE & CONQUER **10 Hours**

Brute-Force: Selection Sort and Bubble Sort. Sequential Search and Brute-Force String Matching. Closest-Pair and Convex-Hull Problems by Brute Force. Exhaustive Search. Depth First Search (DFS), Breadth First Search (BFS), Applications of DFS and BFS, Decrease and conquer: Insertion Sort, Topological Sort, Generating Permutations, Binary search, Computing Median and the Selection problem.

UNIT III: DIVIDE & CONQUER AND TRANSFORM & CONQUER **10 Hours**

Divide-and-Conquer: Mergesort. Quicksort. Binary Tree Traversals and Related Properties. Multiplication of Large Integers and Strassen's Matrix Multiplication. Transform and Conquer: Presorting and its Applications, Balanced Search Trees, Heaps and Heap sort. Horner’s rule and Binary exponentiation, Space & Time Tradeoff: Horspool string matching algorithm, Btrees.

UNIT IV: DYNAMIC PROGRAMMING AND GREEDY TECHNIQUES 10 Hours

Dynamic Programming: Basic examples, The Knapsack Problem and Memory Functions Binomial Coefficients, Optimal Binary Search Trees, Warshall's and Floyd's Algorithms Greedy Approach: Prim's Algorithm. Kruskal's Algorithm. Dijkstra's Algorithm. Huffman Trees.

UNIT V: COPING WITH LIMITATIONS OF ALGORITHM POWER 09 Hours

Backtracking: n-Queens Problem, Subset-Sum Problem, Branch-and-Bound: Travelling Salesman problem, Knapsack Problem, Approximation Algorithms for NP hard problems, Limitations of Algorithm Power: Decision Trees, P, NP, and NP-Complete Problems.

TEXT BOOKS:

1. Introduction to the Design and Analysis of Algorithms, by Anany Levitin, Pearson Education, Third Edition, 2014.
2. Computer Algorithms, by Horowitz E., Sahani S., Rajasekharan S., Galgotia Publications, 2001.

REFERENCE BOOKS:

1. Introduction to Algorithms, Cormen T.H, Leiserson C. E, Rivest R.L, Stein C, 3rd Edition, PHI 2010.
2. Data Structures and Algorithm Analysis in C++, by Mark Allen Weiss, Pearson Education, 4th edition, 2012.
3. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014.

e-BOOKS/ONLINE RESOURCES:

1. https://india.oup.com/product/design-and-analysis-of-algorithms-9780198093695.
2. https://www.pdfdrive.com/design-and-analysis-of-algorithms-books.html.

MOOCs:

1. https://nptel.ac.in/courses/106106093/35.
2. https://eu.udacity.com/course/intro-to-algorithms--cs215.
3. https://www.edx.org/course/algorithms-data-structures-microsoft-dev285x-1.
4. https://visualgo.net/en.
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Acquire the knowledge on fundamentals of algorithmic design steps, analyse concepts and types of algorithm design techniques.

CO2: Understand and analyze the design of algorithms using Brute force, Divide & Conquer,

Decrease & Conquer, Transform & conquer, Dynamic Programming, Greedy technique, Backtracking, Branch & Bound techniques.

CO3: Assess the performance and correctness of algorithms.

CO4: Design and Implement efficient algorithms by applying appropriate design techniques for solving real world problems.

CO5: Design solutions for various engineering applications using appropriate algorithms.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC404**					
Category	Engineering Science Courses : Professional Core					
Course title	**MICROPROCESSOR AND MICROCONTROLLER – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - IV CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

This course will enable students to

1. Make familiar with importance and applications of microprocessors and microcontrollers.
2. Discuss 8086 Microprocessor Instruction set.
3. Understand the working of 8255 Programmable Peripheral Interface.
4. Expose architecture of 8086 microprocessor and ARM processor.
5. Familiarize instruction set of ARM processor.

UNIT I: INTRODUCTION TO MICROPROCESSOR 10 Hours

The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. Assembly language programming: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code.

UNIT II: 8086 MICROPROCESSOR INSTRUCTION SET 10 Hours

x86: Instructions sets description, Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming: BIOS INT 10H Programming, DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment.

UNIT III: 8255 PROGRAMMABLE PERIPHERAL INTERFACE 09 Hours

8255 Pin descriptions, Architecture, Control register, Mode 0, Mode 1 and Mode 2 Operations, Interfacing of DAC and ADC to 8086 in Mode 0 only. 8255 I/O programming: I/O addresses MAP of x86 PC's, programming and interfacing the 8255. 8253 – Programmable timer, pin functions, architecture, Mode 0, 1, 2, 3, 4, and 5 operations, Programs for monostable and astable operations.

UNIT IV: INTRODUCTION TO MICROCONTROLLER 10 Hours

Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions.

UNIT V: ARM INSTRUCTION SET **09 Hours**

Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises.

TEXT BOOKS:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
2. Andrew N Sloss, Dominic Symes and Chris Wright, ARM System Developers Guide, Elsevier, Morgan Kaufman publishers, 2008.

REFERENCE BOOKS:

1. Venugopal K R and Rajkumar, Microprocessor x86 Programming, BPB Publications, New Delhi, 2017.
2. K M Bhurchandi and AK Ray, Advanced Microprocessors and Peripherals, 3rd Edition, McGraw Hill, 2017.
3. Douglas V. Hall, Microprocessors and Interfacing, Revised 2nd Edition, Tata McGraw Hill, 2006.
4. K. Udaya Kumar and B.S. Umashankar, Advanced Microprocessors & IBM-PC Assembly Language Programming, Tata McGraw Hill, 2003.

e-BOOKS/ONLINE RESOURCES:

1. Microprocessor, https://lecturenotes.in/subject/21/microprocessor-mp.
2. https://www.smartzworld.com/notes/microprocessors-and-microcontrollers-mpmc/.
3. https://easyengineering.net/microprocessor-and-microcontroller-system-by-godse/.

MOOCs:

1. Microprocessors and Microcontrollers - NPTEL - PDF Drive, https://www.pdfdrive.com/microprocessors-and-microcontrollers-nptel-e17318114.html

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Differentiate between microprocessors and microcontrollers.
CO2: Design and develop assembly language code to solve problems using 8086 microprocessors.
CO3: Gain the knowledge for interfacing various devices to x86 family and ARM processor.
CO4: Demonstrate the design of interrupt routines for interfacing devices.
CO5: Apply the instructions of ARM processor to develop applications.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC405**					
Category	Engineering Science Courses: Professional Core					
Course title	**OPERATING SYSTEMS - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - IV CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the Operating System Structure, System Call, Virtual Machines.
2. Demonstrate the process inter process communication and process states.
3. Analyze the various process synchronization algorithms and solve classical problems.
4. Identify presence of deadlock in the system and recover from deadlock.
5. Design File System and Evaluate the various secondary device and scheduling algorithm for secondary devices.

UNIT I: INTRODUCTION TO OPERATING SYSTEMS **10 Hours**

System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication.

UNIT II: MULTI-THREADED PROGRAMMING **09 Hours**

Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors

UNIT III: DEADLOCKS **10 Hours**

Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

UNIT IV: VIRTUAL MEMORY MANAGEMENT 09 Hours

Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

UNIT V: SECONDARY STORAGE STRUCTURES, PROTECTION 10 Hours

Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts"9th edition, Wiley Global Education, 2012.

REFERENCE BOOKS:

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition.
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw Hill, 2013.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI (EEE), 2014.
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson. 2014.

e-BOOKS/ONLINE RESOURCES:

1. Operating Systems Study Guide by Tim Bower
2. Lecture Notes on Operating Systems by Mythili Vutukuru
3. Schaum's Outline of Operating Systems (Schaum's Outline Series) by J. Archer Harris.

MOOCs:

1. http://onlinevideolecture.com/?course=computer-science&subject=operating-systems.
2. http://www.nptel.ac.in/courses/106108101/.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Describe features, types and design considerations of modern operating system.

CO2: Analyze & Apply the various process scheduling algorithms.

CO3: Illustrate the concepts of synchronization and handle Deadlocks.

CO4: Explain memory management strategies and analyze various page replacement Algorithms.

CO5: Describe the design considerations of file system and compare various disk scheduling algorithms.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC406**					
Category	Engineering Science Courses : Professional Core					
Course title	**SOFTWARE ENGINEERING – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - IV CSE/ISE
	L	T	P	SS	Credits	
	4	0	0	0	4	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the various professional and ethical issues.
2. Learn the concept of software engineering process.
3. Gain knowledge in the project management.
4. Understand the software design methodology.
5. Analyse the verification process.

UNIT I: INTRODUCTION **09 Hours**

Introduction: FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.

UNIT II: CRITICAL SYSTEMS, SOFTWARE PROCESSES **09 Hours**

Critical Systems: A simple safety- critical system; System dependability; Availability and reliability. Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering.

UNIT III: REQUIREMENTS **10 Hours**

Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document. Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management. System models, project management System Models: Context models; behavioural models; Data models; Object models; Structured methods. Project Management: Management activities; Project planning; Project scheduling; Risk management.

UNIT IV: SOFTWARE DESIGN **10 Hours**

Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles. Object-Oriented design: Objects and Object Classes; An Object-Oriented design process; Design evolution.

UNIT V: DEVELOPMENT **10 hours**

Rapid Software Development: Agile methods; Extreme programming; Rapid application development. Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution. Verification and validation Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods. Software testing: System testing; Component testing; Test case design; Test automation. Management Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model. Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modelling, Project duration and staffing.

TEXT BOOKS:

1. Roger S Pressman "Software Engineering: A Practitioners Approach" Mc Graw Hill Seventh Edition" 2005.
2. Ian Sommerville "Software Engineering" Pearson Education Tenth Edition 2016.

REFERENCE BOOKS:

1. Sungdeok Cha, Richard N Taylor and Book of Software Engneering " Springer Ist Edition 2019.
2. Mohammad Ali Shaik Software Engineering with UML : Designed to Promote Student Learning "Notion Press 1 edition 2018"
3. Rajib Mall, Fundamentals of Software Engineering, "Eastern Economy Edition" Fourth Edition, 2018.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106105087/pdf/m02L03.pdf

MOOCs:

1. https://www.mooc-list.com/tags/software-engineering

2. https://www.edx.org/learn/software-engineering

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Identify the process, services and delivery models in software engineering.
CO2: Employ the concept of project management.
CO3: Extend the functionalities of resource management and scheduling mechanisms.
CO4: Analyse the design models in software environment.
CO5: Develop management techniques in software.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
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</table>

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC407</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">DESIGN AND ANALYSIS OF ALGORITHMS – LABORATORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - IV CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Design and implement various algorithms in C++.
2. Determine the time complexity of various sorting algorithms.
3. Employ various design strategies for problem solving.
4. Measure and compare the performance of different algorithms.
5. Understand, develop and analyse the various algorithms under Divide & Conquer, Greedy, Dynamic and backtracking techniques.

DESCRIPTION:

Design, develop, and implement the specified algorithms for the following problems using C++ language under LINUX /Windows environment.

LAB PROGRAMS:

1. Sort a given set of elements using Merge sort and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot graph of the time taken versus number of elements. The elements can be read from file or generated using random number generator.
2. Sort a given set of elements using Quick sort and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot graph of the time taken versus number of elements. The elements can be read from file or generated using random number generator.
3. Write a program to perform insert and delete operations in Binary Search Tree.
4. Print all the nodes reachable from a given starting node in a digraph using BFS method.
5. a) Obtain the Topological ordering of vertices in a given digraph.
   b) Compute the transitive closure of a given directed graph using Warshall's algorithm.
6. a) Check whether a given graph is connected or not using DFS method.
   b) Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
7. Sort a given set of elements using the Heap sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus number of elements.

8. Search for a pattern string in a given text using Horspool String Matching algorithm.
9. Implement 0/1 Knapsack problem using dynamic programming.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
12. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
13. Write a program to solve Travelling Sales Person problem using dynamic programming approach.
14. Implement N Queen's problem using Back Tracking.
15. Write a program to construct an AVL tree for a given set of integers.

COURSE OUTCOMES:

The student at the end of the course, will be able to

CO1: Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming etc).

CO2: Implement a variety of algorithms such as sorting, graph related, combinatorial, etc, in a high level language.

CO3: Develop programs and analyse its time complexity.

CO4: Analyze and compare the performance of algorithms using language features.

CO5: Apply and implement learned algorithm design techniques and data structures to solve real world problems.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC408</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Course : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">MICROPROCESSOR AND MICROCONTROLLER - LABORATORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - IV CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable students to

1. Learn 8086 instruction sets and gains the knowledge of how assembly language works
2. Provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM.
3. Understand the usage of 8255 Programmable peripheral Interface with I/O devices and Microprocessor.
4. Give the knowledge and practical exposure on connectivity of the Hardware devices to Microprocessor
5. Know how to execute the programs on interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

DESCRIPTION:

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation.

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element "X" in a list of 'n' 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.

5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

HARDWARE PROGRAMS: PART B

8. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
9. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.
10. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
11. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
12. Design and develop an assembly language program to generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
13. Design and develop an assembly language program to generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
14. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
15. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Use 8086 instruction sets and gains the knowledge of how assembly language works.
CO2: Design and implement programs written in 80x86 assembly language.
CO3: Know functioning of hardware devices and interfacing them to x86 family.
CO4: Gain the knowledge of 8255 PPI interfacing with I/O devices and Microprocessor.
CO5: Choose processors for various kinds of real world applications.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester (Part A + Part B)	20	Execution of one program each from Part A and Part B	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18MCCE409</td></tr>
<tr><td>Category</td><td colspan="6">Mandatory Course</td></tr>
<tr><td>Course title</td><td colspan="6">CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - IV CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">----</td><td colspan="2">Total Max. Marks: 50</td><td></td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:
This course will enable the students

1. Constitution of India and Professional Ethics is to make the students aware of their fundamental rights and duties.
2. As a citizen of India it would be a moral obligation on everyone to know the Constitution of the country where they live in.
3. Constitution of India enlightens the citizen about the duties of the state and to what extent those duties are translated into laws.
4. The objective of the coursework is to follow basic ethics of technical profession for enabling them to be an expert professional.
5. The important object of the course work is to ensure everyone who attained the age of voting right shall cast their vote and participate in the democratic process at different levels.

UNIT I: **06 Hours**
Preamble to the Constitution of India. Fundamental rights under Part-III-details of Exercise of rights, Limitations & Important case laws.

UNIT II: **04 Hours**
Relevance of Directive principles of State Policy under Part-IV, Fundamental Duties & their significance.

UNIT III: **04 Hours**
Union Executive – President, Prime Minister, Parliament & the Supreme Court of India.
State Executive – Governors, Chief Minister, State Legislator and High Courts.

UNIT IV: **05 Hours**
Constitutional Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes; Emergency Provisions; Electoral process; Amendment procedure; Latest Important Constitutional amendments.

UNIT V: **05 Hours**
Scope & aims of engineering ethics, Responsibility of Engineers; Impediments to responsibility; Honesty, Integrity and reliability, risks, safety & liability in engineering.

REFERENCE BOOKS:

1. Durga Das Basu: "Introduction to the Constitution of India" (Students Edn.) Prentice – Hall EEE, 19th/20th Edn., 2001.
2. "Engineering Ethics" by Charles E.Haries, Michael. S.Pritchard and Micheal J.Robins Thompson Asia, 2003-08-05.
3. "An Introduction to Constitution of India" by M.V. Pylee, Vikas Publishing, 2002
4. "Engineering Ethics" by M. Govindrajan, S. Natarajan, V.S. Senthilkumar. Prentice – Hall of India Pvt. Ltd. New Delhi, 2004.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Be able to know the basic Constitutional rights of citizens, i.e. Fundamental rights, right to vote and participate in democratic process.

CO2: Be able to know the constitutional mandate in form of duties imposed upon the state for ensuring social economic, political, ethical and cultural rights of the citizens.

CO3: Be able to know not only the rights, but also duties that a citizen has to abide in the country they reside.

CO4: The outcome of the course predominantly would be to feel proud by every student that they are aware of the Indian Constitution which is in a written document form.

CO5: Another important outcome would be to make aware the students the Preamble of the Constitution which is a key opener for understanding the edifice of Indian Constitution.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Unit-I, II &III Test-I: 20 Marks.</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Unit-IV &V Test-II: 20 Marks.</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
</table>

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18BSBM410</td></tr>
<tr><td>Category</td><td colspan="6">Basic Sciences</td></tr>
<tr><td>Course title</td><td colspan="6">BRIDGE MATHEMATICS-II</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - IV
Lateral Entry Students</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable all students to

1. Develop a thorough knowledge and deep understanding of Laplace transforms, Laplace transform of derivatives, integrals and periodic function.
2. Study the reduction formulae for definite and indefinite integrals, Evaluation of these integrals with standard limits.
3. Be skilled in computations and applications Double and Triple integrals, beta and Gamma functions.
4. Be able to solve the ordinary differential equations of first order and first degree and first order simultaneous differential equations.
5. Apply the concept of higher order differential equations.

UNIT I: LAPLACE TRANSFORMS **09 Hours**

Laplace Transforms: Definition and basic properties, Laplace transform of elementary functions and standard results, Laplace transform of derivatives and integrals, Laplace transform of periodic function, Unit step functions, Inverse Laplace Transforms, Convolution theorem.

UNIT II: INTEGRAL CALCULUS - I **09 Hours**

Standard reduction formulae for definite and indefinite integrals, Evaluation of these integrals with standard limits, problems, Tracing of standard limits, problems, Tracing of standard curves in Cartesian form.

UNIT III: INTEGRAL CALCULUS - II **10 Hours**

Double and Triple integrals, evaluation by the change of order of integration, Beta and Gamma functions, Relation between beta and Gamma functions, applications.

UNIT IV: DIFFERENTIAL EQUATIONS – I **10 Hours**

Solutions of ordinary differential equations of first order and first degree: Homogeneous forms, Linear and Bernoulli equations, Exact and reducible to exact equations, using standard integration factors. Solving the first order simultaneous differential equations.

UNIT V: DIFFERENTIAL EQUATIONS - II **10 Hours**

Second and higher order differential equations, homogeneous linear equations with constant and variable co-efficients, problems. Non-homogeneous linear equations with constant and variable co-efficients, problems. Application of Laplace transform to solve linear ordinary differential equations of first and second order with constant co-efficients.

TEXT BOOKS:

1. G. B. Thomas and R. L. Finney, Calculus, Addison Wesley, 9th Edition, 1998.
2. E. Kreyszig, "Advanced Engineering Mathematics" - Wiley, 2013.
3. P. V. O Neil Advanced Engineering Mathematics, Pearson/Thomson.
4. D. S. Chandrashekaraiah, “Engineering Mathematics-II”, Prism Books Pvt. Ltd. 7th Edition, 2014.

REFERENCE BOOKS:

1. B.V. Ramana "Higher Engineering Mathematics" Tata Mc Graw-Hill, 2006
2. N P Bali and M. Goyal, "A text book of Engineering mathematics", Laxmi publications, latest edition.
3. H. K Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Use Laplace transform of elementary functions and standard results, Laplace transform of derivatives and integrals.

CO2: Compute reduction formulae for definite and indefinite integrals, Tracing of standard curves in Cartesian form.

CO3: Use Double and Triple integrals, beta and gamma functions appearing in engineering applications

CO4: Solve ordinary differential equations of first order and first degree and first order simultaneous differential equations.

CO5: Solve second and higher order differential equations.

SCHEME OF EXAMINATION:

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V SEMESTER CSE

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC501</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">COMPUTER NETWORKS - THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - V CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Get the idea of choosing the required functionality at each layer for a given application and Trace the flow of information from one node to another node in the network.
2. Understand the division of network functionalities into layers.
3. Learn the component required to build different types of networks and identify the solution for the functionalities in each layer.
4. Learn the working and functions of various protocols of all the layers.
5. Design a basic web page.

UNIT I: PHYSICAL LAYER **10 Hours**

Introduction: Uses of Computer Network, Network Hardware and Network Software, Reference Models. Physical Layer: Guided Transmission, Wireless Transmission, Digital Modulation and Multiplexing, Public Switched Telephone Network.

UNIT II: DATALINK LAYER **10 Hours**

Issues, Error Detection and Correction, Elementary Datalink Protocol, Sliding Window Protocol. Medium Access Control Sublayer: Channel Allocation Problem, Multiple Access Protocol, Ethernets, Datalink Layer Switching.

UNIT III: NETWORK LAYER **10 Hours**

Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of service, Internetworking, Network layer in the Internet-IPv4, IPv6.

UNIT IV: TRANSPORT LAYER **09 Hours**

Transport service, Elements of Transport Protocols, Congestion Control, Internet Transport Protocol- UDP, TCP.

UNIT V: APPLICATION LAYER **09 Hours**

DNS, Electronic Mail, World Wide WEB.

TEXT BOOKS:

1. Computer Networks, Andrew S Tannenbaum and David J Wetherall, Pearson, 5th edition, 2014.

2. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition, 2013.

REFERENCE BOOKS:

1. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER.
2. Computer Networking-A Top-Down approach, James F Kurose, Keith W Ross, 5th edition, Pearson, 2016.
3. Mayank Dave, Computer Networks, Second edition, Cengage Learning.

e-BOOKS/ONLINE RESOURCES:

1. http://freecomputerbooks.com/networkComputerBooks.html.
2. https://www.pdfdrive.com/computer-networking-books.html.

MOOCs:

1. https://www.coursera.org/courses?query=computer%20network.
2. https://www.quora.com/Which-is-the-online-course-to-learn-computer-networks.
3. https://in.udacity.com/course/computer-networking--ud436.
4. https://swayam.gov.in/courses/5172-computer-networks.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Analyze the need of for different protocols in data link layer and network layer of TCP/IP protocol suite.

CO2: Design network using internetworking concepts and related protocol by analysing the need for various routing protocols in different scenarios.

CO3: Apply the various routing algorithms for effective communication and congestion control algorithms to manage the network traffic.

CO4: Classify routers, IP and Routing Algorithms in network layer.

CO5: Design a web page and acquire the knowledge of working of DNS and Email.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC502**					
Category	Engineering Science Courses : Professional Core					
Course title	**ARTIFICIAL INTELLIGENCE - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - V CSE/ISE
	L	T	P	SS	Credits	
	4	0	0	0	4	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable students to

1. Learn the concepts of Artificial Intelligence.
2. Understand the methods of solving problems using Artificial Intelligence.
3. Acquire the concepts of knowledge representation.
4. Design knowledge planning concepts.
5. Acquire different AI learning methods.

