NEW HORIZON COLLEGE OF ENGINEERING

Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka-2016
Ring Road, Bellandur Post, Near Marathalli, Bangalore -560 103, INDIA

Academic Year 2019-20

CSE – Computer Science & Engineering

Third and Fourth Semester

Scheme and Syllabus

CONTENTS

VISION

To emerge as a department of eminence in Computer Science and Engineering in serving the Information Technology Industry and the nation by empowering students with a high degree of technical and practical competence.

MISSION

To strengthen the theoretical and practical aspects of the learning process by strongly encouraging a culture of research, innovation and hands-on learning in Computer Science and Engineering.

To encourage long-term interaction between the department and the IT industry, through the involvement of the IT industry in the design of the curriculum and its hands-on implementation.

To widen the awareness of students in professional, ethical, social and environmental dimensions by encouraging their participation in co-curricular and extracurricular activities.

Program Education objectives (PEOs)

PEO1	Develop Proficiency as computer scientists with an ability to solve a wide range of computational problems in industry, government, or other work environments.
PEO2	Attain the ability to adapt quickly to new environments and technologies, assimilate new information, and work in multi-disciplinary areas with a strong focus on innovation and entrepreneurship.
PEO3	Possess the ability to think logically and the capacity to understand technical problems with computational systems.
PEO4	Possess the ability to collaborate as team members and team leaders to facilitate cutting-edge technical solutions for computing systems and thereby providing improved functionality.

PEO to Mission Statement Mapping

Mission Statements	PEO1	PEO2	PEO3	PEO4
To educate graduates and research scholars to be successful, ethical, and effective problem-solvers and life-long learners.	3	-	2	-
Produce versatile Computer Science graduates infused not only with technical skills, but also with innovative and entrepreneurial skills.	-	3	-	-
Prepare graduates for successful careers in Software Industry.	3	3	3	3
Provide a great work and learning environment and treat each other with respect and dignity.	-	-	2	3
To prepare graduates well enough to function as professional computer scientists and computer engineers.	-	3	-	-

Correlation: 3- High, 2-Medium, 1-Low

Program Outcomes (PO) with Graduate Attributes

	Graduate Attributes	Program Outcomes (POs)
1	Engineering Knowledge	**PO1:** The basic knowledge of Mathematics, Science and Engineering
2	Problem analysis	**PO2:** An Ability to analyse, formulate and solve engineering problems
3	Design and Development of Solutions	**PO3:** An Ability to design system, component or product and develop interfaces among subsystems of computing
4	Investigation of Problem	**PO4:** An Ability to identify, formulate and analyze complex engineering problem and research literature through core subjects of Computer Science.
5	Modern Tool usage	**PO5:** An Ability to use modern engineering tools and equipments for computing practice
6	Engineer and society	**PO6:** An Ability to assess societal, health, cultural, safety and legal issues in context of professional practice in Computer Science & Engineering
7	Environment and sustainability	**PO7:** The broad education to understand the impact of engineering solution in a global, economic, environmental and societal context
8	Ethics	**PO8:** An understanding of professional and ethical responsibility
9	Individual & team work	**PO9:** An Ability to work both as individual and team player in achieving a common goal
10	Communication	**PO10:** To communicate effectively both in written and oral formats with wide range of audiences
11	Project management and finance	**PO11:** Knowledge of contemporary issues, Management and Finance
12	Lifelong learning	**PO12:** An Ability to recognize the need and thereby to engage in independent and life-long learning for continued professional and career advancement

Mapping of POs TO PEOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	-	-	-	-	-	-	-	-	-
PEO2	-	-	-	-	-	-	-	-	-	-	-	-
PEO3	-	-	3	3	-	-	-	-	-	-	3	-
PEO4	-	-	-	-	-	-	-	-	3	-	-	-

Correlation: 3- High, 2-Medium, 1-Low

SCHEME OF THIRD SEMESTER

Academic Batch: 2018-22

S. No	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	TOTAL
1	19CSE31	Applied Mathematics-III	BS	2	1	0	3	4	50	50	100
2	19HSS322	Life skills for Engineers	HSS	3	0	0	3	3	50	50	100
3	19CSE33	Digital Electronics	CSE	3	0	0	3	3	50	50	100
4	19CSE34	Data Structures using C	CSE	3	0	0	3	3	50	50	100
5	19CSE35	UNIX System Programming	CSE	3	0	0	3	3	50	50	100
6	19CSL36	Digital Electronics Lab	CSE	0	0	2	2	4	25	25	50
7	19CSL37	Data Structures using C Lab	CSE	0	0	2	2	4	25	25	50
8	19CSL38	UNIX System Programming Lab	CSE	0	0	2	2	4	25	25	50
9	19CSE39	Mini Project in C	CSE	-	-	-	2	-	25	25	50
Total							**23**	**28**	**350**	**350**	**700**