UNIT I: INTRODUCTION TO AI **09 Hours**

Introduction to AI, Intelligent Agents: Agents and Environment; Rationality; Nature of Environment; Structure of Agents. Problem-Solving: Problem-Solving Agents, Searching Solutions, Search Strategies, Heuristic Functions.

UNIT II: PROBLEM-SOLVING BY SEARCHING **10 Hours**

Classical Search: Local Search Algorithms, Searching Nondeterministic Actions, Partial Observations; AI Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Real-Time Decisions, Stochastic Games, Other Games; Constraint Satisfaction Problems: Introduction and Inferences, Backtracking and Local Search.

UNIT III: KNOWLEDGE REPRESENTATION **10 Hours**

Logical Agents: Knowledge Based Agents, Logic, Propositional Logic. First-Order Logic: Representation, Syntax and Semantics, Usage, Knowledge Engineering. Inference In First-Order Logic: Inference, Unification, Lifting, Chaining, Resolution.

UNIT IV: KNOWLEDGE PLANNING **09 Hours**

Planning: Classical Planning, Algorithms For Planning State Space Search, Graphs, Planning Approaches and Analysis. Hierarchical Planning, Non-Deterministic Domain, Multi-agent Planning. Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Objects, Reasoning.

UNIT V: LEARNING **10 Hours**

Introduction to Learning, Supervised Learning, Learning Decision Trees, Regression And Classification With Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Ensemble Learning Machine Learning, Explanation-Based Learning, Learning Using Relevance Information; Reinforcement Learning.

TEXT BOOKS:

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell, Peter Norvig, 3rd Edition, Pearson Education, 2010.
2. "Artificial Intelligence" by Elaine Rich, Kevin Knight, Shiva Shankar B Nair: Tata McGraw Hill 3rd edition. 2013.

REFERENCE BOOKS:

1. "Artificial Intelligence", by George F Luger, 5th Edition Pearson Education, 2009.
2. Artificial Intelligence: foundations of computational agents, by David Poole, Alan Mackworth, 2nd Edition, Cambridge University Press, 2017.

e-BOOKS/ONLINE RESOURCES:

1. Artificial Intelligence - MIT: https://courses.csail.mit.edu/6.034f/ai3/rest.pdf.
2. https://epub.uni-regensburg.de/13629/1/ubr06078_ocr.pdf.
3. Lecture Notes in Artificial Intelligence – Springer: https://www.springer.com/series/1244.

MOOCs:

1. Artificial Intelligence -http://www.nptelvideos.in/2012/11/artificial-intelligence.html.
2. https://www.edx.org/course/introduction-to-artificial-intelligence-ai-2.
3. The quest for artificial intelligence-a history of ideas and achievements-Cambridge University Press: http://ai.stanford.edu/~nilsson/QAI/qai.pdf.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Describe the modern view of AI as the study of agents.

CO2: Apply AI search Models and Generic search strategies for problem solving.

CO3: Write Logic for representing Knowledge and Reasoning of AI systems.

CO4: Design different planning strategies for knowledge presentations.

CO5: Design different learning algorithms for improving the performance of AI systems.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 08 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC503</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">DATABASE MANAGEMENT SYSTEMS – THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - V CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>4</td><td>0</td><td>0</td><td>0</td><td>4</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable students to

1. Understand fundamental concepts, terminology and application of databases.
2. Discuss design concepts and creation of relational databases.
3. Acquire basic and advanced SQL commands.
4. Design overview of database programming and procedural languages.
5. Design transaction management, database recovery and security.

UNIT I: INTRODUCTION **10 Hours**

Introduction, Characteristics of Database approach, Advantages of using DBMS approach, when not to use a DBMS. Database System Concepts and Architecture: Data models, Schemas and instances, Three schema architecture and data independence, Database languages and interfaces, database system environment. Data Modelling using the Entity-Relationship(ER) model: Using High-Level conceptual Data Models for Database Design, A sample Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship Types of Degree Higher than Two, Database Design using ER-to Relational Mapping.

UNIT II: RELATIONAL DBMS **09 Hours**

Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations. Relational Algebra: Unary Relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations.

UNIT III: SQL **09 Hours**

SQL Data Definition and Data Types specifying basic constraints in SQL, Basic retrieval queries in SQL, Insert, Delete and Update statements in SQL, Additional features of SQL, More complex SQL Queries, Specifying Constraints as Assertion and Trigger, Views.

UNIT IV: DATABASE DESIGN THEORY AND NORMALIZATION 10 Hours

Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT V: TRANSACTION PROCESSING, ERROR RECOVERY, DATA STORAGE AND INDEXES 10 Hours

Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods. Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees.

TEXT BOOKS:

1. Fundamental of Database Systems by Ramez Elmasri and Shamkant B Navathe, Sixth Edition, Addison Wesley, 2011.
2. Database System Concepts, Sixth Edition, Abraham Silberschatz, Henry F. Korth, S. Sudarshan : Tata McGraw-Hill, 2010.

REFERENCE BOOKS:

1. An Introduction to Database Systems by C.J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, 2006.
2. Database Systems: The Complete Book, Second Edition, Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, Pearson Education, 2001.

e-BOOKS/ONLINE RESOURCES:

1. Introduction to structured Query Language (SQL).
2. https://cs.uwaterloo.ca/~tozsu/courses/CS338/lectures/4%20Basic%20SQL.pdf.
3. An Introduction to Relational Database: www.cis.gsu.edu/dmcdonald/cis3730/SQL.pdf.
4. DBMS by Raghu Ramakrishnan: https://www.academia.edu/.../Ramakrishnan_Raghu.

MOOCs:

1. http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design.
2. http://www.iitg.ernet.in/awekar/teaching/cs344fall11/.
3. www.w3schools.com/sql/.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand basic concepts of Database Management System.

CO2: Design ER-Diagram for real world applications using database concepts.

CO3: Formulate relational algebraic expressions using relational model concepts and Implement SQL queries using relational model concepts.

CO4: Analyse and apply normalization concept for relational schema.

CO5: Analyse transaction processing and concurrency control techniques.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC504**					
Category	Engineering Science Courses : Professional Core					
Course title	**COMPUTER GRAPHICS – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - V CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand about 2D and 3D graphics primitives and attributes.
2. Know about Geometric transformations on 2D and 3D objects.
3. To study about Clipping functions.
4. Study about various viewing functions.
5. To acquire knowledge about Curved surfaces.

UNIT I: INTRODUCTION **09 Hours**

Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The Programmer's interface; Graphics architectures; Programmable pipelines; Graphics programming: Programming two dimensional applications. Video Display Devices: Raster Scan display, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL- Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms-DDA, Bresenham's, circle generation algorithms - Bresenham's.

UNIT II: 2D GEOMETRIC TRANSFORMATIONS AND 2D VIEWING **09 Hours**

2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. inverse transformations, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions.

UNIT III: CLIPPING, 3D GEOMETRIC TRANSFORMATIONS, COLOR AND ILLUMINATION MODELS **10 Hours**

Clipping: normalization and viewport transformations, clipping algorithms, 2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping, polygon fill area clipping:

Sutherland-Hodgeman polygon clipping algorithm. Geometric Objects and Transformations, Affine Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three dimensional applications, 3D Geometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.

UNIT IV: VIEWING , VISIBLE SURFACE DETECTION 10 Hours

Viewing and Projections; orthographic and perspective projection, camera positioning, Hidden Surface Removal; its importance in rendering, z buffer algorithm, clipping, culling, 3D Viewing; 3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions, Visible Surface Detection Methods; Classification of visible surface Detection algorithms, back face detection, depth buffer method, OpenGL visibility detection functions.

UNIT V: INPUT AND INTERACTION, CURVES AND COMPUTER ANIMATION 10 Hours

Input and Interaction; Input devices, Clients and Servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus; Picking, Building Interactive Models, Animating Interactive Programs, Design of Interactive Programs, Logic Operations, Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions, Corresponding openGL functions.

TEXT BOOKS:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version, 3rd/4th Edition, Pearson Education, 2011.
2. E. S. Angel, Interactive Computer Graphics, A top-down approach with OpenGL, (5e), Pearson Education, 2009.

REFERENCES:

1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges: "Computer graphics with OpenGL", Pearson education
2. Kelvin Sung, Peter Shirley, Steven Baer: Interactive Computer Graphics, Concepts and Applications, Cengage Learning.
3. Xiang, Plastock : Computer Graphics , sham's outline series, 2nd edition, TMG.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106106090/
2. https://nptel.ac.in/courses/106102065/8

MOOCs:

1. https://www.mooc-list.com/tags/computer-graphics
2. https://nptel.ac.in/courses/112102101/47

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Design and implement algorithms for 2D/3D graphics primitives and attributes.
CO2: Analyze Geometric transformations on 2D and 3D objects.
CO3: Apply the concepts of clipping and visible surface detection in 2D and 3D viewing.
CO4: Analyze the algorithms for viewing geometrical objects.
CO5: Know about Curves and Quadric surfaces.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC507</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">COMPUTER GRAPHICS – LABORATORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - V CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Design and develop software packages for 2D/3D graphical applications.
2. Geometric transformations on 2D and 3D objects in OpenGL.
3. Know about Clipping Algorithms.
4. Know about various viewing functions in OpenGL.
5. Works in graphics packages like OpenGL for application development.

PART A

1. Implement Brenham's line drawing algorithm for all types of slope.
2. Create and rotate a triangle about the origin and a fixed point.
3. Draw a colour cube and spin it using OpenGL transformation matrices.
4. Draw a colour cube and allow the user to move the camera suitably to experiment with perspective viewing.
5. Clip a lines using Cohen-Sutherland algorithm.
6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.
7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user.
8. Develop a menu driven program to animate a flag using Bezier Curve algorithm.
9. Develop a menu driven program to fill the polygon using scan line algorithm.

PART B

Develop a mini project to implement the skills learnt in theory and exercises indicated in Part A. Use OpenGL software.

NOTE:

1. Any question from Part A may be asked in the examination.
2. A report of about 10 – 12 pages on the package developed in Part B, duly certified by the Department must be submitted during examination.

TEXT BOOKS:

1. E. S. Angel, Interactive Computer Graphics, A top-down approach with OpenGL, (5e), Pearson Education, 2009.

REFERENCE BOOKS:

1. M M Raiker, Computer Graphics using OpenGL, Filip learning/Elsevier.

e-BOOKS/ONLINE RESOURCES:

1. http://www.cse.iitm.ac.in/~vplab/courses/CG/PDF/OPENGL_BASICS.pdf
2. https://learnopengl.com/

MOOCs:

1. https://www.mooc-list.com/tags/computer-graphics
2. https://www.nptelvideos.com/computer_graphics/

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Design and develop 2D/3D graphics applications.
CO2: Analyze Geometric transformations on 2D and 3D.
CO3: Apply the concepts of clipping in 2D and 3D viewing.
CO4: Able to develop algorithms for viewing geometrical objects.
CO5: Able to know graphics packages like OpenGL for application development.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester (Part A + Part B)	20	Execution of any one program from Part A and demonstration of mini project from Part B	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC508**					
Category	Engineering Science Courses : Professional Core					
Course title	**DATABASE MANAGEMENT SYSTEMS – LABORATORY**					
Scheme and Credits	No. of Hours/Week					Semester - V CSE/ISE
	L	T	P	SS	Credits	
	0	0	3	0	1.5	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Apply the specification of Structured Query Language (SQL) for database creation and manipulation.
2. Design the ER Diagram and apply ER-mapping rules.
3. Apply the working of different concepts of DBMS.
4. Implement and test the database developed for applications.
5. Demonstrate GUI for database usage.

PART-A: SQL PROGRAMMING:

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: MINI PROJECT:

- Use Java, PHP, Python, or any other similar front-end tool.
- All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted).

PART-A: SQL PROGRAMMING

1. Library Database:

Consider the following schema for a Library Database:

BOOK(Book_id, Title, Publisher_Name, Pub_Year)

BOOK_AUTHORS(Book_id, Author_Name)

PUBLISHER(Pub_id, Name, Address, Phone)

BOOK_COPIES(Book_id, Branch_id, No-of_Copies)

BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date)

LIBRARY_BRANCH(Branch_id, Branch_Name, Address)

Write SQL queries to:

1. Retrieve details of all books in the library: id, title, name of publisher, authors, number of copies in each branch, etc.
2. Get the particulars of borrowers who have borrowed more than 3 books from Jan 2019 to Jun 2019.
3. Delete a book in BOOK table and Update the contents of other tables to reflect this data manipulation operation.
4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
5. Create a view of all books and its number of copies that are currently available in the Library**.**

2. Sales_Order Database

Consider the following schema for Sales_Order Database:

SALESMAN(Salesman_id, Name, City, Commission)

CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)

ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)

Write SQL queries to:

1. Count the customers with grades above Bangalore's average.
2. Find the name and numbers of all salesman who had more than one customer.
3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)
4. Create a view that finds the salesman who has the customer with the highest order of a day.
5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted

3. Movie Database:

Consider the following schema for Movie Database:

ACTOR(Act_id, Act_Name, Act_Gender)

DIRECTOR(Dir_id, Dir_Name, Dir_Phone)

MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)

MOVIE_CAST(Act_id, Mov_id, Role)

RATING(Mov_id, Rev_Stars)

Write SQL queries to:

1. List the titles of all movies directed by 'ABCD'.

2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by 'XYZ' to 5.

4. College Database

Consider the schema for College Database:

STUDENT(USN, SName, Address, Phone, Gender)

SEMSEC(SSID, Sem, Sec)

CLASS(USN, SSID)

SUBJECT(Subcode, Title, Sem, Credits)

IA-MARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to:

1. List all the student details studying in fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 Marks of student USN '11XX1234' in all subjects.
4. Calculate the FinalIA (average of best two test Marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
   If FinalIA = 17 to 20 then CAT = 'Outstanding'
   If FinalIA = 12 to 16 then CAT = 'Average'
   If FinalIA< 12 then CAT = 'Weak'
   Give these details only for 8th semester A, B, and C section students.

5. Company Database

Consider the schema for Company Database:

EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)

DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)

DLOCATION(DNo,DLoc)

PROJECT(PNo, PName, PLocation, DNo)

WORKS_ON(SSN, PNo, Hours)

Write SQL queries to:

1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.

2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department
4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).
5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000.

PART B: MINI PROJECT

- For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process.
- Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool.
- Indicative areas include; health care, education, industry, transport, supply chain, etc.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Use Structured Query Language (SQL) for database creation and manipulation.

CO2: Design the ER Diagram and apply ER-mapping rules.

CO3: Demonstrate the working of different concepts of DBMS.

CO4: Implement and test the database developed for applications.

CO5: Demonstrate GUI for database usage.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester (Part A + Part B)	20	Execution of any one program from Part A and demonstration of mini project from Part B	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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PROFESSIONAL ELECTIVE - I

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE51A**					
Category	Engineering Science Courses : Professional Elective					
Course title	**SOFTWARE ARCHITECTURE AND TESTING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - V CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand software architectural requirements and drivers.
2. Be exposed to architectural styles and views.
3. Be familiar with architectures for emerging technologies.
4. Apply quality metrics for quality assurance to various softwares.
5. Analyse methodologies in testing.

UNIT I: INTRODUCTION **09 Hours**

Basic Concepts of Software Architecture - Architecture business cycle - architectural patterns - reference models - architectural structures, views; Introduction to Styles - Simple Styles - Distributed and Networked Architectures - Architecture for network based applications - Decentralized Architectures.

UNIT II: DESIGN METHODOLOGIES **09 Hours**

Structured Design - Design Practices – Stepwise Refinement – Incremental Design - Structured System-Analysis and Design - Jackson Structured Programming - Jackson System Development.

UNIT III: ARCHITECTURE DESIGN **10 Hours**

Typical Architectural Design - Data Flow - Independent Components - Call and Return – Using Styles in Design – choices of styles – Architectural design space – Theory of Design Spaces – Design space of Architectural Elements – Design space of Architectural styles.

UNIT IV: INTRODUCTION TO SOFTWARE QUALITY **10 Hours**

Challenges – Objectives – Quality Factors – Components of SQA – Contract Review – Development and Quality Plans – SQA Components in Project Life Cycle – SQA Defect Removal Policies – Reviews. Testing methodologies: Basics of Software Testing – Test Generation from Requirements – Finite State Models – Combinatorial Designs - Test Selection, Minimization and Prioritization for Regression Testing – Test Adequacy, Assessment and Enhancement.

UNIT V: TEST STRATEGIES **10 Hours**

Testing Strategies – White Box and Black Box Approach – Integration Testing – System and Acceptance Testing – Performance Testing – Regression Testing - Internationalization Testing – Ad-hoc Testing – Website Testing – Usability Testing – Accessibility Testing.

TEXT BOOKS:

1. Len Bass, Paul Clements, Rick Kazman, ―Software Architecture in Practice, Third Edition, Addison, Wesley, 2012.
2. David Budgen, "Software Design", Second Edition, Pearson Education, 2004.
3. Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy, ―Software Architecture, Foundations, Theory and Practice, Wiley 2010.

REFERENCES:

1. Daniel Galin, “Software Quality Assurance – from Theory to Implementation”, Pearson Education, 2009
2. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
3. Aditya Mathur, “Foundations of Software Testing”, Pearson Education, 2008
4. Ron Patton, “Software Testing” , Second Edition, Pearson Education, 2007

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106104027/

MOOCs:

1. https://www.mooc-list.com/course/software-architecture-coursera

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Explain different quality metrics for various softwares.
CO2: Illustrate usage of quality metrics to analyse the product Quality.
CO3: Evaluate the test plan and various testing methods.
CO4: Assess software quality standards.
CO5: Develop new quality metrics for software to assure quality.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE51B**					
Category	Engineering Science Courses : Professional Elective					
Course title	**PROBABILITY AND STOCHASTIC PROCESSES – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - V CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the basics of Sampling and Probability theory, Random Variables, and Probability Distributions.
2. Understand various Standard Distributions and learn how to solve problems.
3. Understand the basics of Stochastic Processes and different types of stochastic processes.
4. Learn Discrete-parameter and Continuous-parameter Markov Chains.
5. Analyze Queuing models and Networks.

UNIT I: INTRODUCTION TO SAMPLING AND PROBABILITY THEORY 09 Hours

Sampling, Measures of Central Tendency – Mode, Median, Mean, Variance, Standard Deviation. Probability, Events, Types of Events, Addition Rule of Probability, Condition Probability, Independent Events, Multiplication Rule, Law of Total Probability, Bayes' Rule.

UNIT II: RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS 10 Hours

Random Variables, Discrete Random Variables, Probability Distribution of a Discrete Random Variable, Probability Mass Function, Cumulative Distribution Function of a Discrete Random Variable, Continuous Random Variables, Probability Distribution of a Continuous Random Variable, Probability Density Function, Cumulative Distribution Function of a Continuous Random Variable, Expectation, Variance and Standard Deviation of Discrete and Continuous Random Variables. Covariance and Correlation, Independent Random Variables.

UNIT III: STANDARD DISTRIBUTIONS 10 Hours

Binomial Distribution, Hyper-geometric Distribution, Poisson Distribution, Geometric Distribution, Negative Binomial Distribution, Exponential Distribution, Uniform Distribution, Normal Distribution, Gamma Distribution, Weibull Distribution, Central Limit Theorem, Two Dimensional Random Variables, Jointly Distributed Random Variables, Marginal Probability Distribution, Conditional Distribution and Conditional Expectation.

UNIT IV: STOCHASTIC PROCESSES 10 Hours

Introduction, Classification of Stochastic Processes, Types of Stochastic Processes – Strictly Stationary Process, Independent Processes, Renewal Processes, Markov Process, Wide-Sense

Stationary Processes, Introduction to Discrete-parameter Markov Chains, Transition Probability Matrix, Time Homogeneity, Computation of One-Step, Two-Step and n-Step Transition Probabilities, Chapman Kolmogorav Equations, Variations of Markov Chains, Global Balance. Discrete-Parameter Birth-Death Processes, Introduction to Continuous-parameter Markov Chains, Birth and Death Process, M/M/m Queue, Pure Birth and Pure Death Processes, Non-Birth-Death Processes.

UNIT V: QUEUING THEORY **09 Hours**

Introduction, Elements of Queuing Model, Distribution of Inter-Arrival Time, Distribution of Service Time, Classification of Queuing Models – Single Server and Multi-Server, Network of Queues, Open Queuing Networks, Closed Queuing Networks, Non-exponential Service-Time Distributions and Multiple Job Types.

TEXT BOOKS:

1. Kishore S Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, John Wiley and Sons, II Edition, 2008.

REFERENCE BOOKS:

1. P Kousalya, Probability, Statistics and Random Processes, Pearson Education, Dorling Kindersley (India), 2013.
2. L. B. Castananda, V Arunachalam and S Dharmaraja, Introduction to Probability and Stochastic Processes with Applications, John Wiley and Sons, 2012.
3. Marek Capinski and Tomasz Jerzy Zastawniak , Probability Through Problems, Springer, 2003.
4. Dimitri P. Bertsekas and John N. Tsitsiklis, Introduction To Probability, Athena Science, II Edition, 2008.

e-BOOKS/ONLINE RESOURCES:

1. http://www.math.louisville.edu/~pksaho01/teaching/Math662TB-09S.pdf.
2. https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/amsbook.mac.pdf.
3. https://faculty.math.illinois.edu/~r-ash/BPT/BPT.pdf.
4. https://web.ma.utexas.edu/users/gordanz/notes/introduction_to_stochastic_processes.pdf.
5. http://www.math.harvard.edu/~knill/books/KnillProbability.pdf.

MOOCs:

1. https://www.edx.org/course/introduction-probability-science-mitx-6-041x-2.
2. https://www.mooc-list.com/course/probability-coursera.
3. https://www.youtube.com/channel/UC8uY6yLP9BS4BUc9BSc0Jww.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Apply the concepts of sampling and probability in solving problems.

CO2: Review the differences between discrete and continuous random variables.

CO3: Map the problems to respective probability distributions and solve accordingly.

CO4: Model real world problems to appropriate stochastic models.

CO5: Solve problems using queuing theory.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPE51C</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="6">OPERATIONS RESEARCH – THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - V CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The students will be able to

1. Formulate Optimization Problem as a Linear Programming Problem.
2. Solve the Problems using Simplex Method.
3. Optimize the problems by using Revised and Dual Simplex methods.
4. Formulate and Solve Transportation and Assignment Problems.
5. Apply Game Theory for Decision Making Problems.

UNIT I: INTRODUCTION & LINEAR PROGRAMMING 09 Hours

Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Introduction to Linear Programming Problem (LPP):Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.

UNIT II: SIMPLEX METHOD –1 10 Hours

The essence of the Simplex method; Setting up the Simplex method; Types of variables, Algebra of the Simplex method; the Simplex method in tabular form; Tie breaking in the Simplex method, Big M method, Two phase method.

UNIT III: SIMPLEX METHOD –2 09 Hours

Revised Simplex Method, Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The Dual Simplex method.

UNIT IV: TRANSPORTATION AND ASSIGNMENT PROBLEMS 10 Hours

The Transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the Assignment problem. Minimization and Maximization varieties in Transportation and Assignment problems.

UNIT V: GAME THEORY 10 Hours

Game Theory: The formulation of Two Persons, Zero Sum games; Saddle Point, MaxiMin and MiniMax principle, Solving simple games- a prototype example; Games with Mixed

Strategies; Graphical solution procedure. Decision Analysis: Decision making without Experimentation, Decision making with Experimentation, Decision Trees.

TEXT BOOKS:

1. Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag, Preetam Basu, *Introduction To Operations Research,* 10th Edition, Tata McGraw-Hill Education India, 2017.
2. S D Sharma*: Operations Research*, Kedarnath, Ramanath and Company, 2012.

REFERENCE BOOKS:

1. Richard Chase, Ravi Shankar, F. Robert Jacobs, Operations and Supply Chain Management, 14th Edition, McGraw-Hill.
2. Hamdy A. Taha*, Operations Research: An Introduction,* 9th Edition, Prentice Hall, India, 2010.
3. Wayne L Wilson: Operations Research Applications and Algorithms, 4th Edition, Cengage Learning, 2003.
4. Premkumar Gupta, D S Hira: Operations Research, S Chand Publications, New Delhi, 7th Edition, 2012.
5. Sharma J K: Operations Research: Theory and Applications, 6th Edition, Macmilan, 2016.

e–BOOKS/ONLINE RESOURCES:

1. Operations Research
2. https://faculty.psau.edu.sa/filedownload/doc-6-pdF-14b14198b6e26157b7eba06b390ab763-original.pdf
3. Principles-of-mathematics-in-operations-research https://itslearningakarmazyan.files.wordpress.com/2015/09/operation-research-aplications-and-algorithms.pdf
4. Introduction to Operations Research
5. https://notendur.hi.is/~kth93/3.20.pdf

MOOCs:

1. https://swayam.gov.in/course/1342-introduction-to-operations-research.
2. https://onlinecourses.nptel.ac.in/noc15mg01/preview.
3. https://nptel.ac.in/courses/112106134/.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Identify and Formulate LP Problems for Maximization and Minimization Problems.
CO2: Solve Optimization Problems using Simplex Method.
CO3: Solve and Optimizer Dual and Revised-Simplex Methods.
CO4: Model the given Problem as Transportation, Assignment Problem and Solve.

CO5: Apply Game Theory for Decision Support System.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CSPE51D</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="6">EMBEDDED SYSTEMS – THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - V CSE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable students to

1. Design embedded computer system hardware.
2. Describe the basics of Assembly language programming concepts.
3. Implement the applications of embedded systems.
4. Use and describe the implementing the applications of real-time operating system on an embedded computer system.
5. Provide a general overview of advanced architectures of Embedded Systems.

UNIT I: EMBEDDED COMPUTING **09 Hours**

Embedded Computing: Introduction, Complex Systems and Microprocessor, The Embedded System Design Process, Formalisms for System Design, Design Examples. The 8051 Architecture: Introduction, 8051 Micro controller Hardware, Input / Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

UNIT II: BASIC ASSEMBLY LANGUAGE PROGRAMMING CONCEPTS 10 Hours

The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051. Data Transfer and Logical Instructions, Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Further Details on Interrupts.

UNIT III: EMBEDDED SYSTEM APPLICATIONS **10 Hours**

Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication. Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

UNIT IV: BASIC DESIGN USING A REAL-TIME OPERATING SYSTEM

10 Hours

Principles, Semaphores and Queues, Hard Real-Tjme Scheduling Considerations, Saving Memory and Power, RTOS example like uC-OS (Open Source) Embedded Software Development Tools: Host and Target machines, Linker, Locators for Embedded Software,

Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

UNIT V: INTRODUCTION TO ADVANCED ARCHITECTURES 09 Hours

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, l2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

TEXT BOOKS:

1. Computers and Components: Principles of Embedded Computing System Design, Wayne Wolf, Elsevier, 4th edition, Morgan Kaufmann Publishers, 2016.
2. The 8051 Microcontroller, Kenneth J. Ayala, Thomson , 3rd edition, Cengage Learning, 2007.

REFERENCE BOOKS:

1. Jean J. Labrosse**,** Embedding System Building Blocks, CMP publishers, Second Edition, 2002.
2. Raj Kamal, Embedded Systems: Architecture, Programming, and Design, 2nd edition, Tata
   McGraw Hill, 2013.
3. Ajay V Deshmukh, Micro Controllers: Theory and Applications, Tata McGraw Hill,2017.
4. Frank Vahid, Tony Givargis, Embedded System Design, John Wiley, 2006.
5. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education, 2011.

e-BOOKS/ONLINE RESOURCES:

1. Embedded Systems, https://users.ece.cmu.edu/~koopman/lectures/index.html.
2. http://read.pudn.com/downloads158/ebook/707037/Embedded%20Systems%20Design%20-%202ed%20-%200750655461.pdf.
3. www.electronics-lab.com/embedded-systems-online-training-resources/.

MOOCs:

1. Embedded Systems, https://nptel.ac.in/downloads/108105057.
2. Microcontroller, https://www.classcentral.com/tag/microcontroller.
3. https://www.coursera.org/courses?query=microcontroller.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Distinguish the characteristics of embedded computer systems.

CO2: Know the concepts of 8051 microcontroller programming.

CO3: Ability to build applications of embedded system using 8051 microcontroller.

CO4: Design and develop applications of Real Time Operating System.
CO5: Get the knowledge of advanced architectures of Embedded system.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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OPEN ELECTIVE - I

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIOE51A**					
Category	Engineering Science Courses : Open Elective					
Course title	**ADVANCED JAVA AND J2EE - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - V CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Gain the knowledge of Servlets and JavaBeans to develop server side and component-based software.
2. Identify the need for advanced Java concepts like Enumerations and Collections.
3. Apply skills to design GUI's using JavaFX.
4. Master the whole process of designing, implementing and deploying J2EE Database Applications.
5. Understand SOAP, Web Services and Service Oriented Architecture (SOA).

UNIT I: SERVLET AND JAVA BEANS **09 Hours**

The Life Cycle of a Servlet, A simple Servlet, The Servlet API, The Javax. servlet Package, Reading Servlet Parameter, The Javax. servlet. http package, Handling HTTP Requests and Responses, Using Cookies, Session Tracking. Java Beans: Overview of Java Beans with an example, Bound and Constrained Properties, The Java Beans API.

UNIT II: THE COLLECTIONS AND FRAMEWORK **10 Hours**

Collections Overview, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Arrays, The legacy Classes and Interfaces, Parting Thoughts on Collections, Formatter, Scanner.

UNIT III: STRING HANDLING AND GUI PROGRAMMING WITH JAVAFX
10 Hours

The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching String, Modifying a String, Data Conversion Using valueof(), Changing the Case of Characters Within a String, Joining Strings, Additional String Methods, String Buffer, String Builder.JavaFX Basic Concepts, Writing and Executing JavaFX Program, JavaFX Controls: Using Image and ImageView, ToggleButton, RadioButton, CheckBox, ComboBox, TextField.

UNIT IV: JDBC OBJECTS AND J2ME ARCHITECTURE **10 Hours**

The Concept of JDBC, JDBC Driver Types, JDBC Packages, Overview of the JDBC Process, Database Connection, Statement Objects, ResultSet, Transaction Processing, Metadata, Data Types. J2ME Architecture, Small Computing Device requirements, Run-Time Environment, MIDlet Programming, Java Language for J2ME, J2ME Software Development Kits, Hello World J2ME Style, Multiple MIDlet's in a MIDlet Suite, J2ME Wireless Toolkit.

UNIT V: J2ME WEB SERVICES **09 Hours**

Web Services Basics, J2EE Multi-Tier Web Services Architecture, Client Tier Implementation, Web Tier Implementation, Enterprise JavaBeans Tier Implementation, Enterprise Information Systems Tier Implementation, Inside WSDL, J2ME MIDlets and Web Services, Remote Method Invocation Concept, SOAP Basics, WSDL and SOAP, WSDL and HTTP Binding.

TEXT BOOKS:

1. Herbert Schildt, Java: The Complete Reference, 10th Edition, McGraw-Hill, 2017.
2. James Keogh, J2ME: The Complete Reference, McGraw-Hill, 2003.

REFERENCE BOOKS:

1. Kim Topley, J2ME in a Nutshell, O'Reilly, 2002.
2. Balaguruswamy, Programming with Java, 5th Edition, McGraw-Hill, 2014.
3. David Flanagan, Java in a Nutshell, 4th Edition, O'Reilly, 2002.
4. Sing Li And Jonathan Knudsen, Beginning J2ME: From Novice to Professional, 3rd Edition, Apress, 2005.
5. Uttam K Roy, Advanced Java Programming, Oxford University press, 2015.

e-BOOKS/ONLINE RESOURCES:

1. https://github.com/Shailendra-Java/Library/blob/master/Java%20%20The%20Complete%20Reference%2C%209th%20Edition%20-%20Herbert%20Schildt.pdf.
2. https://s3-ap-southeast-1.amazonaws.com/tv-prod/documents/5570-HeadFirstJava2ndEdition.pdf.

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs07/preview.
2. https://www.youtube.com/watch?v=IKRqOHF4RHA&list=PLG1O8ca4ky0Q6XZgM3N6kbaR8rd2fdcL.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand the servlets, Java Beans, GUI Programming using JavaFX**.**

CO2: Apply string Functions, JavaFX and JDBC concepts to create applications.

CO3: Analyze J2ME architecture, run time environment to design MIDlet Programming.
CO4: Evaluate SOAP, WSDL, HTTP Binding.
CO5: Design application using JavaBeans, JavaFX and JDBC.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIOE51B</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Open Elective</td></tr>
<tr><td>Course title</td><td colspan="6">PYTHON PROGRAMMING - THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - V CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the Syntax and Semantics to write Functions in Python.
2. Handle Strings and Files in Python.
3. Demonstrate usage of Lists, Dictionaries and Regular expressions in Python.
4. Apply Object Oriented Programming Concepts in Python.
5. Design projects using python that access databases and perform operation on database.

UNIT I: **09 Hours**

Python Datatypes: Expressions, Variables and Assignments, Strings, Lists and Tuples, Objects and Classes, Python Standard library. Imperative Programming: Python Programs, Execution Control Structures, User Defined Functions, Python Variables and Assignments, Parameter Passing.

UNIT II: **10 hours**

Text Data, Files & Exceptions: Strings Revisited, Formatted output, Files, Errors & Exceptions. Execution Control Structures: Decision Control & the if Statement, for Loop and Iteration Patterns, Two-dimensional Lists, while loop, More Loop Patterns, Additional Iteration Control Statements.

UNIT III: **09 Hours**

Container & Randomness: Dictionaries, Sets, Character Encodings and Strings, Module random**.** Namespaces: Encapsulation in Functions, Global versus Local Namespaces, Exception Control Flow, Modules as Namespaces, Classes as Namespaces.

UNIT IV: **10 hours**

Object Oriented Programming: Defining a New Python Class, Examples of User-Defined Classes, Designing New Container Classes, Overloaded Operators, Inheritance, and User-Defined Exceptions. Graphical User Interfaces: Basics of tkinter, GUI Development, Event-Based tkinter Widgets, Designing GUIs, OOP for GUIs.

UNIT V: **10 hours**

Recursion: Introduction to Recursion, Examples of Recursion, Run Time Analysis, Searching. The Web & Search: The World Wide Web, Python WWWAPI, String Pattern Matching. Databases & Data Processing: Databases and SQL, Database Programming in Python, Functional Language Approach, Parallel Computing.

TEXT BOOKS:

1. Ljubomir Perkovic, "Introduction to Computing Using Python: An Application Development Focus", John Wiley & Sons, 2012.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016. (http://greenteapress.com/wp/think- python/).

REFERENCE BOOKS:

1. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

e-BOOKS/ONLINE RESOURCES:

1. https://medium.mybridge.co/19-free-ebooks-to-learn-programming-with-python-8f6f0ad4a7f8
2. https://www.digitalocean.com/community/tutorials/digitalocean-ebook-how-to-code-in-python

MOOCs:

1. https://www.datacamp.com/courses/intro-to-python-for-data-science.
2. https://www.edx.org/course/introduction-to-computer-science-and-programming-using-python-0.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO2: Demonstrate proficiency in handling Strings and File Systems.

CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO4: Interpret the concepts of Object-Oriented Programming as used in Python.

CO5: Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CSOE51C</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses: Open Elective</td></tr>
<tr><td>Course title</td><td colspan="6">COMPUTER ORGANIZATION AND ARCHITECTURE-THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - V (Non CSE/ISE)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the various components and views of a computer system.
2. Learn the design of arithmetic logic unit, memory unit, processing unit and I/O unit.
3. Familiarize with the complexities involved in the design of a computer system.
4. Compare the various computer systems.
5. Design efficient computer systems.

UNIT I: INTRODUCTION **10 Hours**

The General Purpose Machine: Structure of a Digital Computer, The general purpose machine, The Perspectives of a Computer System: The machine/assembly language programmer's view, The computer architect's view, The computer system logic designer's view, Historical perspective. Machines, Machine Languages and Digital Logic: Classification of computers and their instructions, Computer instruction sets. Informal description of the simple RISC computer SRC, Formal description of SRC using register transfer notation, RTN, Description of addressing modes with RTN, Register transfer and logic circuits : from behaviour to hardware.

UNIT II: COMPUTER ARITHMETIC AND ARITHMETIC UNIT **09 Hours**

Number systems and radix conversion, Fixed-point arithmetic, Floating-point arithmetic.

UNIT III: MEMORY SYSTEM DESIGN **09 Hours**

Components of the Memory System, Semiconductor RAM Memories, Read-only memories, Speed, Size and cost, Cache memories, Performance considerations, Virtual memories, Secondary Storage.

UNIT IV: PROCESSOR DESIGN **10 Hours**

Some Fundamental Concepts, Execution of a complete Instruction, Multiple-Bus Organization, Hardwired Control, Microprogrammed Control. Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets, Datapath and Control Considerations, Superscalar Operation.

UNIT V: I/O AND PERIPHERAL DEVICES **10 Hours**

Accessing I/O devices, Interrupts, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces, Display devices, Printers, Input Devices.

TEXT BOOKS:

1. Vincent P Heuring & Harry F Jordan, T G Venkatesh, "Computer Systems Design and Architecture", 2014, Pearson Education Limited.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organisation, Fifth Edition, July 2017, McGraw Hill Education.

REFERENCE BOOKS:

1. William Stallings, Computer Organization and Architecture, Fourth Edition, PHI.
2. M.Mano, Computer Architecture, Prentice Hall.
3. Hayes, Computer Architecture & Organization, Third Edition, TMH.
4. Patterson, Computer Architecture, PH

e-BOOKS/ONLINE RESOURCES:

1. www.freebookcentre.net/ComputerScience.../Computer-Organization-and-Architectur...
2. https://www.pdfdrive.com/computer-organization-and-architecture-books.html
3. www.freetechbooks.com/computer-organization-and-architecture-f56.html

MOOCs:

1. https://www.classcentral.com/course/nptel-computer-organization-and-architecture-a-pedagogical-aspect-9824

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand the design principles of a computer system.

CO2: Design and analyze the performance of the arithmetic logic unit, memory unit, input / output unit and processing unit of a computer system.

CO3: Compare the various computer systems and build an efficient computer system.

CO4: Analyse the bottlenecks in a computer system.

CO5: Modify the design to improve the performance of a computer system.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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VI SEMESTER CSE

BANGALORE UNIVERSITY
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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC601</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">COMPILER DESIGN - THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VI CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>4</td><td>0</td><td>0</td><td>0</td><td>4</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the major concepts of languages and its compilers.
2. Enrich the knowledge in various phases of compiler and its use, learn concepts of parsers.
3. Know implementations of parsing through LL parser and LR parser.
4. Understand run time environments of compilers.
5. Analyse code optimization techniques, machine code generation and use of symbol table.

UNIT I: INTRODUCTION TO COMPILING AND LEXICAL ANALYSIS 10 Hours

Language processors, Analysis of the source program, The phases of a compiler, Cousins of the compiler, Grouping of phases, Compiler-construction tools. The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, Lexical Analyzer generator Lex, Design of a lexical analyzer generator.

UNIT II: SYNTAX ANALYSIS-I 09 Hours

Introduction, Context-free Grammar and Structure of Language, Writing a grammar, Parser and its Types, Top down Parsing, Bottom up parsing.

UNIT III: SYNTAX ANALYSIS-II AND SYNTAX DIRECTED TRANSLATION 10 Hours

LR Parsers, Simple LR parsers, Powerful LR Parsers, Canonical LR, Look Ahead LR, Parser generator Yacc, Syntax-directed definitions, Evaluation orders of SDD, Applications of SDD's.

UNIT IV: INTERMEDIATE CODE AND RUNTIME ENVIRONMENTS 09 Hours

Variants of syntax trees, three address code, introduction to run time environments, storage organization, stack allocation of space, access to nonlocal data on stack, heap management, garbage collection.

UNIT V: CODE GENERATION AND OPTIMIZATION 10 Hours

Issues in the design of a code generator, The target language, addresses in target code, basic blocks and flow graphs, optimization of basic blocks, A simple code generator, machine independent principal sources of code optimization.

TEXT BOOKS:

1. Compilers Principles, Techniques and Tools, A.V.Aho, Monica, Ravi Sethi, JD Ullman, 2nd edition, Pearson Education/Prentice Hall of India, 2009.
2. Principles of Compiler Design, Alfred V. Aho, Jeffrey D. Ullman, Narosa Publishing, 2002.

REFERENCE BOOKS:

1. Allen I. Holub, Compiler Design in C, PHI.
2. The Theory and Practical of Compiler Writing', Jean-Paul Trembly, Paul G. Sorenson, BS Publications.
3. Compiler Construction : Principle and Practice by Louden ,Cengage Publications.

e-BOOKS/ONLINE RESOURCES:

1. https://holub.com/goodies/compiler/compilerDesignInC.pdf.

MOOCs:

1. http://nptel.ac.in/courses/106108052/1.
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-035-computer-language-engineering-sma-5502-fall-2005.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand basics of Compilers and its phases and solve problems related to Shift reduce parsing, compute LR(0), LR(1) and LALR sets of items and parse table for a given grammar.

CO2: Demonstrate the ability to write syntax directed translations of simple statements and understand the working of procedure calls.

CO3: Demonstrate the ability to write intermediate code for a given high level programming language and be able to represent the intermediate codes as Quadruples, Triples and Indirect Triples.

CO4: Identify the basic blocks, draw flow graphs and represent directed acyclic graphs for The identified basic blocks. Write the target optimized code (assembly code) for the given three address code.

CO5: Get practical programming skills necessary for constructing a compiler.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC602</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">CRYPTOGRAPHY AND NETWORK SECURITY - THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - VI CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
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<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Learn security architecture, classical techniques and symmetric encryption
2. Understand public key cryptography and number theory basics.
3. Analyze data integrity with Hash functions, MACs.
4. Know various methods of key distribution and user authentication.
5. Familiarize transport level protocols with SSL, TLS, PGP and Secure E-mail. Know network threats, Viruses, worms and vulnerabilities.

UNIT I: INTRODUCTION **10 Hours**

Computer Security concepts, OSI security architecture, Security Attacks, Services and Mechanisms, Network security model, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Play fair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, The data encryption standard, DES encryption, DES decryption, avalanche effect, strength of DES, AES.

UNIT II: NUMBER THEORY AND PUBLIC-KEY CRYPTOGRAPHY **10 Hours**

Prime Numbers, Fermat's and Euler's theorems, Testing for primality, Principles of public key cryptosystems. Applications and requirements for public-key cryptosystems, public-key cryptanalysis. RSA algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange algorithm, key exchange protocols, man in the middle attack, Elliptic Curve Cryptography.

UNIT III: DATA INTEGRITY AND MESSAGE AUTHENTICATION CODES
09 Hours

Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, MACs Based on Hash Functions: HMAC.

UNIT IV: KEY DISTRIBUTION AND USER AUTHENTICATION 09 Hours

Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates,X-509 certificates, Kerberos.

UNIT V: TRANSPORT-LEVEL AND SYSTEM SECURITY 10 Hours

Secure Sockets Layer, Transport Layer Security, Electronic Mail Security: Pretty good privacy, notation, operational description, S/MIME: Multipurpose internet mail extensions, S/MIME functionality, S/MIME Messages. Intruders, Intrusion detection, Viruses and related threats, virus counter measures.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security", 6th Edition, Pearson Education, 2014.

REFERENCE BOOKS:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles, Algorithms and Protocols", Wiley Publications, 2003.
3. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security", Second Edition, Private Communication in Public World, PHI 2002.

e-BOOKS/ONLINE RESOURCES:

1. Online resources of Stallings's Cryptography and Network Security. Principles and Practice http://williamstallings.com.
2. Online resources of Menez, van Oorschot, Vanstone's Handbook of Applied Cryptography available at http://www.cacr.math.uwaterloo.ca/hac/.

MOOCs:

1. NPTEL Course on http://nptel.ac.in/courses/106105031/
2. CryptographyI on Coursera, https://www.coursera.org/course/crypto

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand the basic components of security architecture, classical techniques and DES.

CO2: Acquire fundamental knowledge on the concepts of prime numbers for cryptography, Demonstrate traditional public key ciphers.