SCHEME OF FOURTH SEMESTER

Academic Batch: 2018-22

S. No	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	TOTAL
1	19CSE41	Discrete Mathematics and Graph Theory	BS	2	1	0	3	4	50	50	100
2	19HSS421	Economics For Engineers	HSS	3	0	0	3	2	25	25	50
3	19HSS423	Environmental Science and Awareness	HSS	0	0	0	0	1	25	25	50
4	19CSE43	Object Oriented Programming with Java	CSE	3	1	0	4	5	50	50	100
5	19CSE44	ARM Processor	CSE	3	0	0	3	3	50	50	100
6	19CSE45	Computer Organization	CSE	4	0	0	4	4	50	50	100
7	19CSL46	Object Oriented Programming with Java Lab	CSE	0	0	2	2	4	25	25	50
8	19CSL47	ARM Processor Lab	CSE	0	0	2	2	4	25	25	50
9	19CSE48	Mini Project in Java	CSE	-	-	-	2	-	25	25	50
Total							**23**	**27**	**325**	**325**	**650**

THIRD SEMESTER

(SYLLABUS)

APPLIED MATHEMATICS – III

Course Code: 19CSE31 **Credits: 03**
L:T:P : 2:1:0 **CIE Marks : 50**
Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Use appropriate numerical methods to solve algebraic equations and transcendental equations.
CO2	Solve initial value problems using appropriate numerical methods and Evaluate definite integrals numerically.
CO3	Fit a suitable curve by the method of least squares, determine the lines of regression for a set of statistical data, and obtain the extremal of a function.
CO4	Gain ability to use probability distributions to analyze and solve real time problems.
CO5	Apply the concept of sampling distribution to solve engineering problems.
CO6	Use the concepts to analyze the data to make decision about the hypothesis.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	2	-	-	-	1	1	-	2
CO2	3	3	3	2	2	-	-	-	1	1	-	2
CO3	3	3	3	2	2	-	-	-	1	1	-	2
CO4	3	3	3	2	2	-	-	-	1	1	-	2
CO5	3	3	3	2	2	-	-	-	1	1	-	2
CO6	3	3	3	2	2				1	1		2

Course Syllabus			
Module No.	**Contents of the Module**	**Hours**	**Co's**
1.	**Numerical Methods-1:** Numerical solution of algebraic and transcendental equations: Regula-falsi method and Newton-Raphson method-Problems, Interpolation: Newton's forward and backward formulae for equal intervals, Newton divided difference and Lagrange's formulae for unequal intervals (without proofs)-Problems.	**9L + 2T**	**CO1**

2.	**Numerical Methods 2:** Numerical solution of ordinary differential equations of first order ar of first degree: Modified Euler's method and Runge-Kutta method fourth-order-Problems, Milne's predictor and corrector method Problems Numerical integration: Simpson's 1/3rd rule, Simpson's 3/8th rul Weddle's rule (without proofs)-Problems. **Applications:** Application of numerical integration to velocity of particle and volume of solids	**9L + 2T**	**CO2**
3.	**Statistical Methods and Calculus of Variation:** Fitting of the curves of the form $y = a + b\,x,\quad y = a + b\,x + c\,x^2,\ y = a\,e^{bx},\quad y = a\,x^b,$ and $y = a\,b^x$ by the method of least square-Problems, Correlation and Regression lines-Problems Variation of a function and a functional, Variational problems, Euler's equation and Isoperimetric problems **Applications:** Minimal surface of revolution and Hanging cable	**9L + 2T**	**CO3**
4.	**Probability distributions:** Random variables (discrete and continuous), probability density functions, Discrete Probability distributions: Binomial and Poisson distributions-Problems, Continuous Probability distributions: Exponential and Normal distributions-Problems **Joint Probability distributions:** Mathematical expectation, correlation, covariance (discrete random variables only)-Problems.	**9L + 2T**	**CO4**
5.	**Sampling Theory:** Sampling, Sampling distributions, test of hypothesis of large samples for means and proportions, confidence limits for means, Student's t-distribution, F-distribution and Chi-square distribution for test of goodness of fit for small samples	**9L + 2T**	**CO5, CO6**

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10th Edition, 2014,
   ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014,
   ISBN: 978-81-7409-195-5.

Reference Books:

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4th Edition, 2015,
   ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4th Edition, 2016, ISBN: 978-0-07-063419-0.

3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28th Edition, 2012,
ISBN: 81-219-0345-9.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd.,
9th Edition, 2014, ISBN: 978-81-318-0832-0.

Assessment Pattern:

1. CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	5	-
Understand	5	5	-
Apply	5	5	10
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

2. SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

LIFE SKILLS FOR ENGINEERS

Course Code : 18HSS322 **Credits : 03**
L:P:T : 3: 0: 0 **CIE Marks : 50**
Exam Hours : 3 **SEE Marks : 50**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Set personal and professional goals
CO2	Develop his critical thinking skills and practice creativity.
CO3	Demonstrate an understanding of personal and professional responsibility
CO4	Apply the concepts of personality development and grooming in real life
CO5	Understand self and work with groups
CO6	Articulate and convey his ideas and thoughts with clarity and focus

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	3	3	3	2	3
CO2	-	-	-	-	-	2	-	3	3	3	2	3
CO3	-	-	-	-	-	2	-	3	3	3	2	3
CO4	-	-	-	-	-	2	-	3	3	3	2	3
CO5	-	-	-	-	-	2	-	3	3	3	2	3
CO6	-	-	-	-	-	2		3	3	3	2	3

Module No.	Module Contents	Hours	COs
1	Goal Setting: Importance of Goals: Creating SMART goals; Critical Thinking and Problem Solving, Six Thinking Hats, Multiple Intelligences and Mind Mapping	6	CO1, CO2
2	Taking Ownership, Being Responsible and Accountable, Meaning of Ownership, Responsibility and Accountability, Practicing these philosophies in course, career and life, Developing a 'Credible Character Impression about self', Self-Motivation, Developing healthy Self-esteem, Leadership	8	CO3
3	Personality Development and Grooming: Expectations from the industry, building personal presence, corporate grooming, corporate etiquettes, Personal branding and image management	6	CO4

4	Self-Awareness and Self-Management: Emotional Intelligence, Knowing your own self- understanding personality, perception, values and attitude, Interpersonal skills - Knowing others, working well with others, developing the right attitude for work, being proactive and positive	8	CO5
5	Articulation and Group Discussion: Ideas generation, expressing thoughts in a logical flow, presenting views in a group	8	CO6

REFERENCE BOOKS:

1. The 7 – Habits of Highly Effective People, Stephen R Covey, Neha Publishers.
2. Seven Habits of Highly Effective Teens, Convey Sean, New York, Fireside Publishers, 1998.
3. Emotional Intelligence, Daniel Coleman, Bantam Book, 2006.
4. How to win friends and influence people Dale Carnegie

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**Self-Study**	**Peer Evaluation**
Marks (out of 50)	**10**	**15**	**15**	**10**
Remember	-	-	-	-
Understand	-	-	-	-
Apply	5	5	-	5
Analyze	-	-	5	-
Evaluate	-	-	-	
Create	5	10	10	5

SEE- Semester End Examination (50 Marks)

NOTE: Being a Life skills course we felt it would be suitable to do the final assessment through a structured group discussion, which will provide an opportunity to test students in all levels of Bloom's Taxonomy.

Bloom's Category	**Group Discussion**
Remember	5
Understand	10
Apply	10
Analyse	10
Evaluate	5
Create	10

DIGITAL ELECTRONICS

Course Code	**: 19CSE33**	**Credits**	**: 03**
L:T:P	**: 3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 3**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand operation and working of various electronic devices.
CO2	Simplify Boolean function using Karnaugh maps and Quine Mc-Clusky method and implement functions with combinatorial circuits.
CO3	Analyze and design modular combinatorial logic circuits.
CO4	Understand the Bi- stable elements like flip-flop and use its functionality to analyze and design the sequential circuits and its applications.
CO5	Understand HDL programming language.
CO6	Design and implement logical circuits using HDL.

Mapping of Course Outcomes to Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	-	-	2	-	-	2	-	2
CO2	3	3	3	3	-	-	2	-	3	2	-	2
CO3	3	3	3	3	-	-	2	-	3	2	-	2
CO4	3	3	3	3	-	-	2	-	3	2	-	2
CO5	3	3	3	3	3	-	2	-	3	2	-	2
CO6	3	3	3	3	3	-	2	-	3	2	-	2

Module No	**Module Contents**	**Hours**	**COs**
1	**Analog devices for Digital Electronics:** BJT vs FETs, EMOS FET, CMOS, Diode as Clipper and Clamper, Bistable Multivibrators, IC Multivibrators: Astable and Monostable,Types of Oscillator, Crystal Oscillator	**9**	**CO1**
2	**Simplification of Boolean Functions:** Review of Boolean algebra, logic gates, canonical forms, Three Variable K – Maps, Four Variable K – Maps, Quine-McCluskey minimization technique, Reduced prime implicants Tables, Map Entered Variables, Introduction to HDL.	**9**	**CO2, CO5, CO6**
3	**Combinational Logic Circuits:** Introduction, Adders, Subtractors, Carry Look Ahead Adder, Parallel Adder, Magnitude Comparator, Priority Encoders, Decoders, Multiplexers, Read Only memories (ROM), Programmable Logic Arrays (PLAs), Verilog implementation of combinational circuits.	**9**	**CO3, CO5, CO6**
4	**Sequential Logic Circuits :** The Basic Flip-flop circuit, Clocked Flip-	**9**	**CO4,**

	flops, Triggering of Flip-flops, types of Flip-flop, Master Slave Flip-Flops, Conversion of Flip-flops, types of Shift Registers, applications of shift register, Verilog implementation of Flip-flop and Shift registers.		**CO5, CO6**
5	**Analysis of Sequential Circuit:**Binary ripple counters, synchronous binary counters, Design of a synchronous mod-n counter using clocke T, JK , D and SR flip-flops, Verilog implementation of counters,Mealy and Moore Models, State Reduction and Assignment, Design Procedure, Design with State Equations, Verilog implementation of Moore and Mealy.	**9**	**CO4, CO5, CO6**