CO3: Learn data integrity with Hash functions, MACs.

CO4: Explore various methods of key distribution and user authentication.

CO5: Security at the transport level with SSL and TLS. Understand PGP and Secure E-mail. Know network threats, vulnerabilities and viruses.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC603**					
Category	Engineering Science Courses: Professional Core					
Course title	**UNIX SYSTEM PROGRAMMING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	4	0	0	0	4	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the importance of UNIX and ANSI standard and features of UNIX file system.
2. Understand Kernel support for process creation, termination and memory allocation.
3. Get an idea about the working of Unix Process, its environment and the various functions used for process control.
4. Generate various signals and perform inter process communication using Message Queues, Semaphores, Shared Memory.
5. Establish Client Server Communication using Sockets.

UNIT I: UNIX AND ANSI STANDARDS AND UNIX FILES 10 Hours

The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics. UNIX FILES: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.

UNIT II: UNIX FILE APIS AND UNIX PROCESSES 10 Hours

General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs. UNIX Processes: Environment of Unix process: Introduction to main function, Process Termination, Command Line Argument, Environment list, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

UNIT III: PROCESS CONTROL AND PROCESS RELATIONSHIP 09 Hours

Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, waited, wait3, wait4 Functions, Race Conditions, exec Functions. Process Relationship: Introduction, Terminal login, Network login, process groups, sessions, job control, Shell execution of programs, Orphaned process groups.

UNIT IV: SIGNALS AND DAEMAN PROCESSES **09 Hours**

Signals: The Unix Kernel Support for Signals, Signal, Signal Mask, Sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers,POSIX.1b, Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client Server Model.

UNIT V: IPC AND SOCKETS **10 Hours**

Inter Process Communication: Overview of IPC methods, Pipes, Popen, Pclose functions, Co-processes, FIFOs system V IPC, Message Queues, Semaphores, Shared Memory, Client server properties, Stream pipes, Passing File descriptors, An open server version 1 and Client server connections functions. Network IPC and Sockets: Introduction, Socket descriptors, Addressing, Connection establishment, Data Transfer Socket Options, Out of band data, Non-blocking, Asynchronous I/O.

TEXT BOOKS:

1. Unix System Programming Using C++ – Terrence Chan – Prentice Hall India, 1999. Stephen A. Rago: Advanced Programming in the UNIX Environment – W.Richard Stevens, 2nd Edition, Pearson Education / PHI, 2005.

REFERENCE BOOKS:

1. Advanced Unix Programming – Marc J. Rochkind:, 2nd Edition, Pearson Education, 2005.
2. The Design of the UNIX Operating System – Maurice.J.Bach:, Pearson Education / PHI, 1987.
3. Unix Internals – Uresh Vahalia:, Pearson Education, 2001.

e-BOOKS/ONLINE RESOURCES:

1. https://www.quora.com/How-can-I-learn-system-programming.
2. http://usp.cs.utsa.edu/usp.
3. http://alandix.com/academic/tutorials/courses/Prog-I.pdf.
4. Using C on the UNIX System A Guide to System Programming David A. Curry O'Reilly & Associates, Inc. 981 Chestnut Street Newton, MA 02164.

MOOCs:

1. https://nptel.ac.in/courses/117106113/.
2. https://www.udemy.com/topic/shell-scripting/.
3. https://www.coursera.org/courses?query=shell%20scripting.
4. https://www.edureka.co/unix.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Compare the ANSI C & C++ AND POSIX standards.

CO2: Apply and Analyse the use of API's for implementing UNIX commands and for solving problems.

CO3: Analyze the process control, Deamon characteristics and error logging.

CO4: Generate signals and perform required action for process control.

CO5: Develop and Analyse various inter process communication methods such as Message Queues, Semaphores, Shared Memory and Sockets.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC607</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">COMPUTER NETWORKS - LABORATORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VI CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): 1. Computer Networks.
2. Programming in C and C++.
3. NS-3 simulator.</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the various network protocols.
2. Implement the network protocols using C/C++.
3. Analyse the programming environment of NS-3 simulator.
4. Evaluate typical wired/wireless network using the NS-3 simulator.
5. Simulate and analyse the various performance factors such as error rate, data rate, throughput etc. in Ethernet LAN.

PART – A

IMPLEMENT USING C / C++:

1. Write a Program to implement RSA algorithm.
2. Write a Program to find the shortest path in a network of 6 to 10 nodes.
3. Write a program for error detecting code using CRC-CCITT (16- bits).
4. Write a program for distance vector algorithm to find suitable path for transmission.
5. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
6. Write a program for error detecting using Hamming Code.
7. Write a Program to implement sliding window protocol.
8. Write a program to implement FIFO-Client and FIFO-Server to transfer files.
9. Using UDP Sockets write client server program to transfer files.
10. Write a program to implement Diffie-Hellman key Exchange.
11. Write a program to implement Congestion Control using leaky bucket.
12. Write a Socket program to implement PING/ECHO.

PART – B

IMPLEMENT USING NS3 OR ANY OTHER SUITABLE NETWORK SIMULATOR:

13. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.

14. Simulate a FOUR node point-to-point network with the links connected as follows: n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.
15. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
16. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
17. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/resources.php.
2. https://www.nsnam.org/support/faq/ns2-ns3.

MOOCs:

1. https://nptel.ac.in/course.php.
2. https://www.coursera.org

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Design programs for any type of TCP and UDP based client-server applications using C/C++.
CO2: Simulate a typical wired network using C/C++/NS3.
CO3: Extend the functionalities of a routing protocol using C/C++/NS3.
CO4: Implement network protocols using C/C++/NS3.
CO5: Simulate and analyse the various performance factors such as error rate, data rate, throughput etc. in Ethernet LAN.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester (Part A + Part B)	20	Execution of one program each from Part A and Part B	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC608**					
Category	Engineering Science Courses: Professional Core					
Course title	**UNIX SYSTEM PROGRAMMING - LABORATORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	0	0	3	0	1.5	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): 1. Programming in C and C++						

COURSE OBJECTIVES:

The course will enable the students to

1. Expose to programming in UNIX/ LINUX environment.
2. Understand the working of Unix Process and its environment.
3. Analyse the working of various process control functions.
4. Implement various signals and perform inter process communication using Message Queues, Semaphores, Shared Memory.
5. Develop a program to establish a Client Server Communication using Sockets.

IMPLEMENT THE FOLLOWING PROGRAMS USING C OR C++:

1. Check the following limits:
   No. of clock ticks, Max. no. of child processes, Max. path length, Max. no. of characters in a file name, Max. no. of open files/ process
2. a. Copy of a file using system calls.
   b. Output the contents of its Environment list
3. a. Emulate the UNIX *ln* command
   b. Create a child from parent process using *fork()* and counter counts till 5 in both processes and displays.
4. Illustrate two processes communicating using shared memory.
5. Demonstrate producer and consumer problem using semaphores.
6. Demonstrate round robin scheduling algorithm and calculates average waiting time and average turnaround time.
7. Implement priority-based scheduling algorithm and calculates average waiting time and average turnaround time.
8. Act as sender to send data in message queues and receiver that reads data from message queue.
9. Where a parent writes a message to *pipe* and child reads message from pipe.
10. Demonstrate setting up a simple web server and host website on your own Linux computer.
11. a. Create two threads using *pthread*, where both thread counts until 100 and joins later.

b. Create two threads using pthreads. Here, main thread creates 5 other threads for 5 times and each new thread print "Hello World" message with its thread number.

12. Using Socket APIs establish communication between remote and local processes.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Apply various API's for implementing UNIX/ LINUX Commands.

CO2: Develop programs to demonstrate various process scheduling algorithms.

CO3: Demonstrate the inter-process communication using Semaphores, Shared Memory, Message Queues etc.

CO4: Implement programs for remote process communication using sockets.

CO5: Apply these programming concepts to develop solutions for real world problems.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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PROFESSIONAL ELECTIVE - II

BANGALORE UNIVERSITY
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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPE62A</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="6">SOFTWARE DEFINED NETWORKS - THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VI CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): 1. Computer Networks</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Gain the knowledge about the working of Software Defined Networks (SDN).
2. Understand the Advanced and Emerging Networking Technologies.
3. Obtain skills to design Advanced Networking and Programming.
4. Learn to use Software Programs to perform varying and complex Networking Tasks.
5. Apply the knowledge of use cases to solve real world problems.

UNIT I: CENTRALIZED AND DISTRIBUTED CONTROL AND DATA PLANES 09 Hours

Introduction; Distributed Control Planes: IP and MPLS, Creation of the IP underlay and MPLS Overlay; Centralized Control Planes; OpenFlow; Hybrid Approaches.

UNIT II: SDN CONTROLLERS AND NETWORK PROGRAMMABILITY 10 Hours

Overview of General Concepts; Layer 3 Centric; Plexxi; CiscoOnePk. Network Programmability: The Management Interface; The Application-Network Divide; Modern Programmatic Interface; I2RS; Modern Orchestration.

UNIT III: DATA CENTER CONCEPTS AND NETWORK FUNCTION VIRTUALIZATION (NFV) 10 Hours

The Multitenant Data Center; The Virtualized Multitenant Data Center; SDN Solutions for Data Center Network; VLAN's; EVPN; VxLan; NVGRE. Network Function Virtualization (NFV): Virtualization and Data Plane I/O; Services Engineered Path; Service Locations and Chaining; NFV at ETSI; Non-ETSI NFV work.

UNIT IV: NETWORK TOPOLOGY AND TOPOLOGICAL INFORMATION ABSTRACTION 09 Hours

Introduction to Network Topology; Traditional Methods; LLDP; BGP-TE/LS; ALTO; I2RS Topology; Building an SDN Framework; Code Building; The Juniper SDN, IETF SDN, Open Daylight Controller Frameworks; SDN Policy.

UNIT V: USECASES ON SOFTWARE DEFINED NETWORKS 10 Hours

Bandwidth Calendaring; Big Data and Application Hyper-Virtualization for Instant CSPF; Data center Orchestration; Puppet; Network Function Virtualization (NFV). Use cases for Input Traffic Monitoring: Introduction; The Firewall; Firewalls as a Service; Network Access Control Replacement; Extending the Use case with a Virtual Firewall; Feedback and Optimization; Intrusion Detection/ Threat Mitigation.

TEXT BOOKS:

1. Thomas D Nadeau & Ken Gray, SDN- Software Defined Networks, O'Reilly, 2013.

REFERENCE BOOKS:

1. Paul Goransson and Chuck Black,Software, Defined Networks: A Comprehensive Approach, 1st Edition, Morgan Kaufmann Publications, 2014.
2. Siamak Azodolmolky, Software Defined Networking with OpenFlow, Packt Publishing, 2013.
3. Jim Doherty, SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization, 1st Edition, Addison Wesley, 2016.
4. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud 1st Edition, Addison-Wesley Professional, 2015.

e-BOOKS/ONLINE RESOURCES:

1. http://dl.amirkabir-science.com/book-paper/sdn/Book-SDN-Software-Defined-Networks.pdf
2. https://issuu.com/nadirchine/docs/software-defined-networks-2nd
3. https://data.kemt.fei.tuke.sk/KomunikacnaTechnika1/prednasky/7_11_2016/kniha_sietovanie.pdf

MOOCs:

1. https://www.youtube.com/watch?v=DiChnu_PAzA&list=PLY-M-dfKubpep8qnXTS_OPxvk30A9uI3w
2. https://nptel.ac.in/courses/106105183/43.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Define Software Defined Networks and recognize the difference between SDN and Traditional Networks.

CO2: Explain Advanced and Emerging Networking Technologies viz., Data Centers, NFV.

CO3: Experiment with data centers from obtained skills and solve the problems related to virtual networks by applying acquired knowledge, facts and rules in different ways.

CO4: Examine the complex networking tasks using methods available in software defined networks.

CO5: Create new and suitable solutions to real world problems based on use cases learnt.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE62B**					
Category	Engineering Science Courses: Professional Elective					
Course title	**NUMBER THEORY AND COMBINATORICS - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the concepts of number theory and solve related problems.
2. Understand the concepts of Congruences, Fermat's theorem and Primitive roots.
3. Analyse the various concepts of arranging, selecting and combining objects from a set.
4. Understand the concept of Binomial Coefficients, Inclusion-Exclusion Principle.
5. Analyse the various concepts of recurrence relation and generating functions that can be used in real world applications.

UNIT I: PRELIMINARY NUMBER THEORY ALGORITHMS 09 Hours

Mathematical Induction, The Binomial theorem. Divisibility Theory in the Integers: The Division algorithm, The Greatest Common Divisor, the Euclidean algorithm, The Diophantine equations. Primes and Their Distribution: Fundamental theorem of arithmetic.

UNIT II: THE THEORY OF CONGRUENCES 10 Hours

Basic properties of Congruence, linear congruences. Fermat's theorem: Fermat's Factorization Method, The Little theorem, Wilson's theorem. Primitive Roots and Indices: The Order of an Integer Modulo n, Primitive Roots of Primes, Composite Numbers Having Primitive Roots, The theory of Indices.

UNIT III: PERMUTATIONS AND COMBINATIONS 10 Hours

Basic Counting Principles, Permutations of sets, Combinations (Subsets) of Sets, Permutations of Multisets, Combinations of Multisets, Finite Probability. The Pigeonhole Principle: Pigeonhole Principle-Simple Form, Pigeonhole Principle-Strong Form. Generating Permutations and Combinations: Generating Permutations, Generating Combinations.

UNIT IV: THE BINOMIAL COEFFICIENTS 09 Hours

The Binomial theorem, Unimodality of Binomial Coefficients, The Multinomial Theorem, Newton's Binomial Theorem. The Inclusion-Exclusion Principle and Applications: The Inclusion-Exclusion Principle, Combinations with Repetition, Derangements.

UNIT V: RECURRENCE RELATIONS AND GENERATING FUNCTIONS 10 Hours

Some Number Sequences, Generating Functions, Exponential generating functions, Solving Linear Homogeneous Recurrence Relations, Non-homogeneous Recurrence Relations. Special Counting Sequences: Catalan Numbers, Difference Sequences and Stirling Numbers, Partition Numbers.

TEXT BOOKS:

1. David M Burton, "Elementary Number Theory", Allyn and Bacon, 1980.
2. Richard A Brualdi, Introductory Combinatorics 5th Edition, Pearson 2009.

REFERENCE BOOKS:

1. G.A Jones & J.M Jones, Elementary Number Theory, Springer UTM, 2007.
2. Niven, H.S Zuckerman & H.L Montgomery, Introduction to the Theory of Numbers, Wiley, 2000.
3. Discrete and Combinatorial mathematics – An applied introduction R.P. Grimaldi, B.V. Ramana Pearson Education (2007).
4. John M. Harris, Jeffry L. Hirst, Michael J. Mossinghoff, Combinatorics and Graph Theory, Second Edition.

e-BOOKS/ONLINE RESOURCES:

1. https://www.maths.ed.ac.uk/~v1ranick/papers/borevich.pdf.
2. http://joshua.smcvt.edu/numbertheory/book.pdf.
3. https://www.whitman.edu/mathematics/cgt_online/cgt.pdf.
4. https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/Chapter3.pdf.
5. http://math.sun.ac.za/swagner/Combinatorics.pdf.

MOOCs:

1. https://www.coursera.org/learn/combinatorics.
2. https://www.coursera.org/courses?query=number%20theory.
3. https://nptel.ac.in/courses/111103020/.
4. https://nptel.ac.in/courses/106106094/28.
5. https://nptel.ac.in/courses/102101056/16.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand Binomial theorem, Euclid's algorithm, fundamental theorem of arithmetic concepts.

CO2: Apply Chinese Remainder Theorem, Fermat's Little theory to solve computer science related problems.

CO3: Compare the various methods of counting using permutations and combinations.

CO4: Understand the concepts of binomial coefficients, Inclusion-Exclusion Principle.

CO5: Formulate the recurrence relations and generating functions and Solve the problems of recurrence relations and generating functions.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE62C**					
Category	Engineering Science Courses : Professional Elective					
Course title	**WIRELESS NETWORKS - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): 1. Computer Networks						

COURSE OBJECTIVES:

The course will enable students to

1. Understand the fundamentals of wireless communication.
2. Discuss the Wireless Spectrum Mechanisms.
3. Explore the significance of Wireless LAN.
4. Acquire Cellular Wireless Networks concepts.
5. Compare Wireless Mobile Application and Long Range Communications.

UNIT I: WIRELESS COMMUNICATIONS **09 Hours**

Introduction to wireless communications; Transmission fundamentals: Signals, analog and digital data transmission, channel capacity, Transmission media, Multiplexing, Switching Techniques.

UNIT II: WIRELESS SPECTRUM **09 Hours**

Spectrum Considerations, Line of Sight Transmission, Fading in the Mobile, Environment, Channel Correction Mechanisms, Digital Signal Encoding Techniques, Coding and Error Control, Orthogonal Frequency Division Multiplexing (OFDM), Spread Spectrum.

UNIT III : WIRELESS LAN **10 Hours**

Introduction to wireless LANs, IEEE 802 Architecture, IEEE 802.11 WLAN – Architecture and Services, Physical Layer, MAC sub layer- MAC Management Sub layer, IEEE 802.11., WLAN Security; Bluetooth: Overview and Specifications; WPAN, ZigBee.

UNIT IV: CELLULAR WIRELESS NETWORKS **10 Hours**

Principles of Cellular Networks, First Generation Analog, Second Generation TDMA, Second Generation CDMA, Third Generation Systems; 4G: LTE Architecture, Evolved Packet Core, LTE Resource Management, LTE Channel Structure and Protocols, LTE Radio Access Network, LTE Advanced.

UNIT V: WIRELESS MOBILE APPLICATION AND LONG RANGE COMMUNICATIONS **10 Hours**

Mobile Application Platform, Mobile App Development, Deployment, Mobile IP; Satellite Parameters and Configurations, Satellite, Capacity Allocation, Satellite Applications, Fixed Broadband Wireless Access; WiMAX/IEEE 802.16, Smart Grid.

TEXT BOOKS:

1. Cory Beard, William Stallings, "Wireless Communication networks and systems" Pearson / Prentice Hall of India, 1st Edition. 2016.
2. Theodore, S. Rappaport, "Wireless Communications, Principles, Practice", 2nd Edition. PHI, 2002.

REFERENCES:

1. C. Siva Ram Murthy and B. S. Manoj, "Adhoc Wireless Networks: Architectures and Protocols", 2nd Edition, Pearson Education, 2008.
2. Jochen Schiller, "Mobile Communications", Person Education, 2nd Edition., 2008.
3. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.
4. Kaveth Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", Pearson Education Asia, 2002.
5. Dharma Prakash Agrawal & Qing-An Zeng, "Introduction to Wireless and Mobile Systems", Thomson India Edition, 2nd Edition., 2007.

e-BOOKS/ONLINE RESOURCES:

1. https://files.pearsoned.de/inf/toc/9781292108728.
2. https://nptel.ac.in/courses/106105080/pdf/M5L7.pdf
3. https://nptel.ac.in/courses/.../Week-5_LTE-WLAN-Bluetooth%20and%20Future.pdf
4. https://nptel.ac.in/courses/106105080/pdf/M5L9.pdf

MOOCs:

1. https://nptel.ac.in/courses/117102062/36.
2. https://www.edx.org/course?search_query=wireless+networks.
3. https://www.coursera.org/courses?query=wireless.
4. https://www.cisco.com/c/en/us/training-events/training-certifications/training catalog/wireless.html.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Summarize the fundamentals of wireless communication.
CO2: Outline various Wireless Spectrum Mechanisms.
CO3: Demonstrate the significance of Wireless LAN.
CO4: Analyse Cellular Wireless Networks concepts.
CO5: Survey Wireless Mobile Application and Long Range Communications.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CSPE62D**					
Category	Engineering Science Courses : Professional Elective					
Course title	**DECISION SUPPORT SYSTEM – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand overview of the foundation and key issues of managerial decision making.
2. Develop and describe the structure of each DSS components.
3. Learn different methodologies for decision support system.
4. Examine group Decision Support System and related approaches such as Cognitive Mapping.
5. Design an Intelligent Decision Support System.

UNIT I: MANAGEMENT SUPPORT SYSTEM **09 Hours**

Managers and Decision Making, Managerial - Decision Making and Information Systems, Managers and Computer Support, Computerized Decision Support and the Supporting technologies, A frame work for decision support, The concept of Decision Support systems, Group Decision Support Systems, Enterprise Information Systems, Knowledge Management systems, Expert Systems, Artificial Neural Networks, Hybrid Support Systems.

UNIT II: MODELING AND SUPPORT **10 Hours**

Systems, Models, Phases of Decision-Making Process, The Intelligence Phase, The Design Phase, Decision Making: The Choice Phase, Decision Making: Implementation Phase, Decision Support, Personality types, gender, human cognition, and decision styles; The Decision –Makers. An Overview: DSS Configuration, Characteristics and Capabilities of DSS, Components of DSS, The Data Management Subsystem, The Model Management Subsystem, The User Interface Subsystem, The Knowledge-Based Management Subsystem, The User, DSS Hardware, DSS Classification.

UNIT III: DECISION SUPPORT SYSTEM DEVELOPMENT **10 Hours**

Introduction to DSS development, The Traditional System Development Life cycle, Alternate Development Methodologies, Prototyping: Development Methodology, DSS Technology Levels and Tools, DSS Development Platforms, DSS Development Tool Selection, Team-Developed DSS, End User-Developed DSS.

UNIT IV: GROUP SUPPORT SYSTEMS **09 Hours**

Group Support Systems: Group Decision Making, Communication and Collaboration, Communication Support, Computer- Supported Cooperative work, Group Support Systems, roup Support Systems Technologies, Group Systems Meeting Room and Online, The GSS Meeting Process, Distance Learning, Creativity and Idea Generation.

UNIT V: INTELLIGENT DECISION SUPPORT SYSTEM **10 Hours**

Concepts And Definition Of Artificial Intelligence, Evolution Of Artificial Intelligence and applications, Expert System: Application , Structure , Working, Problem Area Suitable Benefits and Capabilities , Problems and Limitations , Success Factors, Types of Expert System, Expert System on The Web.

TEXT BOOKS:

1. Decision Support Systems and Intelligent Systems: Efraim Turban. Jay E. Aronson, Ting-Peng Liang 8thEdition, Pearson Education, 2008.
2. Decision Support Systems : Sprague R.H. Jr and H.J. Watson, 4th Edition, Prentice Hall, 1996.

REFERENCE BOOKS:

1. Decision Support System: Daniel J. Power, London Library of Congress Cataloging-in-Publication, 2002.
2. Decision Support and Business Intelligence Systems, Dursun Delen Ramesh Sharda, Efraim Turban, 9th Edition, 2014.
3. Decision Support Systems in 21st Centuary, George M. Marakas, 1st Edition, Pearson Education, 2015.

e-BOOKS/ONLINE RESOURCES:

1. https://www.journals.elsevier.com/decision-support-systems/recent-articles.
2. http://zums.ac.ir/files/research/site/ebooks/Numerical%20Analysis%20and%20Scientific%20Computing/Decision_Support_Systems.pdf.

MOOCs:

1. https://nptel.ac.in/courses/105108081/39.
2. https://www.mooc-list.com/course/data-driven-decision-making-coursera.
3. https://www.edx.org/course/creative-problem-solving-and-decision-making-1.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Recognize different types of Decision Making strategies, frame work for decision support.

CO2: Appraise DSS characteristics, capabilities and configurations.

CO3: Design DSS Technology Levels, Methodology and Tools.

CO4: Analyze Group Decision Making, Communication and Collaboration, Communication Support.

CO5: Develop an Expert System.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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PROFESSIONAL ELECTIVE - III

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE63A**					
Category	Engineering Science Courses : Professional Elective					
Course title	**SYSTEM SOFTWARE – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

This course will enable the students to

1. Learn function of Assembler, Macro processor, Loader, Linker.
2. Apply concepts to generate object codes.
3. Analyse various Assembler design option, Loader, Macro processor design option.
4. Evaluate performance of various Assembler, Loader, and Linker.
5. Create executable code, Load executable code in memory for execution.

UNIT I: EDITORS AND MACHINE ARCHITECTURE **10 Hours**

Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship with Other Parts of the System, User-Interface Criteria. Introduction to System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples.

UNIT II: ASSEMBLERS PART I **09 Hours**

Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

UNIT III: ASSEMBLERS PART II **09 Hours**

Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - One- Pass Assembler, Multi-Pass Assembler, Implementation Examples – MASM Assembler, SPARC Assembler.

UNIT IV: LOADERS AND LINKERS **10 Hours**

Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker, Sun OS Linker.

UNIT V: MACRO PROCESSOR **10 Hours**

Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine- Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

TEXT BOOKS:

1. Leland L. Beck, "System Software", 3rd ed., Pearson Education, 1997.

REFERENCE BOOKS:

1. John R. Levine, "Linkers & Loaders", Morgan Kauffman, 2003.
2. James E Smith and Ravi Nair, "Virtual Machines", Elsevier, 2005.
3. Srimanta Pal, "Systems Programming", Oxford University Press, 2011.
4. John J Donovan, "Systems Programming", Tata McGraw-Hill, 1991.

e-BOOKS/ONLINE RESOURCES:

1. https://www.kopykitab.com/System-Software-Notes-eBook
2. http://www.faadooengineers.com/threads/7960-System-Software-Ebook-Notes-pdf-ppt-download
3. http://www.csnow.in/xadm/data_entry_module/ebook/ebook_upload/57d6404a4f0064.02270917.pdf
4. https://b-ok.cc/book/3506400/136595.

MOOCs:

1. https://study.com/academy/lesson/systems-software-utility-software-device-drivers-firmware-gui.html.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand issues related to the design and implementation of Assembler.

CO2: Distinguish Assemblers functions, Loader functions, Linker functions, and Macro Processor function.

CO3: Examine the design option available in Assembler, Loader, and Linker.

CO4: Validate object codes generated by Assembler, executable code generated by Loader & Linker by manually or using modern tools.

CO5: Design Object code for a given source program, link different object codes into Executable code file and load executable code to memory.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="7">18CIPE63B</td></tr>
<tr><td>Category</td><td colspan="7">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="7">DISTRIBUTED COMPUTING – THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td colspan="2" rowspan="3">Semester - VI CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="8">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Learn the Design Approaches and Issues related to Distributed Computing and Gain the knowledge on Clocks.
2. Understand the Concept of Mutual exclusion algorithms.
3. Apply various Deadlock Detection algorithms to detect Distributed Deadlocks.
4. Gain insight on to Agreement Protocols and Distributed Resource management components *viz.*, Scheduling Algorithms.
5. Know the aspects of Commit Protocols, Concurrency Control algorithms and its applications.

UNIT I: INTRODUCTION **09 Hours**

Distributed OS- Design Approaches and Issues in DOS. Message Passing Model and RPC. Synchronization: Concept of Lamport's Logical Clock and Vector Clocks, Termination Detection.

UNIT II: MUTUAL EXCLUSION **09 Hours**

A simple solution to Distributed Mutual Exclusion, Non Token based algorithms: Lamport's algorithm, Ricart Agarwala's algorithm, Maekawa's algorithm, Token based algorithms: Suzuki Kasami's broadcast algorithm, Raymond's Tree based algorithm.

UNIT III: DISTRIBUTED DEADLOCK DETECTION **10 Hours**

Deadlock handling, Strategies in Distributed Systems, Issues in Deadlock detection and resolution, Control Organization for Distributed Deadlock Detection, Centralized Deadlock Detection algorithm: The Ho Ramamoorthy's algorithm, Distributed Deadlock Detection algorithms: A Path- Pushing algorithm and Edge Chasing algorithm, Hierarchical Deadlock Detection algorithms: The Menasce-Muntz algorithm, The Ho Ramamoorthy's algorithm.

UNIT IV: AGREEMENT PROTOCOLS AND DISTRIBUTED SCHEDULING **10 Hours**

Agreement Protocols: The Byzantine Agreement Problem, Solution to the Byzantine Agreement Problem- Lamport -Shostak- Pease algorithm, Dolev et al.'s algorithm. Distributed

Scheduling: Issues in Load Distribution, Components of a Load Distributing algorithms, Load Distributing algorithms, Performance Comparison, selecting suitable Load Sharing algorithms, Requirements of Load Sharing Policies.

UNIT V: FAULT TOLERANCE AND CONCURRENCY CONTROL:

10 Hours

Commit Protocols, Non-blocking Commit Protocols, Voting Protocols, Dynamic Voting Protocols, The Majority Based Dynamic Voting Protocol, Dynamic Vote Reassignment Protocols. Concurrency Control: Concurrency Control algorithms, Basic Synchronization Primitives, Lock Based algorithms, Timestamp based algorithms, Optimistic algorithms, Concurrency Control algorithms for Data Replication.

TEXT BOOKS:

1. Mukesh Singhal and Niranjan G Shivaratri, Advanced Concepts in Operating Systems, Tata Mcgraw Hill, 2002.
2. Ajay D. Kshemkalyani I, Mukesh Singhal: Distributed Computing Principles, Algorithms, and Systems, Cambridge Press, 2011.

REFERENCES:

1. Pradeep K. Sinha, Distributed operating systems concepts and design, PHI Learning Private Limited Publication, 2007.
2. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education India, 2008.
3. Ceri S and Pelagorthi S, Distributed Databases: Principles and Systems, McGraw Hill, 1984.
4. Jim Gray, Andreas Reuter: Transaction Processing: Concepts and Techniques, Morgan
5. Kauffman Publishers, 1993.

e-BOOKS/ONLINE RESOURCES:

1. Advanced Concepts In Operating Systems https://books.google.co.in/books/about/Advanced_Concepts_In_Operating_Systems.html?id=nel4vdeLcqkC.
2. Distributed Computing Principles, Algorithms, and Systems
3. https://eclass.uoa.gr/modules/document/file.php/D245/2015/DistrComp.pdf.
4. Distributed Operating Systems
5. https://books.google.co.in/books/about/Distributed_Operating_Systems.html?id=l6sDRvKvCQ0C&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false.
6. Transaction Processing
7. https://books.google.co.in/books/about/Transaction_Processing.html?id=VFKbCgAAQBAJ&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false.

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc17_cs42/preview.
2. https://nptel.ac.in/courses/106106168/.
3. https://onlinecourses.nptel.ac.in/noc18_cs45/preview.
4. https://swayam.gov.in/courses/4729-july-2018-cloud-computing-and-distributed systems.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand the fundamentals of Distributed Computing, Design issues and Different Synchronization principles.
CO2: Demonstrate the Mutual Exclusion Concepts in DOS.
CO3: Analyze Deadlock Detection Algorithms of Distributed Operating System.
CO4: Discuss Agreement Protocols, various resource Scheduling techniques.
CO5: Design Commit Protocols and Concurrency Control algorithms in Distributed Systems.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE63C**					
Category	Engineering Science Courses : Professional Elective					
Course title	**STORAGE AREA NETWORKS - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

This course will enable the students to

1. Understand storage centric and server centric systems.
2. Apply various metrics used for designing storage area networks.
3. Analysis RAID concepts.
4. Evaluate data maintains at data centres with the concepts of backup.
5. Create techniques for data storage management at data centres.

UNIT I: INTRODUCTION **10 Hours**

Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

UNIT II: I/O TECHNIQUES **10 Hours**

The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

UNIT III: STORAGE VIRTUALIZATION **10 Hours**

Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Networks.

UNIT IV: SAN ARCHITECTURE AND HARDWARE DEVICES **09 Hours**

Overview, Creating a Network for storage; SAN Hardware devices; The fiber channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

UNIT V: MANAGEMENT OF STORAGE NETWORK **09 Hours**

System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage.

TEXT BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India 2013.
2. Robert Spalding: "Storage Networks: The Complete Reference", Tata McGraw-Hill, 2011.
3. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
4. Richard Barker and Paul Massiglia: "Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

REFERENCES:

1. Jon Tate, Introduction to Storage Area Networks, "Shroff Publishers", First Edition, 2016.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106108058/

MOOCs:

1. https://www.mooc-list.com/tags/storage-area-network
2. http://www.virtualnuggets.com/emcs--storage-area-network.html

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Distinguish storage centric and server centric systems.
CO2: Determine the need for performance evaluation and the metrics used for it.
CO3: Extrapolate RAID and different RAID levels.
CO4: Validate data maintained at data centres.

CO5: Develop techniques for storage management.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CSPE63D</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="6">OPTICAL NETWORK - THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - VI CSE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
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<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the concepts of Optical Networks.
2. Compare different networking components.
3. Analyse First and Second Generation Networks.
4. Learn SONET & WDM Network Design.
5. Compare EPON, GPON, WDN, HFC, FFTC and OTDM.

UNIT I: INTRODUCTION TO OPTICAL NETWORKS **09 Hours**

Telecommunication networks overview and architecture, Multiplexing techniques, Wavelength Division Multiplexing (WDM) optical networks, WDM network evolution, broadcast and select optical WDM network, System and network evolution. Nonlinear effects SPM, CPM, four wave mixing, Solutions. Advantages and challenges of optical networks.

UNIT II: NETWORKING COMPONENTS/BUILDING BLOCKS **09 Hours**

Optical transmitters, detectors, Switches, Wavelength converters, Transmission System Engineering-Couplers, isolators and Circulators, Multiplexes and filters Optical amplifiers. System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration.

UNIT III: FIRST AND SECOND GENERATION NETWORKS **10 Hours**

Basic Networks-SONET/SDH, Computer interconnects, Mans, Layered architecture for SONET and second generation networks, Wavelength Routing Networks- Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations-fixed routing-fixed adaptive routing, fault tolerant routing.

UNIT IV: VIRTUAL TOPOLOGY DESIGN **10 Hours**

Virtual topology design problem, SONET & WDM network design, an ILP formulation, Regular virtual topologies, Control and management, Network management configuration management, Performance management, fault management.

UNIT V: ACCESS NETWORKS **10 Hours**

Introduction to access network, PON(Passive optical networks),EPON and GPON and WDN EPON: overview, principles of operations Network architecture overview, present and future access networks, HFC, FTTC, Optical access networks Deployment considerations, Photonic packet switching, OTDM, Multiplexing and demultiplexing Synchronization.

TEXT BOOKS:

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, 2nd edition, Morgan Kaufmann Publishers.

REFERENCES:

1. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education.
2. Venugopal K R, Wavelength converters in all optical networks, IK-Publishers.
3. Biswanath Mukherjee, Optical WDM Networks, Springer.
4. C. Siva Ram Murthy, Mohan Gurusamy, WDM Optical Networks Concepts and Design and Algorithms, Prentice-Hall.
5. Hussein T. Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/resources.php.
2. https://www.coursera.org.
3. https://link.springer.com/journal/11078.

MOOCs:

1. https://nptel.ac.in/course.php.
2. https://www.coursera.org.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand optical Networks.
CO2: Compare the different networking components.
CO3: Gain the knowledge of SONET and WDM design.
CO4: Understand the different Access Networks.
CO5: Analyse virtual topology design problems.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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OPEN ELECTIVE - II

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIOE62A**					
Category	Engineering Science Courses: Open Elective					
Course title	**SOFT COMPUTING – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Describe soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. Choose Neural network algorithms for real world problems.
3. Analyse fuzzy logic concepts, fuzzy principles & relations.
4. Develop the applications of Genetic Algorithms in Machine Learning.
5. Be familiar with design of various neural networks.

UNIT I: INTRODUCTION TO SOFT COMPUTING **09 Hours**

Concept of Computing Systems, Evolution of Soft Computing- Soft Computing Constituents, Machine Learning Basics, Soft Computing Versus Hard Computing, Characteristics of Soft Computing, Artificial Intelligence, Learning Methods- Supervised Learning, Unsupervised Learning, Reinforcement Learning, Computational Intelligence.

UNIT II: ARTIFICIAL NEURAL NETWORKS **10 Hours**

Introduction, Characteristics, Taxonomy, Evolution of Neural Networks, Basic Models, Important Technologies, Applications, McCulloch-Pitts Neuron, Linear Separability, Hebb Network, Perceptron Networks, Adaptive Linear Neuron (Adaline), Back Propagation Network, Kohonen Self Organizing Feature Maps.

UNIT III: FUZZY LOGIC **10 Hours**

Introduction to Fuzzy logic, Crisp Sets, Fuzzy Sets, and Operations on Fuzzy sets, Classical Relation, Fuzzy Relations, Tolerance and Equivalence Relations. Membership Functions: Features of Membership Functions, Fuzzification, Methods of membership value assignments, Defuzzification: Lambda-cuts of fuzzy sets, Methods, Fuzzy Rule Base and Approximate Reasoning-Truth Values and Tables, Fuzzy Propositions, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Fuzzy Reasoning- Fuzzy Inference Systems, Overview of Fuzzy Expert System, Fuzzy Decision Making.

UNIT IV: GENETIC ALGORITHMS **10 Hours**

Introduction to Genetic Algorithms (GA), Simple Genetic Algorithms, The Schema Theorem, General Genetic Algorithms, Operations on Genetic Algorithms– Population, Encoding, Selection, Crossover, Mutation, Applications of Genetic Algorithms in Machine Learning-Machine Learning Approach to Knowledge Acquisition, Classification of Genetic Algorithms.

UNIT V: HYBRID SYSTEMS & APPLICATIONS **09 Hours**

Hybrid Systems: Neuro-Fuzzy Hybrid System, Neuro-Genetic Hybrid System, Fuzzy-Genetic Hybrid System, Applications of Soft Computing, Image Processing, Optimization, Search Engines, Real Time Applications.

TEXT BOOKS:

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt Ltd, 2012.
2. Samir Roy, Udit Chakraborty, "Introduction to Soft Computing-Neuro-Fuzzy and Genetic Algorithms", First Edition, 2013.
3. David E Goldberg, "Genetic Algorithms in Search Optimization and Machine Learning", Addison Wesley, 1997.

REFERENCE BOOKS:

1. Bart Kosko, "Neural Network and Fuzzy Systems: A Dynamic System Approach to Machine" Prentice-Hall 1998.
2. L. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms, and Applications", Prentice-Hall, 1994.
3. Jack M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishing Co., Boston, 2002.

e-BOOKS/ONLINE RESOURCES:

1. https://bookboon.com/en/introduction-to-soft-computing-ebook.
2. https://Introduction-Soft-Computing-Rajdev-Tiwari-ebook/dp/B007GFX3II.

MOOCs:

1. http://nptel.ac.in/courses/117105084/.
2. http://nptel.ac.in/courses/108104049/.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Analyse the concepts and techniques of soft computing and their roles in building Intelligent Machines.

CO2: Understand and apply various feed forward networks.

CO3: Apply Fuzzy Logic and reasoning to handle uncertainty and solve various engineering problems.

CO4: Evaluate various Genetic Algorithms in Machine Learning.
CO5: Design solutions using various soft computing approaches for a given problem.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIOE62B**					
Category	Engineering Sciences Courses : Open Elective					
Course title	**CYBER LAWS AND SECURITY - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VI CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Define the area of cybercrime and forensics.
2. Explain the motive and causes for cybercrime, detection and handling.
3. Investigate Areas affected by cybercrime.
4. Illustrate tools used in cyber forensic.
5. Infer legal Perspectives in cyber security.

UNIT I: INTRODUCTION **10 Hours**

Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications, The Legal Perspectives, An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT II: CYBERCRIME **09 Hours**

Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT III: TOOLS AND METHODS USED IN CYBERCRIME **09 Hours**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

UNIT IV: COMPUTER FORENSICS **10 Hours**

Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.

UNIT V: SECURITY POLICIES AND CYBER LAWS **10 Hours**

Need for an Information Security Policy, Information Security Standards – Iso, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property – Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License.

TEXT BOOKS:

1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. “Introduction to information security and cyber laws”. Dreamtech Press. ISBN: 9789351194736, 2015.

REFERENCE BOOKS:

1. Thomas J. Mowbray, “Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions”, Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 - 1-118 -84965 -1.
2. James Graham, Ryan Olson, Rick Howard, “Cyber Security Essentials”, CRC Press, 15-Dec-2010.

e-BOOKS/ONLINE RESOURCES:

1. http://www.cyberforensics.in/
2. http://news.asis.io/sites/default/files/Investigating_Intrusions_Network_Cyber Crime.pdf

MOOCs:

1. MOOCs Course on Coursera “Introduction to Forensic Science”, https://www.coursera.org/course/ntufsc
2. Computer and Hacking Forensics", https://www.cybrary.it/course/computer-hackingforensics-analyst/

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Define cyber security, cyber law and their roles.
CO2: Demonstrate cyber security cybercrime and forensics.
CO3: Infer legal issues in cybercrime.
CO4: Demonstrate tools and methods used in cybercrime and security.
CO5: Illustrate evidence collection and legal challenges.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CSOE62C</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Open Elective</td></tr>
<tr><td>Course title</td><td colspan="6">SIMULATION AND MODELING - THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VI CSE</td></tr>
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<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the various cloud services and applications.
2. Learn the concept of virtualization.
3. Gain knowledge in the cloud resource management and scheduling.
4. Understand the security issues in cloud computing.
5. The various system modeling and simulation techniques, and highlight their applications in different areas.

UNIT I: INTRODUCTION **09 Hours**

When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet.

UNIT II: GENERAL PRINCIPLES, SIMULATION SOFTWARE **10 Hours**

Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing. Simulation in Java; Simulation in GPSS. Statistical models in simulation - Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT III: QUEUING MODELS **09 Hours**

Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behaviour of M/G/1 queue; Networks of queues; Rough-cut modeling: An illustration.

UNIT IV: RANDOM-NUMBER GENERATION, RANDOM-VARIATE GENERATION **10 Hours**

Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random-Variate Generation: Inverse

transform technique; Acceptance-Rejection technique; Special properties. INPUT MODELING - Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

UNIT V: IV ESTIMATION OF ABSOLUTE PERFORMANCE 10 Hours

Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations. Verification, calibration, and validation; optimization-Model building, verification and validation; Verification of simulation models; Calibration and validation of models, Optimization via Simulation.

TEXT BOOKS:

1. Jerry Banks and John Carson, "Discrete Event System Simulation", Fifth Edition.

REFERENCES:

1. Geoffrey Gordon, "System Simulation", Second Edition, PHI, 2006 (Unit – V).
2. Frank L. Severance, "System Modeling and Simulation", Wiley, 2001.
3. Averill M. Law and W. David Kelton, "Simulation Modeling and Analysis, Third Edition, McGraw Hill, 2006.
4. Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice", Wiley, 1998.
5. Sheldon M. Ross: Introduction to Probability Models 7th Edition, Academic Press, 2002.
6. Donald E. Knuth: The Art of Computer Programming - Volume 2: Semi Numerical Algorithms, 2nd Edition, PEARSON.
7. Education, Reading MA, USA 2000.
8. Sheldon M. Ross: Simulation 3rd Edition, Academic Press, 2002.
9. M. Law and W. D. Kelton. Simulation Modeling and Analysis, 3rd Edition, McGrawHill, New York, USA, 1998.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112107214/4

MOOCs:

1. https://www.coursera.org/lecture/modeling-simulation-natural-processes/modeling-and-simulation-F7vas

COURSE OUTCOMES:

The students should be able to

CO1: Knowledge and understanding

Understand different methods for random number generation and understanding of the need for the development process to initiate the real problem to have a clear understanding of principle and techniques of simulation methods informed by research direction.

CO2: Cognitive skills (thinking and analysis)

Be able to describe the components of continuous and discrete systems and simulate them and to model any system from different fields and be able to implement numerical algorithm to meet simple requirements, expressed in English and be able to discuss the simulation methods and select the suitable technique on the problems.

CO3: Communication skills (personal and academic)

Know how to simulate any discrete system using queuing systems. Be able to work effectively with others.

CO4: Practical skills

Use a range of commercial software packages to construct, verify and validate models of the given systems.

CO5: Pedagogy for Course Delivery

The class will be taught using theory and case based method. In addition to assigning the case studies, the course instructor will spend considerable time in understanding the concept of innovation through the eyes of the consumer. The instructor will cover the ways to think innovatively liberally using thinking techniques.

SCHEME OF EXAMINATION:

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VII SEMESTER CSE

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC701</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses: Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">INTERNET OF THINGS – THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td><td></td></tr>
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</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the IoT architecture, applications and it's enabling technologies.
2. Understand the IoT System Management.
3. Understand the IoT Design Methodology.
4. Learn Python Programming for Raspberry.
5. Understand Cloud Storage Models, Web Application Framework and Web Services for IoT.