Text Book(s):

1. Digital Principles and Applications, Donald P Leach and Albert Paul Malvino, 8th Edition, 2014, Tata McGraw Hill
2. Electronic Devices and Circuits, Anil K Maini, Varsha Agarwal, 1st Edition, 2009, Wiley.

Reference Book(s):

1. Digital Design: with an Introduction to Verilog HDL, M Morris Mano and Michael D Ciletti, 5th Edition, 2013, Pearson Education
2. Digital Logic Applications and principles- John Yarbrough, 2006, Pearson Education
3. Digital Principles and Design- Donald Givone , 2017, Tata McGraw Hill

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	**Tests**	**Assignments**	**Quizzes**	**Co-Curricular**
Marks (Out of 50)	**25**	**15**	**10**	-
L1: Remember	05	-	-	-
L2: Understand	05	-	-	-
L3: Apply	10	05	05	-
L4: Analyze	05	05	05	-
L5: Evaluate	-	05	-	-
L6: Create	-	-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Marks (Out of 50)**
L1: Remember	05
L2: Understand	10
L3: Apply	20
L4: Analyze	10
L5: Evaluate	05
L6: Create	-

DATA STRUCTURES USING C

Course Code : 19CSE34 | **Credits : 03**
L:T:P : 3:0:0 | **CIE Marks: 50**
Exam Hours : 3 | **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand the concept of array data structures, its applications and dynamic memory management.
CO2	Compare, implement and understand when to apply various sorting techniques.
CO3	Design and implement the operational aspects of stacks, queues and linked list in problem solving.
CO4	Learn and implement various operations on trees.
CO5	Understand the concepts and applications of graphs.
CO6	Perform operations like searching, insertion, deletion, traversing mechanism on various data structures.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	3	3	-	-	-	-	-	-	-
CO4	3	3	2	3	3	-	-	-	-	-	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	-
CO6	3	3	2	3	3	-	2	-	-	-	-	3

Module No	Module Contents	Hours	COs
1	**Introduction to Data Structures:** Arrays and Pointers revisited, Sparse matrix, transpose of a sparse matrix, dynamic memory management .Introduction to Data Structures, Classification of Data Structures, Abstract Data Types, Insertion sort, Quick sort, Shell sort, Radix sort.	**9**	CO1, CO2, CO6
2	**Stacks & Queues: Stacks:** Definition, Stack representation, Primitive operations on stack, array representation of stacks. **Applications of stacks:** Recursion, Fibonacci series, Tower of Hanoi problem, Conversion of expressions, Evaluation of postfix expression, Iteration v/s recursion **Queues:** Definition, Queue representation, Primitive operations on queue, array representation of queues, Circular queue, Priority queue, Double ended queue, Applications of queues.	**9**	CO3, CO6

3	**Linked Lists:** Dynamic memory allocation revisited – malloc, calloc, realloc, free, Introduction to linked list, Representation of linked list in memory, primitive operations on linked list, searching a linked list, circular linked list, doubly linked list, header linked list. **Applications of linked list:** Josephus problem, addition of two long integers, addition of two polynomials, Linked representation of stack, Linked representation of queue,	**9**	CO1, CO3, CO6
4	**Trees-I:** Introduction, Binary tree – strictly binary tree, complete binary tree, representing binary tree in memory, traversing a binary tree, binary Search tree, insertion and deletion in binary search tree, threaded binary tree. Expression trees, construction of an expression tree from prefix and postfix, Heap tree, creation of heap tree, insertion in heap, Deletion from heap.	9	CO4, CO6
5	**Trees-II & Graphs:** AVL Trees, Rotations in AVL tree, Insertion and deletion in an AVL tree, Huffman's algorithm. Introduction to Graph, Graph theory terminologies, sequential representation of a graph, adjacency matrix and path matrix, Warshall' s algorithm, Linked representation of a graph, Operations on a graph, Traversing a graph, Topological sorting	9	CO4, CO5, CO6

Text Books:

1. " Data Structures with C ", SEYMOUR LIPSCHUTZ, Special Indian Edition, Thirteenth reprint 2015, McGraw Hill Education
2. " Data Structures using C ", Aaron M. Tanenbaum, YedidyahLangsam& Moshe J Augenstein, Thirteenth Impression 2014, Pearson Education

Reference Books:

1. " Data Structures – A Pseudocode Approach with C ", Richard F Gilberg and Behrouz A Forouzan, Second edition, Fifth Indian Reprint 2015, Cengage Learning

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks (Out of 50)	**30**	**10**	**10**
Remember	5		5
Understand	10	5	
Apply	15	5	5
Analyze			
Evaluate			
Create			

SEE – Semester End Examination (50 marks)

Bloom's Taxonomy	Tests
Remember	5
Understand	20
Apply	25
Analyze	
Evaluate	
Create	

UNIX SYSTEM PROGRAMMING

Course Code : 19CSE35 **Credits: 03**
L:T:P : 3:0:0 **CIE Marks: 50**
Exam Hours : 3 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to

CO1	Understand the fundamental concepts of UNIX Operating system and POSIX standards.
CO2	Understand the basic set of commands and utilities in UNIX systems.
CO3	Learn and apply the important UNIX APIs and system calls in the UNIX environment.
CO4	Learn about UNIX processes, process APIs and filter commands.
CO5	Develop, Debug and execute shell scripts effectively.
CO6	Design and implement AWK script.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	-	-	-	-	-	3	3	-
CO6	3	3	3							3	3	

Module No	Module Contents	Hours	COs
1	**Getting Started & Understanding UNIX Commands:** Operating System, UNIX Operating System, UNIX architecture, Features of UNIX, The POSIX Standards UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics	**7**	**CO1**
2	**General Purpose Utilities:** passwd, who, tty, lock, sty, script, clear an tput, uname, date, cal, calendar, bc **File System and Attributes :** File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, File Attributes- ls, ls –l, file permissions, chmod, directory permissions, umask, file ownership, chown and chgrp, file modification and access times, touch, find, Inodes in UNIX , Application Program Interface to Files, UNIX kernel support for files, Directory files, Hard and Symbolic Links.	**9**	**CO2**
3	**UNIX APIs:** General File APIs , File and Record locking, Directory File	**10**	**CO3**

	APIs, Device File APIs, FIFO File APIs		
4	**UNIX Processes**: UNIX kernel support for processes, Process APIs- fork, vfork, _exit, wait, waitpid, exec, pipe- Process status, running jobs in background, nice, signals, kill, at and batch, cron **Simple filters and Regular Expressions:** more, wc, od, pr, cmp, diff, comm, head, tail, cut, paste, sort, tr, uniq, nl grep – searching for a pattern, grep options, regular expressions, egrep and fgrep	**9**	**CO4**
5	**Shell Programming and AWK:** Shell variables, shell scripts, read, positional parameters, exit status, logical operators, exit, if conditions, test and [], case, expr, sleep and wait, while and for. AWK preliminaries, splitting line into fields, printf – formatting output, comparison operators, number processing, variables, reading program from a file, BEGIN and END section, positional parameters, getline, built in variables, arrays, functions, control flow, looping	**9**	**CO5, CO6**

Text Book(s):

3. Your UNIX – The ultimate Guide , SUMITABHA DAS, TATA McGraw Hill Edition, 23rd reprint 2012, McGraw Hill
4. UNIX System Programming Using C++, Terrence Chan, Prentice-Hall of India Private Limited

Reference Book(s):

1. UNIX – Concepts & Applications, SUMITABHA DAS, TATA McGraw Hill Edition, Fourth edition, 26th reprint 2015, McGraw Hill
2. Advanced Programming in the UNIX Environment, W Richard Stevens and Stephen A Rago, Addison Wesley Publications, Third Edition
3. UNIX and SHELL Programming , Richard F Gilberg and Behrouz A Forouzan, 15th impression, 2015, Cengage Learning

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	**Tests**	**Assignments**	**Quizzes**	**Co-Curricular**
Marks (Out of 50)	**30**	**10**	**10**	
L1: Remember			5	
L2: Understand	5	5	5	
L3: Apply	5			
L4: Analyze	10	5		
L5: Evaluate	10			
L6: Create				

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks (Out of 50)
L1: Remember	
L2: Understand	10
L3: Apply	10
L4: Analyze	10
L5: Evaluate	20
L6: Create	

DIGITAL ELECTRONICS LAB

Course Code : 19CSL36 | **Credits : 02**
L:T:P : 0:0:2 | **CIE Marks : 25**
Exam Hours : 3 | **SEE Marks : 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand, design and implement operation of electronic device circuitry.
CO2	Simplify various logical circuits using Karnaugh maps.
CO3	Design and implement modular combinatorial logic circuits.
CO4	Design and implement sequential circuits, logic circuits using Verilog.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	2	-	-	2	-	2
CO2	3	3	3	3	-	-	2	-	3	2	-	2
CO3	3	3	3	3	-	-	2	-	3	2	-	2
CO4	3	3	3	3	-	-	2	-	3	2	-	2

E. No	Experiment	Hours	COs
1	To plot the Characteristics of a BJT and FET	6	CO1
2	Design and implement clipper and clamper (positive and negative for both) using diodes.	4	CO1
3	Design and implement an Astable Multivibrator circuit using 555 timer for a given frequency and duty cycle.	4	CO1
4	Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.Simulate and verify its working using Verilog code	4	CO2, CO5
5	Perform n bit addition / subtraction using 4 bit full adder IC. Simulate and verify its working using Verilog code.	4	CO3, CO5
6	Design and implement BCD to seven segment decoder. Simulate and verify given decoder using VERILOG code.	4	CO2, CO3, CO5
7	Design and implement Ring counter and Johnson counter using 4-bit shift register and demonstrate its working. Simulate and verify the working using VERILOG code.	4	CO4, CO5
8	Design and implement a mod-n (n<8) synchronous up or down counter using J-K Flip-Flop ICs and demonstrate its working. Simulate and verify mod 8 synchronous up or down counter using VERILOG code.	6	CO2, CO4, CO5

9	Design and implement an asynchronous counter using decade counter IC to count from 0 to n (n<=9) and demonstrate its working.	4	CO4
10	Design and implement a sequence generator (3 bits) using Moore model and JK flip flop. Simulate and verify the working using VERILOG code.	4	CO2, CO4, CO5

Reference Material(s):

1. Fundamentals of Digital Logic with Verilog Design - Stephen Brown and Zvonko Vranesic, 2017, Tata McGraw Hill
2. Digital Design: with an Introduction to Verilog HDL, M Morris Mano and Michael D, Ciletti, 5th Edition, 2013, Pearson Education

CIE – Continuous Internal Evaluation: LAB (25 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 25)	**25**
L1: Remember	-
L2: Understand	05
L3: Apply	05
L4: Analyze	10
L5: Evaluate	05
L6: Create	-

SEE – Semester End Examination: LAB (25 Marks)

Blooms Taxonomy	**Marks (Out of 25)**
L1: Remember	-
L2: Understand	05
L3: Apply	05
L4: Analyze	10
L5: Evaluate	05
L6: Create	-

DATA STRUCTURES USING C LAB

Course Code : 19CSL37 | **Credits : 02**
L:T:P : 0:0:2 | **CIE Marks: 25**
Exam Hours : 3 | **SEE Marks: 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand array data structures, its applications and dynamic memory management.
CO2	Compare, implement and understand when to apply various sorting techniques.
CO3	Develop the operational aspects of stacks, queues and linked list in problem solving.
CO4	Analyze and Implement various traversal operations on trees, graphs.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	3	3	-	-	-	-	-	-	-
CO4	3	3	2	3	3	-	-	-	-	-	-	-

Exp. No	Experiment
1	Write a program to check whether the given matrix is sparse or not and represent the matrix in sparse representation and determine the transpose of sparse representation.
2	Write a program to determine the transpose of a sparse matrix.
3	Write a program to sort the numbers using quick sort with recursion.
4	Write a C program to search a element using Binary search technique
5	a. Write a program to demonstrate Tower of Hanoi problem b. Write a program for Ackermann's function
6	Develop a program for STACK that performs following primitive operations: push, pop and display
7	Develop a program to convert INFIX notation to POSTFIX
8	Write a menu driven program to perform the following primitive operations on single linked list A. Create a list with one node B. Insertion at front, rear ,after any given node C. Deletion at front, rear ,after any given node D. Display E. Reverse
9	Develop a program for adding two polynomials

10	Develop a C program for solving Josephus problem.
11	Write a Menu driven program to perform the following primitive operations in double linked list A. Insertion B. Deletion C. Display
12	Develop a program to traverse a tree using in-order, pre-order and post-order.
13	Develop a program to perform insertion, deletion and traversal of a binary search tree
14	Develop a program to implement BFS and DFS traversal of graph

CIE – Continuous Internal Evaluation: Theory (25 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 25)	**25**
L1: Remember	
L2: Understand	
L3: Apply	
L4: Analyze	
L5: Evaluate	25
L6: Create	

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Marks (Out of 50)**
L1: Remember	
L2: Understand	
L3: Apply	
L4: Analyze	
L5: Evaluate	25
L6: Create	

UNIX SYSTEM PROGRAMMING LAB

Course Code : 19CSL38 **Credits: 02**
L:T:P : 0:0:2 **CIE Marks: 25**
Exam Hours : 3 **SEE Marks: 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Execute various UNIX commands on a standard UNIX operating system.
CO2	Apply and change the ownership and file permissions using advanced UNIX commands.
CO3	Execute C / C++ programs on UNIX making use of UNIX APIs.
CO4	Understand and work on UNIX system calls, shell programming and AWK on UNIX.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	-	-	-	-	3	3	-