UNIT I: INTRODUCTION TO INTERNET OF THINGS (IoT) 10 Hours

Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates. Domain Specific IoT - Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

UNIT II: IoT AND M2M 09 Hours

M2M, Difference between IoT and M2M, SDN and NFV for IoT, Need for IoT Systems Management, Simple Network Management Protocol, Network Operator Requirements, IoT System Management with NETCONF-YANG.

UNIT III: IoT DESIGN METHODOLOGY AND IoT SYSTEMS 10 Hours

Purpose and Requirements Specification, Process Specification, Information Model Specification, Service Specification, IoT Level Specification, Functional View Specification, Operational Level Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring. Logical Design using Python – Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes, Python Packages of Interest for IoT.

UNIT IV: IoT PHYSICAL DEVICES AND ENDPOINTS **09 Hours**

Basic Building Blocks of an IoT device, About Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Controlling LED, Interfacing LED and Switch, Interfacing Light Sensor.

UNIT V: IoT PHYSICAL SERVERS AND CLOUD OFFERINGS **10 Hours**

Introduction to Cloud Storage Models and Communication APIs, Python Web Application Framework – Django, Django Architecture, Development with Django, Designing RESTful Web API, Amazon Web Services for IoT.

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", University Press, 2015.

REFERENCE BOOKS:

1. Raj Kamal, Internet of Things – Architecture and Design Principles, McGraw Hill, 2017.
2. Peter Waher, "Learning Internet of Things", PACKT Publishing, 2015.
3. Adrian McEwen and Hakim Cassimally, "Designing Internet of Things", John Wiley and Sons, 2014.

e-BOOKS/ONLINE RESOURCES:

1. https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf
2. http://www.internet-of-things-research.eu/pdf/Digitising_the_Industry_IoT_IERC_2016_Cluster_eBook_978-87-93379-82-4_P_Web.pdf
3. http://www.buyya.com/papers/IoT-Book2016-C1.pdf
4. http://www.mforum.ru/arc/iot-book_compressed_MForum.pdf
5. http://madsg.com/wp-content/uploads/2015/12/Designing_the_Internet_of_Things.pdf

MOOCs:

1. https://www.edx.org/micromasters/curtinx-internet-of-things-iot
2. https://www.mooc-list.com/tags/iot
3. https://www.coursera.org/specializations/internet-of-things
4. https://www.my-mooc.com/en/categorie/internet-of-things
5. https://www.engineering.com/Education/EducationArticles/ArticleID/13506/Interested-in-IoT-These-MOOCs-Might-Be-for-You.aspx

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Demonstrate the knowledge of IoT architecture and design.

CO2: Analyse the need of IoT System Management and Apply.
CO3: Design an IoT System using Design Methodology
CO4: Develop Applications using Raspberry Pi and Python.
CO5: Test connectivity using AWS IoT Test service provided by Amazon.

SCHEME OF EXAMINATION:

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC702</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">MACHINE LEARNING – THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - VII CSE/ISE</td></tr>
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<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable students to

1. Understanding the importance of concepts of machine learning algorithms.
2. Exploring the significance of decision tree learner in machine learning.
3. Identifying the concepts and working of artificial neural networks.
4. Recognizing the principles of Bayesian learning.
5. Ascertaining the concepts of hypothesis, instance based learning & reinforcement learning.

UNIT I: INTRODUCTION TO MACHINE LEARNING **09 Hours**

Introduction, Well posed learning problems, Designing a learning system: Choosing training experience, Choosing target function, Choosing a representation for target function, Choosing a function approximation algorithm, The final design, Perspective and Issues in Machine Learning. Concept Learning: Concept Learning Task, Concept learning as search, Find-S algorithm, Version Space and Candidate Elimination algorithm, Inductive Bias.

UNIT II: DECISION TREE LEARNING **10 Hours**

Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm: The best attribute classifier, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Avoiding data overfitting, Post rule pruning. Incorporating continuous-valued attributes, Alternative measures for selecting attributes, Handling training examples with missing attribute values, Handling attributes with different costs.

UNIT III: ARTIFICIAL NEURAL NETWORKS **10 Hours**

Introduction: Biological motivation. Neural network representations, Appropriate problems for neural network learning, Perceptrons: Representational power of perceptrons, The perceptron training rule, Illustration of Perceptron training rule, Gradient Descent and Delta Rule, Multilayer networks and Backpropagation algorithm: Differentiable threshold unit, The Backpropagation algorithm, Learning in Arbitrary Acyclic Networks, Derivation of the Backpropagation rule.

UNIT IV: BAYESIAN LEARNING **09 Hours**

Introduction, Bayes Theorem, Bayes Theorem and Concept Learning: Brute-Force Bayes Concept Learning, MAP hypothesis and Consistent Learners; Maximum likelihood and least-squared error hypothesis, Maximum likelihood hypothesis for predicting probabilities, Minimum description length principle, Naïve Bayes classifier, Bayesian Belief Networks, The Expectation Maximization algorithm.

UNIT V: EVALUATING HYPOTHESIS, INSTANCE BASED AND REINFORCEMENT LEARNING **10 Hours**

Estimating hypothesis accuracy: Sample error and true error, Confidence interval for discrete-valued hypothesis; Basics of Sampling Theory: Error estimation and estimating Binomial Proportions, The Binomial Distribution, Mean and Variance, Estimators, Bias and Variance, Confidence Intervals; Two-sided and One-sided Bounds. Instance Based Learning: Introduction, k-nearest neighbour learning, Locally weighted regression, Radial Basis Functions, Case Based Reasoning. Reinforcement Learning: Introduction, The learning task, Q learning, Temporal difference learning, Relationship to Dynamic Programming.

TEXT BOOKS:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

REFERENCE BOOKS:

1. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, 2nd Edition, 2010.
2. An Introduction to Machine Learning, Kubat, Miroslav, Springer Verlag, 2015.

e-BOOKS/ONLINE RESOURCES:

1. http://ai.stanford.edu/~nilsson/mlbook.html.
2. http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html.
3. http://web4.cs.ucl.ac.uk/staff/D.Barber/pmwiki/pmwiki.php?n=Brml.Online.

MOOCs:

1. https://www.coursera.org/learn/machine-learning.
2. https://medium.com/@amarbudhiraja/MOOCs-for-machine-learning-5a2f2c6cdcfe.
3. https://onlinecourses.nptel.ac.in/noc19_cs35/preview.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Realizing the importance of basic machine learning concepts.
CO2: Understanding the principles of decision tree learning.
CO3: Distinguish between different types of neural network learners.
CO4: Examining the significance of Bayesian learning and its applications.
CO5: Analysing the significance of reinforcement algorithms towards real world problems.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC705**					
Category	Engineering Science Courses : Professional Core					
Course title	**INTERNET OF THINGS - LABORATORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	0	0	3	0	1.5	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable students to

1. Learn the features of Raspberry Pi and Arduino MCU boards.
2. Learn how to program the Raspberry Pi and Arduino MCU boards.
3. Demonstrate various experiments on Raspberry Pi and Arduino MCU boards.
4. Use IoT enabling technologies to design an IoT System.
5. Apply the MQTT protocol for IoT system Design.

DESCRIPTION:

Design, develop, and implement the specified programs for the following problems using Raspberry Pi and Arduino MCU boards.

LAB PROGRAMS

1. Learn the basics of Arduino MCU boards, features and pinouts of Arduino UNO, differentiate between READ and WRITE pins, install and configure the Arduino IDE, and basics of soldering.
2. Arduino program to blink an LED and implement a traffic signal system using digitalWrite() and pinMode() functions.
3. Arduino program to vary the intensity of LED based on the reading of Light Dependent Resistor (LDR) using analogRead() and analogWrite() functions.
4. Arduino program to toggle LED by pressing a button and to implement a switch debounce circuit to prevent glitches in user input.
5. Arduino program to implement a serial communication event.
6. Arduino program to implement a temperature and humidity sensor and switch ON an LED if the temperature is too hot.
7. Arduino program to drive a DC motor and a stepper motor.
8. Arduino program to implement an ultrasonic sensor to measure distance to an obstacle and "buzz" when too close to object.
9. Arduino program to implement a 16x2 LCD alphanumeric display and display temperature and current date and time.

10. Arduino program to implement a GSM module and send SMS using some carrier to a cellphone number.
11. Learn the basics of Raspberry Pi, features, pinout and configuration.
12. Program to implement MQTT protocol and publish some data.

COURSE OUTCOMES:

The student at the end of the course, will be able to

CO1: Demonstrate the usage of Raspberry Pi and Arduino MCU boards.
CO2: Implement various experiments on Raspberry Pi and Arduino MCU boards for IoT system design.
CO3: Develop Applications using Raspberry Pi, Arduino MCU boards and Python.
CO4: Test connectivity using AWS IoT Test service provided by Amazon.
CO5: Implement other application protocols and publish data.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC706</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">MACHINE LEARNING - LABORATORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable students to

1. Understand the applications of machine learning algorithms on different datasets.
2. Implement the machine learning algorithms in any programming language of choice.
3. Apply the concepts of Artificial Neural Networks for some applications.
4. Understanding the importance of concepts of machine learning algorithms.
5. Exploring the significance of decision tree learner in machine learning.

NOTE:

1. The data sets for the laboratory experiments can be downloaded from public repositories (https://archive.ics.uci.edu/ml/datasets.html) or can be constructed by the students themselves.
2. The programs can be implemented in either Python or Java programming language.
3. For experiments from 1 to 6 and 10 no build-in functions/APIs are to be used from either Python/Java.

LAB EXPERIMENTS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the Naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply K-Means algorithm to cluster a set of data stored in a .CSV file. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

COURSE OUTCOMES:

The students at the end of the course, will be able to
CO1: Realizing the importance of basic machine learning concepts.
CO2: Understanding the principles of decision tree learning.
CO3: Distinguish between different types of neural network learners.
CO4: Examining the significance of Bayesian learning and its applications.
CO5: Analyzing the significance of reinforcement algorithms towards real world problem.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks. *****

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC707**					
Category	Engineering Science Courses : Professional Core					
Course title	**PRELIMINARY PROJECT**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	0	0	6	0	3	
CIE Marks: 50			Total Max. Marks: 50			
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. To select a problem applying relevant knowledge and skills acquired during the program.
2. To carry out literature survey to identify and present the problem formulation.
3. To finalize the specification of the project work, prepare project plan and methodology, considering professional, cultural and societal factors.
4. To develop experimental planning and select appropriate techniques and tools to conduct experiments to evaluate and critically examine the outcomes.
5. To prepare synopsis and preliminary report for approval of topic selected.
6. To develop oral and written communication skills to effectively convey the technical content.

GUIDELINES:

1. The preliminary project work starts at the beginning of 7th semester with the formation of team consisting of 2 to 4 students.
2. The topic of the project work should be finalized by the team in consultation with the project guide.
3. The project work is carried out on-campus/off-campus along with the course work.
4. The project team shall update the guide, on the progress of work, once in a week.
5. A project report and a presentation on the work shall be prepared.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Identify a real life/engineering problem, utilize prior knowledge and conduct extensive survey, in addressing the problem and generating abstract design.

CO2: Plan, monitor and manage project schedule, resources and work assignments to ensure timely completion.

CO3: Perform professionally as a team member, accepting responsibility, taking initiative and providing leadership necessary to ensure progress of project.

CO4: Use formal and informal communications with team members and guide, make presentations and prepare technical document.

CO5: Provide methodology for solution within the context of legal framework addressing the societal and environmental concerns and upholding ethical issues.

Rubrics for CIE:

1. Introduction and justification of topic : 10%
2. Literature survey and conclusion : 30%
3. Objectives and scope of project work : 30%
4. Methodology to be adopted : 20%
5. Presentation of contents to project work : 10%

NOTE: The percentage mentioned above indicates marks allocation.

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PROFESSIONAL ELECTIVE - IV

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE74A**					
Category	Engineering Science Courses : Professional Elective					
Course title	**HIGH PERFORMANCE COMPUTING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the key factors affecting the performance of computer science and engineering applications.
2. Develop ability to map applications to high-performance computing systems.
3. Design hardware/software for achieving performance on real-world applications.
4. Learn the usage of parallel algorithms and parallel programming.
5. Develop ability to achieve better performance.

UNIT I: COMPUTATIONAL SCIENCE AND ENGINEERING INTRODUCTION **10 Hours**

Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multiscale, multi discipline applications).

UNIT II: HIGH-END COMPUTER SYSTEMS **10 Hours**

Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared memory Symmetric Multiprocessors, Vector Computer, Distributed Memory Computers, Supercomputers and Peta scale Systems, Application Accelerators/Reconfigurable Computing, Novel computers: Stream, multithreaded and purpose-built.

UNIT III: PARALLEL ALGORITHMS **09 Hours**

Parallel models: ideal and real frameworks, Basic Techniques: Balanced Tress, Pointer Jumping, Divide and conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Tress, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques.

UNIT IV: PARALLEL PROGRAMMING **10 Hours**

Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P,

Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays).

UNIT V: ACHIEVING PERFORMANCE **09 Hours**

Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks.

REFERENCES:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Welsey, 2003.
2. David A. Bader (Ed.), Chapman & Hall "Petascale Computing: Algorithms and Applications", CRC Computational Science Series, 2007.
3. Grama, A. Gupta, G. Karypis, V. Kumar, "An Introduction to Parallel Computing, Design and Analysis of Algorithms" 2nd Edition, Addison-Wesley, 2003.
4. G.E. Karniadakis, R.M. Kirby II, "Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation", Cambridge University Press, 2003.
5. Wilkinson and M. Allen, "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers", 2nd Edition, Prentice Hall, 2005.
6. Peter Pacheco, *An Introduction to Parallel Programming*, Morgan Kaufmann, 2011, ISBN 978-0123742605.

e-BOOKS/ONLINE RESOURCES:

1. https://www.oreilly.com/library/view/introduction-to-parallel/0201648652/
2. https://www.cambridge.org/core/books/parallel-scientific-computing-in-c-and-mpi/B9F38F023D507F1CCEB06ED755171FA9
3. https://www.crcpress.com/Petascale-Computing-Algorithms-and-Applications/Bader/p/book/9781584889090

MOOCs:

1. https://www.mooc-list.com/course/high-performance-scientific-computing-coursera
2. https://www.futurelearn.com/courses/high-performance-computing-cloud

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Acquainted with the fundamental programming techniques for high performance computer architectures.

CO2: Able to design, implement and benchmark parallel programs on shared-memory and distributed-memory systems.

CO3: Understand the various paradigms of high performance computing and their potential

for performance and programmability.

CO4: Write algorithms that yield good performance on high-performance architectures.

CO5: Able to estimate and evaluate the performance of various machine architectures.

SCHEME OF EXAMINATION:

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</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE74B**					
Category	Engineering Science Courses : Professional Elective					
Course title	**MOBILE COMPUTING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand Wireless Transmission Technologies and its applications.
2. Learn various Technologies such as SDMA, FDMA, TDMA, CDMA, GSM, DECT and TERA.
3. Compare IEEE 802.11 and Bluetooth.
4. Overview the different Routing Protocols in Mobile Network Layer.
5. Analyse Traditional TCP, Classical TCP, TCP over 2.5/3G Wireless networks and various wireless application protocols.

UNIT I: INTRODUCTION TO MOBILE COMPUTING & WIRELESS TRANSMISSION **09 Hours**

Introduction to Mobile Computing: Applications, Vehicles, Emergencies, Business, Replacement of wired networks, Infotainment and more, Location dependent services, Mobile and wireless devices, A short history of wireless communication, A market for mobile communications, Some open research topics, A simplified reference model. Wireless transmission: Frequencies for radio transmission, Regulations, Signal propagation, Path loss of radio signals, Additional signal propagation effects, Multi-path propagation, Multiplexing, Space division multiplexing, Frequency division multiplexing, Time division multiplexing, Code division multiplexing, Modulation, Amplitude shift keying, Frequency shift keying, Phase shift keying, Advanced frequency shift keying, Advanced phase shift keying, Multi-carrier modulation, Spread spectrum, Direct sequence spread spectrum, Frequency hopping spread spectrum, Cellular systems.

UNIT II: MEDIUM ACCESS CONTROL & TELECOMMUNICATIONS SYSTEMS **10 Hours**

Medium Access Control: Motivation for a specialized MAC, Hidden and exposed terminals, Near and far terminals, SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access, CDMA, Spread Aloha multiple access, Comparison of S/T/F/CDMA, Telecommunications systems: GSM, Mobile services, System architecture, Radio interface,

Protocols, Localization and calling, Handover, Security, New data services, DECT, System architecture, Protocol architecture.

UNIT III: WIRELESS LAN **10 Hours**

Infrared V/s radio transmission, Infrastructure and ad-hoc network, IEEE 802.11, System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, 802.11b, 802.11a, HIPERLAN, Historical: HIPERLAN 1, HiperLAN2, Bluetooth, User scenarios, Architecture, Radio layer, Baseband layer, Link manager protocol, L2CAP, Security, SDP, Profiles, IEEE 802.15.

UNIT IV: MOBILE NETWORK LAYER **09 Hours**

Mobile IP, Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimizations, Reverse tunneling, IPv6, IP micro-mobility support, Dynamic host configuration protocol, Mobile ad-hoc networks, Routing, Destination sequence distance vector, Dynamic source routing, Alternative metrics, Overview ad-hoc routing protocols.

UNIT V: MOBILE TRANSPORT LAYER & SUPPORT FOR MOBILITY **10 Hours**

Mobile Transport Layer: Traditional TCP, Congestion control, Slow start, Fast retransmit/fast recovery, Implications of mobility, Classical TCP improvements, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction-oriented TCP, TCP over 2.5/3G wireless networks, Performance enhancing proxies. Support for Mobility: System architecture, Wireless application protocol (version 1.x), Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML Script, Wireless telephony application, Push architecture, Push/pull services.

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley. II Edition, 2004.

REFERENCES:

1. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007.
2. Ashok Talukder, RoopaYavagal, and Hasan Ahmed, “Mobile Computing, Technology, Applications and Service Creation”, II Edition, Tata McGraw Hill, 2010.
3. Hansmann, Merk, Nicklous, Stober, “Principles of Mobile Computing”, Springer, II Edition, 2003.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/resources.php
2. https://www.tutorialspoint.com/mobile_computing/mobile_computing_useful_resources.htm
3. https://onlinelibrary.wiley.com/journal/15308677

MOOCs:

3. https://nptel.ac.in/course.php
4. https://www.coursera.org

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand Wireless Transmission Technologies and applications.
CO2: Learn various Mobile Technologies.
CO3: Compare IEEE 802.11 and Bluetooth technologies.
CO4: Understand the working of different Mobile routing protocols in Network layer.
CO5: Investigate the recent developments in wireless computing.

SCHEME OF EXAMINATION:

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<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE74C**					
Category	Engineering Science Courses: Professional Elective					
Course title	**SOCIAL NETWORK ANALYSIS - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the concept of semantic web and related applications.
2. Absorb knowledge representation using ontology.
3. Analyse the Evaluation method on Web Social Networks Extraction.
4. Understand the concepts of Semantic-Based Social Network Analysis and Case studies.
5. Acquire knowledge of visualization and applications of social networks.

UNIT I: INTRODUCTION **09 Hours**

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

UNIT II: MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION **10 Hours**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation, Ontology languages for the Semantic Web: Resource Description Framework, Web Ontology Language, Modelling and aggregating social network data: State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced representations.

UNIT III: DEVELOPING, EVALUATION OF WEB SOCIAL NETWORKS EXTRACTION **10 Hours**

Building Semantic Web applications with social network features, the generic architecture of Semantic Web applications, Sesame, Elmo, GraphUtil, and Flink: the social networks of the Semantic Web community, the features of Flink, System design, and open academia: distributed, semantic-based publication management, the features of open academia, System design. Evaluation of web-based social network extraction: Differences between survey methods and electronic data extraction, Context of the empirical study, Data collection,

Preparing the data, optimizing goodness of fit, Comparison across methods and networks, Predicting the goodness of fit, Evaluation through analysis.

UNIT IV: ONTOLOGIES, SEMANTIC-BASED SOCIAL NETWORK ANALYSIS

10 Hours

Context, Methodology, Data acquisition, Representation, storage and reasoning, Visualization and Analysis, Results, Descriptive analysis, Structural and cognitive effects on scientific performance. Ontologies are us: emergent semantics in folksonomy systems: A tripartite model of ontologies, Ontology enrichment. Case studies: Ontology emergence in del.icio.us, Community-based ontology extraction from Web pages, Evaluation.

UNIT V: VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

09 Hours

Graph theory: Graph Traversals and Distances, Graph Distance, Centrality, Power, and Bottlenecks, Cliques, Clusters and Components: Components and Subgraphs, Subgraphs—Ego Networks, Triads, Cliques, Hierarchical Clustering, Triads, Network Density, and Conflict.

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2. Social Network Analysis for Startups, Maksim Tsvetovat and Alexander Kouznetsov, oreilly 2011.

REFERENCE BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, 2008.

e-BOOKS/ONLINE RESOURCES:

1. http://www.dce.edu.in/question-bank/cs6010-sna-add-qb.pdf
2. https://ocw.mit.edu/courses/sloan-school-of-management/15-599-workshop-in-it-collaborative-innovation-networks-fall-2011/lecture-notes/MIT15_599F11_lec04.pdf

MOOCs:

1. http://openscienceasap.org/education/courses/social-network-analysis/.
2. https://www.my-mooc.com/en/mooc/sna/.
3. https://www.classcentral.com/course/coursera-social-network-analysis-338.
4. https://www.coursera.org/courses?query=social%20network%20analysis.

COURSE OUTCOMES:

The students at the end of the course, will be able to
CO1: Develop semantic web related applications.
CO2: Apply the knowledge using ontology.

CO3: Compare the various methods on Web Social Networks.
CO4: Apply various case studies on Semantic-Based Social Network Analysis.
CO5: Analyse the concepts of visualization and applications of social networks.

SCHEME OF EXAMINATION:

<table>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	18CSPE74D					
Category	Engineering Science Courses: Professional Elective					
Course title	**DIGITAL IMAGE PROCESSING-Theory**					
Scheme and Credits	No. of Hours/Week					Semester – VII CSE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 3 Hrs
Prerequisites (if any): NIL						

Course Objectives:
The course will enable the students to

1. Define the fundamental concepts in image processing
2. Evaluate techniques followed in image enhancements in spatial domain
3. Compare spatial and frequency domain enhancement techniques
4. Illustrate image segmentation
5. Implement Image compression algorithms

UNIT I: Introduction **09 Hours**
Fundamental Steps in Digital Image Processing, Components of an ImageProcessing System, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

UNIT II : Image Enhancement in The Spatial Domain: **10 Hours**
Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of SpatialFiltering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

UNIT III: Image Enhancement in Frequency Domain **10 Hours**
Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

UNIT IV: Image Segmentation **09 Hours**
Detection of Discontinuities, Edge linking and Boundary Detection, Thresholding, Region-Based Segmentation

UNIT V: Image Compression **10 Hours**
Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Image Compression Standards

TEXTBOOKS:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition,2008.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.

REFERENCE BOOKS:

1. Milan Sonka," Image Processing, Analysis and Machine Vision", Thomson Press India Ltd, 4th Edition.
2. S. Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, TMH, 2015

e-BOOKS/ONLINE RESOURCES:

1. Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Third Edition, Pearson Education, 2009.

MOOCs:

1. http://www.nptelvideos.in/2012/12/digital-image-processing.html
2. http://in.mathworks.com/discovery/digital-image-processing.html?s_tid=srchtitle

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Ability to understand fundaments of digital image processing and its applications

CO2: Ability to apply spatial domain, frequency domain and filtering techniques for image enhancement.

CO3: Ability to analyze various noise models.

CO4: Ability to conduct practical experiments on basic operations, filtering and various transformations on images.

CO5: Ability to design and develop Image Processing system for real-world applications.

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PROFESSIONAL ELECTIVE - V

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE75A**					
Category	Engineering Science Courses : Professional Elective					
Course title	**CLOUD COMPUTING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand cloud characteristics and types of clouds.
2. Understand cloud services and solutions.
3. Know about cloud offerings and management.
4. Understand virtualization technologies.
5. Understand the relevance of Cloud, SOA and Benchmarks.

UNIT I: INTRODUCTION **09 Hours**

Essentials - Benefits - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics - Cloud Adoption. Cloud Models - Cloud Characteristics - Measured Service - Cloud Models - Security in a Public Cloud - Public versus Private Clouds - Cloud Infrastructure Self Service.

UNIT II: CLOUD SERVICES AND SOLUTIONS **09 Hours**

Gamut of Cloud Solutions - Principal Technologies - Cloud Strategy - Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined. Cloud Solutions - Introduction - Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) – Cloud sourcing.

UNIT III: CLOUD OFFERINGS AND CLOUD MANAGEMENT **10 Hours**

Cloud Offerings - Information Storage, Retrieval, Archive and Protection - Cloud Analytics - Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud. Cloud Management - Resiliency - Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Meeting.

UNIT IV: CLOUD VIRTUALIZATION TECHNOLOGY **10 Hours**

Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements - Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Centre.

UNIT V: CLOUD, SOA AND INFRASTRUCTURE BENCHMARKING 10 Hours

SOA and Cloud - SOA Defined - SOA and IaaS - SOA-based Cloud Infrastructure Steps - SOA Business and IT Services. OLTP Benchmark - Business Intelligence Benchmark - e-Business Benchmark - ISV BenchMarks Cloud Performance Data Collection and Performance Monitoring Commands Benchmark Tools.

TEXT BOOKS:

1. Kumar Saurabh, "Cloud Computing: Insights into New-Era Infrastructure", Wiley India, 2011.

REFERENCE BOOKS:

1. John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises", Recursive Press, 2013.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice)", O'Reilly, 2009.

e-BOOKS/ONLINE RESOURCES:

1. https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf
2. https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf

MOOCs:

1. https://www.mooc-list.com/course/cloud-computing-applications-part-1-cloud-systems-and-infrastructure-coursera
2. https://www.mooc-list.com/course/cloud-computing-concepts-part-2-coursera

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Identify different types of clouds and services.
CO2: Interpret cloud solutions.
CO3: Demonstrate cloud offerings and management.
CO4: Implement Storage and Server Virtualization.
CO5: Apply SOA principles for cloud design and identify types of benchmarking.

SCHEME OF EXAMINATION:

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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPE75B</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="6">BIG DATA - THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - VII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
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<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
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COURSE OBJECTIVES:

The course will enable the students to

1. Understand big data for business intelligence.
2. Illustrate business case studies for big data analytics.
3. Discuss NoSQL big data management.
4. Demonstrate map-reduce analytics using Hadoop.
5. Compare Hadoop related tools such as Pig, Cassandra and Hive for big data analytics.

UNIT I: INTRODUCTION TO BIG DATA **09 Hours**

Definition, Characteristics, Evolution and Challenges of Big data, need for Big data, Data warehouse environment v/s Hadoop environment, Introduction to Big data analytics, Classification of analytics, Importance of big data analytics and data science, terminologies used in big data environment, industry examples of big data.

UNIT II: NoSQL and MongoDB **09 Hours**

NoSQL: Introduction, Types of NoSQL Databases, Importance of NoSQL, Advantages of NoSQL, NoSQL versus RDBMS, Use of NoSQL in Industry, SQL versus NoSQL, NewSQL, MongoDB: Introduction, need for MongoDB, terms used in RDBMS and MongoDB, Datatypes in MongoDB, MongoDB query language.

UNIT III: HADOOP **10 Hours**

Introduction, features and advantages of Hadoop, Hadoop versus SQL, Importance of Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, History, overview and Use cases of Hadoop, Hadoop distribution, Hadoop Distributed File System (HDFS), Processing data with Hadoop, Managing resources and applications with Hadoop YARN, Interacting with Hadoop Ecosystem.

UNIT IV: MAPREDUCE AND CASSANDRA **10 Hours**

MAPREDUCE: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression, Job scheduling, task execution, MapReduce types, input formats, output formats. Cassandra: Introduction, features of Cassandra, CQL data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) operations, Collections, Using a counter, Time To Live (TTL), Alter commands, Import and Export, Querying System tables, Examples.

UNIT V: HIVE AND PIG **10 Hours**

Hive: Introduction, history and recent releases of Hive, Hive features, Hive integration and workflow, Hive data units, Architecture, data types, File format, Hive Query Language (HQL), RCFile Implementation, SERDE, Used-Defined Functions (UDF). Pig: Introduction, features, the anatomy of Pig, Pig on Hadoop, Pig philosophy, Use cases for Pig: ETL processing, Overview of Pig Latin, Data types in Pig, Running and Execution modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex data types, Piggy bank, UDF, Parameter Substitution, Diagnostic operator, Word count example using Pig, Pig versus Hive.

TEXT BOOKS:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd, 2018.

REFERENCES:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
6. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
7. Alan Gates, "Programming Pig", O'Reilley, 2011.

e-BOOKS/ONLINE RESOURCES:

1. http://en.wikipedia.org/wiki/Big_data
2. http://bigdatauniversity.com
3. http://en.wikipedia.org/wiki/Data_science
4. http://www.mongodb.com/nosql-explained
5. http://nosql-database.org
6. http://hadoop.apache.org
7. http://tutorialspoint.com/mongodb

MOOCs:

1. www. edureka.co/big-data/course
2. Big data Computing, https://onlinecourses.nptel.ac.in/noc19_cs33
3. Big data, https://nptel.ac.in/courses/106104135/48

COURSE OUTCOMES:

The students at the end of the course, will be able to
CO1: Describe big data and use cases from selected business domains.
CO2: Discuss the business case studies for big data analytics.
CO3: Explain NoSQL big data management.
CO4: Perform map-reduce analytics using Hadoop.
CO5: Use Hadoop related tools such as Cassandra, Pig and Hive for big data analytics.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE75C**					
Category	Engineering Science Courses: Professional Elective					
Course title	**ADVANCED COMPUTER ARCHITECTURE - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the milestones of modern computer models, system attributes, types of memory and vector computers.
2. Identify the basic principles of programs and network properties for parallelism.
3. Comply the hardware technologies like ISA, bus system and shared memory.
4. Examines the linear and non-linear pipeline and super scalar architecture.
5. Summarize solutions for parallel programming, cache coherence, threading and processing.

UNIT I: PARALLEL COMPUTER MODELS **09 Hours**

Computer Development Milestones, Elements of Modern Computers, Evolution of Computer Architecture, System Attributes to Performance, Shared-Memory Multiprocessors, Distributed-Memory Multicomputer, A Taxonomy of M1MD Computers, Vector Supercomputers, SIMP Supercomputers.

UNIT II: PROGRAM AND NETWORK PROPERTIES **10 Hours**

Conditions of Parallelism: Data and Resource Dependences, Hardware and Software Parallelism, the Role of Compilers. Program Partitioning and Scheduling: Grain Sizes and Latency, Grain Packing and Scheduling, Static Multiprocessor Scheduling. Program Flow Mechanisms: Control Flow versus Data Flow, Demand-Driven Mechanisms, Comparison of Flow Mechanisms. System Interconnect Architectures: Network Properties and Routing, Static connection networks, Dynamic Connection Networks.

UNIT III: HARDWARE TECHNOLOGIES **10 Hours**

Advanced Processor Technology: Design Space of Processors, Instruction-Set Architectures, CISC Scalar Processors, RISC Scalar Processors. Superscalar and Vector Processors: Superscalar Processors, The VLIW Architecture, Vector and Symbolic Processors. Backplane Bus Systems: Backplane Bus Specification, Addressing and Timing Protocols, Arbitration, Transaction, and Interrupt, the IEEE Futurebus+ Standards. Shared-Memory Organizations: Interleaved Memory Organization, Bandwidth and Fault Tolerance, Memory Allocation Schemes.

UNIT IV: PIPELINING AND SUPERSCALAR TECHNOLOGIES 09 Hours

Linear Pipeline **Processors:** Asynchronous and Synchronous Models, Clocking and Timing Control, Speedup, Efficiency, and Throughput. Nonlinear Pipeline Processors: Reservation and Latency Analysis, Collision-Free Scheduling, Pipeline Schedule Optimization. Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction Scheduling, Branch Handling Techniques. Arithmetic Pipeline Design: Computer Arithmetic Principles, Static Arithmetic Pipelines, Multifunctional Arithmetic Pipelines.

UNIT V: PARALLEL AND SCALABLE ARCHITECTURES 10 Hours

Multiprocessor System Interconnects: Hierarchical Bus Systems, Crossbar Switch and Multiport Memory, Multistage and Combining Networks. Cache Coherence and Synchronization Mechanisms: The Cache Coherence Problem, Snoopy Bus Protocols, Directory-Based Protocols. Vector Processing Principles: Vector Instruction Types, Vector-Access Memory Schemes. Principles of Multithreading**:** Multithreading Issues and Solutions Parallel Programming Models: Shared-Variable Model, Message-Passing Model, Data-Parallel Model.

TEXT BOOKS:

1. Kai Hwang, Advanced Computer Architecture – Parallelism, Scalability, Programmability McGraw Hill 2005.

REFERENCE BOOKS:

1. David E Culler, J P Singh, Anoop Gupta, Parallel Computer Architecture, Harcoust Asia and Morgan Kaufmann, 1998.
2. Advanced Computer Architecture and Parallel Processing, Kai Hwang Faye A Briggs McGrawHill book Company, 1st edition 2017.
3. John L. Hennessy, David A. Patterson Computer Architecture A Quantitative Approach, 5th Edition ELSEVIER 2011.

e-BOOKS/ONLINE RESOURCES:

1. Advanced Computer Architecture
2. https://www.mheducation.co.in/9789339220921-india-advance-computer-architect
3. Parallel Computer Architecture
4. https://www.elsevier.com/.../parallel-computer-architecture/culler/978-1-55860-343-1
5. Computer Architecture A Quantative Approach
6. https://booksite.elsevier.com/9780123838728/

MOOCs:

1. https://www.classcentral.com/tag/computer-architecture
2. https://www.mooc-list.com/tags/computer-architecture

3. https://swayam.gov.in/courses/4730-july-2018-computer-architecture

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Describe the evolution of parallel Computer models like computer architecture Multiprocessors, multicomputer and super computers.

CO2: Develop and analyse the parallel programing conditions along with the network properties like partitioning, scheduling.

CO3: Design and Implement processor, memory, and bus hardware technologies.

CO4: Formulates the basic pipeline architecture, superscalar architecture feature by Improving the speed while avoiding different types of hazards

CO5: Creates parallel programming techniques and explore the multiprocessor interconnects cache memory coherence problem with solution and synchronous Mechanism.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CSPE75D**					
Category	Engineering Science Courses : Professional Elective					
Course title	**NETWORK MANAGEMENT - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): 1. Computer Networks						

COURSE OBJECTIVES:

This course will enable the students to

1. Understand the fundamentals of interoperable network management.
2. Understand general concepts and architecture behind standards based network management.
3. Discuss advanced Remote Monitoring, and Management Information Base.
4. Discuss different Network Management Applications.
5. Explore Broadband Network Management.

UNIT I: DATA COMMUNICATIONS AND NETWORK MANAGEMENT OVERVIEW **09 Hours**

Network management Goals, architecture and perspectives. Review of information network and technology: Topology, node Components, Transmission technology.

UNIT II: SNMPv1 **09 Hours**

SNMPv1: Basic foundations, Standards, models and languages, network management organization and standards, SNMP model, organisation model, information models. SNMP Communication Models and functional models.

UNIT III: SNMPv2, REMOTE MONITORING AND MIB **10 Hours**

SNMPv2, System Architecture, Structure of Management Information, Management Information Base, protocols. Remote Monitoring, and Management Information Base, Case study. Network Management Tools: Network statistics measurement system, MIB Engineering, NMS Design and system.

UNIT IV: NETWORK MANAGEMENT APPLICATIONS **10 Hours**

Configuration Management, Fault Management, Performance Management, Event Correlation Techniques, Security Management, Accounting Management, Report Management, policy-based Management, service level Management.

UNIT V: BROADBAND NETWORK MANAGEMENT **10 Hours**

Broadband Network and services, MPLS network management. Broadband Access Networks, ADSL, ADSL Management, PON, PON Management, Broadband Wireless Network: Broadband Wireless Access Networks, Mobile Wireless Network, Satellite Networks.

TEXT BOOKS:

1. M. Subramanian, "Network management: principles and practice", Adison- Wesley, 2010.
2. J. Burke, "Network management concepts and practice, A Hands-on approach", Pearson Education, 2009.

REFERENCES:

1. Dharma Prakash Agrawal & Qing-An Zeng, "Introduction to Wireless and Mobile Systems", Thomson India Edition, 2nd Ed., 2007
2. Stephen B. Morris, "Network Management, MIBs and MPLS", Pearson Education, 2003, rp 2008.
3. Anurag Kumar, D.Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach", Elsevier, 2004.
4. Benoit Claise and Ralf Wolter, "Network Management: Accounting and Performance Strategies", Pearson Education, 2007, rp2008.

e-BOOKS/ONLINE RESOURCES:

1. http://ceit.aut.ac.ir/~siabi/NSM/320Network%20Management%20Principles%20and%20Practice%20-%202nd%20Edition%20(2010)_2.pdf
2. https://nptel.ac.in/courses/IITMADRAS/Computer_Networks/pdf/Lecture41_SNMP.pdf

MOOCs:

1. https://www.coursera.org/courses?query=networking
2. https://nptel.ac.in/courses/106105081/37
3. https://www.perpetual-solutions.com/training-courses/175,7/snmp

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Describe basic concepts of Network Management.

CO2: Analyse SNMPv1 concepts and architecture behind standards based network

Management.

CO3: Summarize SNMPv2 and Remote Monitoring, and MIB.

CO4: Design Network Management Applications concepts.

CO5: Analyse and apply Broadband Network Management.

SCHEME OF EXAMINATION:

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VIII SEMESTER CSE

BANGALORE UNIVERSITY
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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC801</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">DATA SCIENCE - THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VIII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable students to

1. Understand the principles of Data warehousing and data mining.
2. Build and Develop a Data Warehouse and mapping the data warehouse to a multiprocessor architecture.
3. Perform classification and prediction of data.
4. Examine the types of data in cluster analysis with various Clustering techniques.
5. Know the various Data analytics and Data visualization techniques.

UNIT I: INTRODUCTION TO DATA MINING **10 Hours**

Importance of Data Mining, Data Mining Functionalities, Different kinds of Data, Classification of Data Mining Systems, Primitives, Major Issues and challenges in Data Mining, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

UNIT II: DATA WAREHOUSING **09 Hours**

Data warehousing Components, Building a Data warehouse, Mapping the Data Warehouse to a Multiprocessor Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup and Transformation Tools, Metadata, reporting, Query tools and Applications, Online Analytical Processing (OLAP), OLAP and Multidimensional Data Analysis.

UNIT III: CLASSIFICATION AND PREDICTION **09 Hours**

Supervised and unsupervised learning, Definition of classification, Decision Tree Induction, Bayesian Belief networks, Bayesian classification, Rule Based Classification, K-nearest neighbor method, Prediction using Linear and Non-linear Regression, Classification Accuracy and Error Measures.

UNIT IV: CLUSTERING AND ASSOCIATION RULE MINING **10 Hours**

Types of Data in Cluster Analysis, Classification of clustering methods, K-means, BIRCH, DBSCAN, STING Algorithms, Outlier Analysis. Basic concepts of Association Rules, Classification of Association Rules, Apriori Algorithms, FP Tree, Multilevel Association rules, Categorical Association Rules, Multidimensional Association Rules. Mining Frequent closed Itemsets, Metarule-guided Association Rules, Constraint Based Association Rules.

UNIT V: DATA ANALYTICS AND VISUALIZATION **10 Hours**

Introduction to Data Analysis, Applied Statistical techniques, Types of Statistical Data, Types of Big Data Analytics, Collecting data for Sampling and Distribution, Probability, Frequency Distribution, Population and Parameters, Central Tendency, Measures of Central Tendency, Different Types of Statistical Means, Problems of Estimation and Normal Distribution curve. Data Visualization: Basic Principles, Importance, Conventional Data Visualization Methods, Ideas and tools for Data Visualization.

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, Data Mining, Concepts and Techniques, Elsevier, Third Edition, 2011.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Data Mining Algorithms, 2005.

REFERENCE BOOKS:

1. V K Jain, Data Science and Analytics, Khanna Publishing, 2018.
2. David Hand, Heikki Mannila, Padhraic Smyth, Principles of Data Mining, PHI, 2009.
3. Margaret H Dunham, Data Mining Introductory and Advanced Topics, Pearson Education, 2008.

e-BOOKS/ONLINE RESOURCES:

1. http://en.wikipedia.org/wiki/Data_warehouse
2. http://www.inf.unibz.it/dis/teaching/DWDM/slides/dw1.pdf
3. https://repo.palkeo.com/algo/informationretrieval/Data%20mining%20and%20analysis.pdf

MOOCs:

1. https://www.coursera.org/specializations/jhu-data-science?siteID=OyHlmBp2G0c-0328ZKV34mF3.yMgOBpdWA&utm_content=2&utm_medium=partners&utm_source=linkshare&utm_campaign=OyHlmBp2G0c.
2. https://www.thisismetis.com/courses/introduction-to-data-science?utm_source=LDS&utm_medium=affiliate&utm_campaign=LDS2019affiliate
3. https://www.udemy.com/python-for-data-science-and-machine-learning-bootcamp/?ranMID=39197&ranEAID=OyHlmBp2G0c&ranSiteID=OyHlmBp2G0c-wgJMi8qQiA2u1hpioHWhbQ&LSNPUBID=OyHlmBp2G0c
4. https://www.datacamp.com/?tap_a=5644-dce66f&tap_s=97692-82206a

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Demonstrate the concept of data mining principles.

CO2: Discuss the Data Warehousing Architectures and its Implementation.

CO3: Apply the association rules, design and deploy appropriate classification techniques for mining the data.

CO4: Cluster the high dimensional data for better organization of the data.

CO5: Explore the knowledge of various techniques of data analytics and data visualization Tools.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU

B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18MCIP803</td></tr>
<tr><td>Category</td><td colspan="6">Mandatory Course</td></tr>
<tr><td>Course title</td><td colspan="6">INTELLECTUAL PROPERTY RIGHTS</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - VIII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">----</td><td colspan="2">Total Max. Marks: 50</td><td colspan="2"></td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Acquire the main objective of the course paper IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. Get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, tradeMarks, designs.
3. Know about the registration of IPR for adding credit to their work done.
4. Generate students to build their career as entrepreneurs for eradicating unemployment with the concerned field.
5. Bring in interest amongst the students for generating thinking and for igniting the young minds for bringing new ideas and research in the field of technology.

UNIT I: INTRODUCTION **3 Hours**

Meaning of Property, Origin, Nature, Meaning of Intellectual Property Rights, Provision of IPR under TRIPS and WTO. Kinds of Intellectual property rights—Copyright, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge.

UNIT II: PATENT RIGHTS AND COPY RIGHTS **10 Hours**

Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties. **COPY RIGHT:** Origin, Definition &Types of Copy Right, Registration procedure, Assignment & licence, Terms of Copy Right, Infringement, Remedies, Copyrights with special reference to software.

UNIT III: TRADE MARKS AND DESIGNS **7 Hours**

Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties. **DESIGN:** Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention of design- types and functions. Semiconductor Integrated circuits and layout design Act-2000.

UNIT IV: INNOVATION **3 Hours**

Indicators for Innovation – Innovation for improvement of business keeping in view stakeholders expectation; Leadership Indication – Business innovation in products, process and methods of stakeholders engagement for the purpose of overall improvement of the business; Pardoning mistakes by employees in business and encouraging for experimentation for innovative ideas; Rewarding for good experimentation and innovation; exploring and absorbing cutting edge technology; Pay for innovative results; Budget for Research and Development;

UNIT V: ENTREPRENEURSHIP **3 Hours**

Community Based Micro Finance Institute (CBMFI) by choosing self-group having overall good track record for creation of entrepreneurship; Entrepreneurship through Community Micro Vendor Development Programme (CMVDP) by providing proper training and skills to generate business in village areas and act as supply chain for companies around the village by way supplying products; Entrepreneurship skills, Market Place, Initiating a venture, planning for a venture and evaluating a venture; Entrepreneurship for women.