Exp. No	Experiment	Hours
1	Execution of various general purpose utility commands	**2**
2	Execution of various file/directory handling commands	**2**
3	Write a C/C++ POSIX compliant program to check the following limits: (i) No. of clock ticks (ii) Max. no. of child processes (iii) Max. path length (iv) Max. no. of characters in a file name (v) Max. no. of open files/ process	**1**
4	Write a C/C++ program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.	**1**
5	Write a C / C++ program to emulate the unix ln command.	**2**
6	Write a C/C++ program that creates a zombie and then calls system to execute the ps command to verify that the process is zombie.	**2**
7	Write a C/C++ program to implement the system function.	**2**
8	Execution of various filter commands	**2**
9a **b**	Write a shell script to accept a file and check if it is executable. If not make it executable Write a shell script which will accept a filename and starting and	**2**

	ending line numbers and displays these lines from given file	
10a **b**	Write a shell script which displays a list of all the files in the current directory to which you have read, write and execute permissions. A shell script receives even number of filenames as arguments. Suppose four files are supplied as arguments then the first file should get copied into second, third file into fourth and so on. If odd number of filenames is supplied then no copying should take place and an error message should be displayed.	**2**
11a **b**	Write a shell script which gets executed the moment the user logs in. It should display the message, " Good Morning", " Good Afternoon", " Good Evening", depending upon the time at which the user logs in. Write a shell script which accepts any number of arguments and prints them in reverse order. Ex: If file name is test then $sh test A B C should produce C B A.	**2**
12a **b**	Write scripts to demonstrate built in variables available in AWK Write scripts to demonstrate built in functions available in AWK	**2**

Reference Material(s):

1. Your UNIX – The ultimate Guide , SUMITABHA DAS, TATA McGraw Hill Edition, 23rd reprint 2012, McGraw Hill
2. UNIX System Programming Using C++, Terrence Chan, Prentice-Hall of India Private Limited
3. Advanced Programming in the UNIX Environment, W Richard Stevens and Stephen A Rago, Addison Wesley Publications, Third Edition

CIE – Continuous Internal Evaluation: Theory (25 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 25)	**25**
L1: Remember	
L2: Understand	
L3: Apply	25
L4: Analyze	
L5: Evaluate	
L6: Create	

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks (Out of 50)
L1: Remember	
L2: Understand	
L3: Apply	25
L4: Analyze	
L5: Evaluate	
L6: Create	

MINI PROJECT in C

Course Code	**: 19CSE39**	**Credits:**	**02**
L:T:P	**: 0:0:0**	**CIE Marks:**	**25**
Exam Hours	**: 03**	**SEE Marks:**	**25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand the technological needs and/or societal needs.
CO2	Use C-programming skills and support tools to develop application.
CO3	Analyze and evaluate performance metrics.
CO4	Test, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	2	2
CO2	3	3	3	3	3	2	2	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	2	2	2
CO4	3	3	3	3	3	2	2	2	2	2	2	2

The student shall be capable of identifying a problem related to the field of Computer Science and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The code developed towards the project will be reviewed by a panel of experts during the course of the semester. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

Sample Mini project includes:

1) Tic-Tac-Toe Game
2) Quiz Game
3) Library Management
4) Telecom Billing Management system
5) Numerical Method Applications

CIE - Continuous Internal Evaluation (25 Marks)

Bloom's Taxonomy	**Mini Project**
Marks (Out of 25)	**-**
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	25
Create	-

SEE – Semester End Examination (25 marks)

Bloom's Taxonomy	Mini Project
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	25
Create	-

FOURTH SEMESTER

(SYLLABUS)

DISCRETE MATHEMATICS AND GRAPH THEORY

Course Code: 19CSE41 **Credits: 03**
L: T: P : 2:1:0 **CIE Marks: 50**
Exam Hours : 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Verify the correctness of an argument using propositional logic, predicate logic and truth tables.
CO2	Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.
CO3	Solve problems involving relations and functions.
CO4	Apply Pigeon hole principle to solve real life problems.
CO5	Represent and apply graph theory in solving computer science problems.
CO6	Illustrate the fundamental concepts of trees, connectivity and planarity graphs.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	1	-	-	-	1	3	-	2
CO2	3	3	2	3	1	-	-	-	1	3	-	2
CO3	3	3	2	3	1	-	-	-	1	3	-	2
CO4	3	3	2	3	1	-	-	-	1	3	-	2
CO5	3	3	2	3	1	-	-	-	1	3	-	2
CO6	3	3	2	3	1	-	-	-	1	3	-	2

Course Syllabus			
Module No.	**Contents of the Module**	**Hours**	**COs**
1.	**Mathematical Logic:** Basic Connectives and Truth Tables, Tautology and Contradiction, Logic Equivalence, The Laws of Logic, Logical Implication, Rules of Inference, Quantifiers Definition and the use of Quantifiers in logical implication.	**9L + 2T**	**CO1**
2.	**Properties of the Integers**: The Well Ordering Principle, Mathematical Induction, Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations, The Binomial Theorem	**9L + 2T**	**CO2**
3.	**Relations and Functions**: Cartesian Products and Relations, One-to-One and Onto functions, The Pigeon hole Principle, Function Composition and Inverse Functions. Properties of Relations, Equivalence Relations and Partitions	**9L + 2T**	**CO3, CO4**