REFERENCE BOOKS:

1. Cornsih W.R. Intellectual Property, Patents, TradeMarks, Copyrights and Allied Rights (1999), Asia Law House, Hyderabad.
2. Intellectual Property Rights and the Law, Dr. G.B. Reddy, Gogia Law Agency.
3. Law relating to Intellectual Property, Dr. B. L. Wadehra, Universal Law Publishing Co.
4. P Narayan, Intellectual Property Law (1999), (ed.) Eastern Law House, Calcutta.
5. Bibeck Debroy (ed) Intellectual Property Rights (1998), Rajiv Gandhi Foundation, Delhi.
6. Entrepreneurship and Innovation: Readings and Cases Paperback – April 15, 2011 by Tim Mazzarol (Author)
7. Corporate Social Responsibility, C A Kamal Garg, 2014, BHARAT LAW HOUSE Pvt. Ltd., New Delhi.
8. Peter F. Drucker, Harper Collins, 17-Mar-2009 - Business & Economics - Classic book on Innovation and Entrepreneurship
9. Innovation and Entrepreneurship: A Competency Framework by Charles H. Matthews, Ralph Brueggemann, 2015, Routledge.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Get awareness of acquiring the patent and copyright for their innovative works.

CO2: They also get the knowledge of plagiarism in their innovations which can be questioned legally.

CO3: Apply the acquired concepts of Innovation and Entrepreneurship in their respective areas.

CO4: The yet another important outcome of the course is to make the students as leaders in the area of IPR so that their rights are not infringed in society.

CO5: In recent times Copyright is undergoing changes in the emerging trend of copying through internet and other sources, therefore the outcome of the course is to end this type of unwarranted copying from different medias.

SCHEME OF EXAMINATION:

CIE – 50 Marks	Test I (UNIT I, II & III) - 20 Marks	Quiz I – 5 Marks	25 Marks	Total: 50 Marks
	Test II (UNIT IV & V) - 20 Marks	Quiz II – 5 Marks	25 Marks	

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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COURSE OBJECTIVES:

Course Code	**18CIPC804**					
Category	Engineering Science Courses : Professional Core					
Course title	**PROJECT WORK**					
Scheme and Credits	No. of Hours/Week					Semester – VIII CSE/ISE
	L	T	P	SS	Credits	
	0	0	18	0	09	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

The course will enable the students to

1. Apply / use different experimental techniques, experiments, computational or analytical modelling and simulation tools to carry out tests and generate the results.
2. Analyze the results of experiments conducted / models developed.
3. Create a detailed technical document in prescribed format on the outcome of preliminary project and project work.
4. Prepare a technical presentation to the Project Evaluation Committee of the Department.

GUIDELINES:

1. Project work is a continuation of preliminary project work started in 7th semester.
2. Project team has to execute the work and test the prototype / algorithm within the timeline.
3. Project team has to demonstrate the successful working of prototype / algorithm developed.
4. Project team has to document the work carried out in the form of a report in prescribed format and submit to the department.
5. Project team has to make a technical presentation of the work carried out to the Project Evaluation Committee of the Department.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Apply the engineering principles in planning, formulating an innovative design/approach to problem solving.

CO2: Develop/implement the design with appropriate techniques, resources and contemporary tools.

CO3: Plan, monitor and manage project schedule, resources and work assignments to ensure timely completion.

CO4: Test and evaluate the performance of the implemented project and understand the significance of the solution.

CO5: Perform professionally as a team member, accept responsibility, take initiative and provide leadership necessary to ensure project success.

CO6: Use formal and informal communications with team members and guide, make presentations and prepare technical documents.

CO7: Provide solution within the legal framework addressing societal and environmental concerns and exhibit integrity and ethical behaviour in engineering practice.

SCHEME OF EXAMINATION

Rubrics for CIE:

1. Introduction and justification of topic : 10%
2. Literature survey and conclusion : 20%
3. Objectives and scope of project work : 10%
4. Methodology to be adopted : 30%
5. Presentation of contents of project work : 30%

Rubrics for SEE:

1. Introduction and justification of topic : 10%
2. Literature survey and conclusion : 20%
3. Objectives and scope of dissertation work : 10%
4. Methodology, Experimental / software : 30%
5. Presentation of project work : 30%

NOTE: The percentage mentioned above indicates marks allocation.

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BANGALORE UNIVERSITY

Course Code	**18CIIN805**					
Category	Engineering Science Courses : Mandatory Course					
Course title	**INTERNSHIP**					
Scheme and Credits	No. of Hours/Week					Semester – VIII CSE/ISE
	L	T	P	SS	Credits	
	0	0	6	0	3	
CIE Marks: 100			Total Max. Marks: 100			
Prerequisites (if any): NIL						

Importance:

- Internships are educational and career development opportunities, providing practical experience in a field or discipline.
- The main aim is enhancement of the employability skills of the students passing out from technical institutions.
- Internships can be full time during vacations and part time during academic session.

1. Benefits to Students:

a) Opportunity to see how the theoretical aspects learnt in classrooms are integrated into the practical world.
b) Opportunity to learn –
   i. New skills and supplement acquired knowledge.
   ii. Teamwork skills.
   iii. Time management, multi-tasking in an industrial environment.
c) Helps them decide to choose the industry and the career profile.
d) Provides opportunity to evaluate the organization before committing to a full time position.

2. Benefits to Institute:

a) Build meaningful Industry-Institutional interaction and makes the placement process easier.
b) Curriculum revision can be made based on feedback from Industry/ students.
c) Improve institutional credibility & branding.

3. Benefits to Industry:

(a) Availability of ready to contribute candidates for employment.
(b) New perspectives to problem solving by students undergoing internship.
(c) Availability of quality candidates for temporary or seasonal positions in ongoing projects.

4. Scheme of Evaluation:

Internship activities and allocation of marks for credit computation are listed in Table 1. Students shall carryout internship full time during vacation and/or part time during academic session, over a period of 3 years starting from II Sem vacation and the evaluation shall be carried out during VIII Sem B.Tech. examination.

Students may choose any number of activities as per their interest and based on their convenience and earn internship activity marks and credits.

A student shall earn a total of 100 marks and 3 credits from the activities mentioned in Table 1. Internship shall be evaluated by the Proctor, based on the report of activities performed.

Note: Marks allocated for performance in internship activity are as under: Excellent – 20, Good – 15, Satisfactory – 10

If the certificate does not indicate any performance level, it shall be treated as excellent.

Table 1: Internship activities and allocation of marks for credit computation.

Sl. No.	Activity Head	Document as evidence	Evaluated by	Performance appraisal	Max. Marks
1	Inter/Intra institutional /Workshop/ training	Certificate	Programme Coordinator	Satisfactory/Good/ Excellent	Participation: 10 Organisation: 10
2	Working for consultancy/research project	Certificate	Principal Investigator	Satisfactory/Good/ Excellent	20
3	Festival (Technical, Business, Cultural & others)	Certificate	Faculty In-charge / Principal	Satisfactory/Good/ Excellent	Participation: 10 Organisation: 10
4	Contribution in Incubation/ Innovation / Entrepreneurship cell/ Institutional Innovation Council	Certificate	Cell In-charge	Satisfactory/Good/ Excellent	20
5	Participation in innovation related competition – Hackathons etc	Certificate	Faculty Proctor	Satisfactory/Good/ Excellent	20
6	Development of new product/business plan/registration of start-up	Certificate	Faculty In-charge	Satisfactory/Good/ Excellent	40
7	Participation in all activities of Institute Ex. IPR workshop, leadership task, idea, design, innovation, business competition,	Certificate	Faculty Coordinator / Principal	Satisfactory/Good/ Excellent	Participation: 5 Organisation: 5 5 marks for each activity subject to max. of 20.
8	Work experience at family business	Declaration by parent	TPO	Satisfactory/Good/ Excellent	20
9	Internship with industry, Govt., NGO, PSU, MSME, Online internship	Detailed report	Faculty Proctor / TPO / Industry Supervisor	Satisfactory/Good/ Excellent	20-40 2 weeks: 20 4 weeks: 30 6 weeks: 40
10	Rural internship	Detailed report & Certificate	Faculty Proctor/ TPO/NCC/NSS Head	Satisfactory/Good/ Excellent	20 (any one activity)

The following are rural internship activities that may be carried out by students in teams:

1. Prepare and implement plan to create local job opportunities.
2. Prepare and implement plan to improve education quality in village.
3. Prepare an actionable Detailed Project Report for Doubling the village Income.
4. Developing Sustainable Water Management system.
5. Prepare and Improve a plan to improve health parameters of villagers.
6. Developing and implementing Low Cost Sanitation facilities.
7. Prepare and implement plan to promote Local Tourism through Innovative Approaches.
8. Implement/Develop technology solutions which will improve quality of life.
9. Prepare and implement solution for energy conservation.
10. Prepare and implement plan to skill village youth and provide employment.
11. Develop localized techniques for reduction in construction Cost.
12. Prepare and implement plan for sustainable growth of village.
13. Setting of Information imparting club for women leading to contribution in social and economic issues.
14. Developing and managing efficient garbage/ solid waste disposable system.
15. Contribution to any national level initiative of Government of India. For eg. Digital India/ Skill India/ Swachh Bharat Internship, Sansad Adarsh Gram Yojana, etc.

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PROFESSIONAL ELECTIVE - VI

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE86A**					
Category	Engineering Science Courses : Professional Elective					
Course title	**PATTERN RECOGNITION - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VIII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the concept of a pattern and the basic approach to the development of pattern recognition algorithms.
2. Apply Maximum-likelihood parameter estimation and the principles of Bayesian parameter estimation in relatively complex probabilistic models.
3. Evaluate systems and algorithms for pattern recognition with focus on sequences of patterns.
4. Learn various feature extraction and feature selection techniques.
5. Analyze different Non-Metric methods, such as Decision trees, CART, etc., to solve the pattern recognition problems.

UNIT I: INTRODUCTION **09 Hours**

Machine Perception, Pattern Recognition Systems, The Design Cycle, Learning and Adaption. Bayesian Decision Theory: Continuous Features, Minimum Error-Rate Classification, Classifiers, Discriminant Functions, and Decision Surfaces, The Normal Density, Discriminant Functions for the Normal Density.

UNIT II: MAXIMUM-LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION, NON-PARAMETRIC TECHNIQUES **10 Hours**

Maximum-Likelihood Estimation, Bayesian Estimation, Bayesian Parameter Estimation-Gaussian Case, General Theory, Hidden Markov Models, Density Estimation, Parzen windows, k_n - Nearest- Neighbor Estimation, The Nearest- Neighbor Rule, Metrics and Nearest-Neighbor Classification.

UNIT III: LINEAR DISCRIMINANT FUNCTIONS **10 Hours**

Linear Discriminant Functions and Decision Surfaces, Generalized Linear Discriminant Functions, The Two-Category Linearly Separable Case, Minimizing the Perception Criterion Functions, Relaxation Procedures, Nonseparable Behavior, Minimum Squared-Error Procedures, The Ho-Kashyap Procedures.

UNIT IV: FEATURE EXTRACTION AND FEATURE SELECTION 10 Hours

Types of Feature Selection, Mutual Information (MI) for Feature Selection, Chi-square Statistic, Goodman–Kruskal Measure, Laplacian Score, Singular Value Decomposition (SVD), Non-negative Matrix Factorization (NMF), Random Projections (RPs) for Feature Extraction, Locality Sensitive Hashing (LSH), Class Separability, Genetic and Evolutionary Algorithms, Ranking for Feature Selection, Feature Selection for Time Series Data.

UNIT V: NON-METRIC METHODS 09 Hours

Overview of Decision Trees, CART, ID3, C4.5, Recognition with Strings, Grammatical Methods, Grammatical Inference.

TEXT BOOKS:

1. Richard O. Duda, Peter E. Hart, and David G.Stork: Pattern Classification, 2nd Edition, Wiley-Interscience, 2001.
2. M Narasimha Murty, Der V Susheela Devi: Introduction to Pattern Recognition and Machine Learning, IISc Press, 2015.

REFERENCE BOOKS:

1. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.
2. SergiosTheodoridis and Konstantinos Koutroumbas: Pattern Recognition, 4th Edition, Elsevier, 2009.

e-BOOKS/ONLINE RESOURCES:

1. http://users.isr.ist.utl.pt/~wurmd/Livros/school/Bishop%20%20Pattern%20Recognition%20And%20Machine%20Learning%20-%20Springer%20%202006.pdf
2. http://www.cs.ukzn.ac.za/~sviriri/Books/Machine-Learning-PatternRecognition/book3.pdf

MOOCs:

1. https://nptel.ac.in/courses/117105101/

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Define pattern and recall approaches to the development of pattern recognition algorithms by exhibiting memory of learned concepts.
CO2: Solve problems in new situations by applying acquired knowledge of different models.
CO3: Determine the usage of Linear Discriminant Functions, and defend the particular algorithm's usage in real time problem solving.
CO4: Extract features from the given pattern by using feature extraction Algorithms.
CO5: Compare different Non-Metric methods, such as Decision Trees, ID3 and C4.5.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE86B**					
Category	Engineering Science Courses : Professional Elective					
Course title	**GREEN COMPUTING – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VIII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Learn what Green IT is and how it can help to improve environmental Sustainability.
2. Apply the concepts related to Green devices and hardware along with software techniques.
3. Analyse the Green enterprise activities, managing the green IT is adopted or deployed in enterprises.
4. Evaluate various laws, standards, and protocols.
5. Implement the strategies to develop Green IT.

UNIT I: GREEN IT **09 Hours**

Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach, Enhancing Environmental sustainability, IT Standards and Eco-Labelling of IT, Enterprise IT strategy, Merits and Demerits.

UNIT II: GREEN HARDWARE WITH GREEN SOFTWARE **10 Hours**

Green Hardware: Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Energy-saving software techniques, evaluating and Measuring Software Impact to platform power.

UNIT III: GREEN ENTERPRISES AND THE ROLE OF IT **10 Hours**

Organization and Enterprise, Greening Information Systems, Greening the Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Issues, Enablers and making the case for IT and Green Enterprise.

UNIT IV: MANAGING & REGULATING THE GREEN IT **10 Hours**

Managing Green IT: Strategizing Green Initiatives, Implementation, Information Assurance, Communication and Social media. Regulating the Green IT: Laws, Standards and Protocols: The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standard bodies, Building standards, Data centres, Social movements and Greenpeace.

UNIT V: IMPLEMENTATION **09 Hours**

Awareness to implementations, Greening by IT, A megatrend, A creation of green IT strategy, Research and Development directions.

TEXT BOOKS:

1. San Murugesan, G. R. Gangadharan: Harnessing Green IT, WILEY -2013.
2. Bhuvan Unhelkar: Green IT Strategies and Applications: Using Environmental Intelligence (Advanced & Emerging Communications Technologies) – 2011.

REFERENCE BOOKS:

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journey", Shoff/IBM Rebook, 2011.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.
3. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
4. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

e-BOOKS /ONLINE RESOURCES:

1. http://shodh.inflibnet.ac.in:8080/jspui/bitstream/123456789/424/2/02_introduction.pdf
2. http://www.greencompliance.com
3. https://www-03.ibm.com/press/attachments/GreenIT-final-Mar.4.pdf
4. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118305393.ch2

MOOCs:

1. https://www.apus.edu/schedule-classes/schedule/course/issc387
2. https://www.researchgate.net/publication/221939724_Need_of_Green_Computing_Measures_for_Indian_IT_Industry
3. https://www.greenit.net/greenit_training.html
4. https://www.slideshare.net/ranjanagore/enterprise-green-it-strategy

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand Green IT with its different dimensions to the Environmental Sustainability.
CO2: Compare Green devices and hardware along with its green software methodologies.
CO3: Analyse the various Green enterprise activities, functions and their role with IT.
CO4: Design Data centres with standard laws and protocols for regulating Green IT.
CO5: Validate the key strategies for Sustainability, Software Impact to platform power & Regulatory/Non-regulatory government initiatives.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE86C**					
Category	Engineering Science Courses : Professional Elective					
Course title	**NATURAL LANGUAGE PROCESSING – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VIII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable students to

1. Understand the natural language text.
2. Define the importance of natural language.
3. Analyse the concepts Machine Translation.
4. Illustrate information retrieval techniques.
5. Acquire Lexical analyser concepts.

UNIT I: OVERVIEW AND LANGUAGE MODELLING 09 Hours

Overview: Origins and Challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications. Language Modelling: Various Grammar-Based Language Models, Statistical Language Model.

UNIT II: WORD LEVEL, SYNTACTIC AND SEMANTIC ANALYSIS 10 Hours

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-Of-Speech Tagging.

Syntactic Analysis: Context-Free Grammar, Constituency, Parsing, Probabilistic Parsing. Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.

UNIT III: NL GENERATION AND MACHINE TRANSLATION 10 Hours

Natural Language Generation: Architectures of NLG Systems, Generation Tasks and Representations, Applications of NLG. Machine Translation: Problems In Machine Translation, Characteristics Of Indian Languages, Machine Translation Approaches, Direct Machine Translation, Rule-Based Machine Translation, Corpus-Based Machine Translation, Semantic Or Knowledge-Based MT Systems, Translation Involving Indian Languages.

UNIT IV: INFORMATION RETRIEVAL 10 Hours

Information Retrieval: Design features of Information Retrieval Systems, Information Retrieval Models, and Classical, Non-classical, Alternative Models of Information Retrieval

– evaluation of the IR System. Natural Language Processing in IR, Relation Matching, Knowledge-based Approaches, Conceptual Graphs in IR, Cross-lingual Information Retrieval.

UNIT V: LEXICAL RESOURCES AND APPLICATIONS 09 Hours

Lexical Resources: WordNet, FrameNet, Stemmers, Part-of-Speech Tagger. Other Applications: Information Extraction, Automatic Text Summarization, Question-Answering System.

TEXT BOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.

REFERENCES:

1. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
2. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.
3. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

e-BOOKS/ONLINE RESOURCES:

1. https://web.stanford.edu/~jurafsky/slp3/ed3book.pdf
2. https://hpi.de/.../user.../NaturalLanguageProcessing/NLP2016/NLP01_IntroNLP.pdf
3. https://www.cimat.mx/~fory/ingsoft/14.pdf

MOOCs:

1. https://nptel.ac.in/courses/106101007/
2. https://www.edx.org/course/natural-language-processing-nlp-2
3. https://www.kaggle.com/itratrahman/nlp-tutorial-using-python

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Describe basic concepts of NLP-Language and Grammar.
CO2: Analyse Word level, syntactic and Semantics.
CO3: Design Machine Translation.

CO4: Analyse and apply NLP Information Retrieval.
CO5: Analyse and apply Lexical analyser concepts.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CSPE86D**					
Category	Engineering Science Courses : Professional Elective					
Course title	**SERVICE ORIENTED ARCHITECTURE – THEORY**					
Scheme and Credits	No. of Hours/Week					Semester – VIII CSE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand various types of service layers.
2. Learn the concepts of web services in SOA.
3. To know about Service Layers.
4. Gain knowledge in designing SOA based applications.
5. Understand benefits and applications of SOA.

UNIT I: INTRODUCTION **09 Hours**

Service-oriented architecture, Common Characteristics of contemporary SOA, Common tangible benefits of SOA, Introduction to XML, XML document structure ,An SOA timeline (from XML to Web services), Evolution of SOA (Standards organizations and Contributing vendors),The roots of SOA (comparing SOA to Past architectures).

UNIT II: PRINCIPLES OF SERVICE-ORIENTATION **09 Hours**

Introduction to Service-orientation enterprise, Anatomy of a service-oriented architecture, Common Principles of Service-orientation, Service-orientation and Object-orientation, Service layer abstraction, Business service layer, Orchestration service layer, Enterprise platforms and SOA platform basics, Enterprise service Bus basics ,SOA support in J2EE,SOA support in .NET,SOA Reference Architecture.

UNIT III: BUILDING SOA-BASED APPLICATIONS **10 Hours**

Service-orientation and contemporary SOA, Service layer abstraction, Application service layer, Business service layer, Orchestration service layer, Agnostic services, Service layer configuration scenarios, Business process design ,WS-BPEL language basics, WS-Coordination overview, Service-oriented business process design, WS-addressing language basics, WS-Reliable Messaging language basics, Service Component Architecture basics.

UNIT IV: SERVICE LAYERS **09 Hours**

Service-orientation and contemporary SOA, Service layer abstraction, Application service layer, Business service layer, Orchestration service layer, Agnostic services, Service layer configuration scenarios, Business process design ,WS-BPEL language basics, WS-

Coordination overview, Service-oriented business process design, WS-addressing language basics, WS-Reliable Messaging language basics, Service Component Architecture basics.

UNIT V: BUILDING SOA-BASED APPLICATIONS **10 Hours**

Service Oriented Analysis and Design, Service Modelling, Design standards and guidelines, Composition, WS-BPEL,WS-Coordination, WS –Policy, WS-Security, Emerging trends in the SOA and Enterprise(Microsoft Azure, amazon Prime),SOA in cloud computing, SOA in critical embedded systems, SOA system by Machine Learning, Block chain as a service [BaaS], SOA in data warehousing, SOA in digital age.

TEXT BOOKS:

1. Service-Oriented Architecture Concepts and Technology and Design-Thomas Erl, Pearson Education.
2. Shankar-Kambhampaty,"Service Oriented–Architecture for Enterprise Applications", Wiley.

REFERENCE BOOKS:

1. Understanding SOA with Web Services **– Eric Newcomer, Greg Lomow, Pearson Education.**
2. Developing Enterprise Web Services **– An Architect's Guide – Sandeep Chatterjee, James Webber, Pearson Education , 2003.**

e-BOOKS/ONLINE RESOURCES:

1. http://textofvideo.nptel.ac.in/106105167/lec10.pdf
2. https://www.coursera.org/learn/service-oriented-architecture
3. https://www.slideshare.net/Zubin67/lecture-notes-for-soa

MOOCs:

1. https://www.mooc-list.com/course/service-oriented-architecture-coursera.

COURSE OUTCOMES:

The students at the end of the course, will be able to
CO1: Understand various types of service layers.
CO2: Learn the concepts of web services in SOA.
CO3: To know about Service Layers.
CO4: Gain knowledge in designing SOA based applications.
CO5: Understand benefits and applications of SOA.

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