4.	**Graph Theory:** Graphs-Definitions and examples, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, graph isomorphism, Euler graphs, Hamiltonian paths and cycles. Trees, Properties of trees, Distance and centers in tree, Rooted and binary trees	**9L + 2T**	**CO5**
5.	**Trees, Connectivity and Planarity**: Spanning trees , Fundamental circuits, Spanning trees in a weighted graph, cut sets, Properties of cut set, All cut sets, Fundamental circuits and cut sets, Connectivity and separability, Network flows, 1-Isomorphism, 2-Isomorphism, Combinational and geometric graphs, Planar graphs, Different representation of a planar graph	**9L + 2T**	**CO6**

Text Books:

1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
2. Narsingh Deo, Graph Theory: With Application to Engineering and Computer Science, Prentice Hall of India, 2003.

Reference Books:

1. Basavaraj S. Anami and Venakanna S. Madalli, Discrete Mathematics – A Concept based approach, Universities Press, 2016.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.
3. D.S. Malik and M.K. Sen, Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.
4. Thomas Koshy, Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

Assessment Pattern:

3. CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	5	-
Understand	5	5	-
Apply	5	5	10
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

4. SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

ECONOMICS FOR ENGINEERS

Course Code: 19HSS421 **Credits: 02**
L:T:P: 2:0:0 **CIE :25**
Exam Hour: 03 **SEE :25**

Course Outcomes: On completion of the course, the student will be able to:

CO1	Gain knowledge about importance of economics in decision-making processes in day-to-day life.
CO2	Analyze business environment at micro and macroeconomic level and understand its impact on industries and in turn on the country's economy.
CO3	Acquire knowledge about costing and estimation of projects for profit making.
CO4	Apply principles of budgeting and finance for entrepreneurial success.

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	1	-	2	2	2	1	2	2
CO2	2	2	1	-	1	-	2	2	2	1	2	2
CO3	2	2	1	-	1	-	2	2	2	1	2	2
CO4	2	2	1	-	1	-	2	2	2	1	2	2

Module No.	Contents of Module	Hours	Cos
1	Introduction to Economics: Role of Engineer as an Economist, Types and problem of economies, Basics of economics (GDP, National income, inflation, business cycle, fiscal and monetary policies, balance of payment).	6	1,3
2	Basic concepts of Microeconomics: concept of Demand & Elasticity of Demand, Concept of Supply & Elasticity of Supply, Meaning of Production and factors of production, Production Possibility Curve, Law of variable proportions and returns to scale, Relevance of Depreciation towards industry, Depreciation computing methods,	6	2,3

3	Concepts of cost of production: different types of cost; accounting cost, sunk cost, marginal cost and opportunity cost, Break even analysis, Make or Buy decision. Cost estimation, Elements of cost as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads,	6	3,4
4	Capital budgeting: Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI . Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI, Payment, Present worth, Future worth	6	1,3,4 ,5
5	Book Keeping and Accounts: Journal, Ledger, Trial balance, asset Types, profit & loss account, balance sheet	6	1,2,3 ,4&6

TEXT BOOKS:

1. Riggs J.L, Engineering Economy, TMH, 2012 edition
2. Jain T.R., Economics for Engineers, VK Publications,2008 Edition
3. IM PANDEY,Finacial Management, Vikas Pub. House, 2018 Edition
4. D N Dwivedi, MangerialEconomics ,Vikas Pub. House, 2018 Edition
5. Dr.A.R Sainath,Sasikala Devi,Engineering Economics and Financial Accounting,Charulatha Publications,2015 edition

REFERENCE BOOKS:

1. Thuesen H.G, Engineering Economy. PHI,1984
2. Prasanna Chandra, Financial Mangement,TMH,2007
3. Singh Seema, Economics for Engineers, IK International,2014
4. Chopra P. N, Principle of Economics, Kalyani Publishers,2012
5. Dewett K K, Modern Economic Theory, S. Chand,2006

Assessment pattern

CIE - Continuous Internal Evaluation (25 Marks, Theory)

Bloom's Category	**Test**	**Assignment**	**SSR**
Marks (out of 50)	**10**	**7.5**	**7.5**
Remember	2.5		
Understand	2.5		
Apply	2.5		
Analyze	2.5	2.5	2.5
Evaluate		2.5	2.5
Create		2.5	2.5

SEE – Semester Ending Examination (25 Marks)

Bloom's Category	**SEE Theory (25)**
Remember	10
Understand	5
Apply	5
Analyze	5
Evaluate	
Create	

ENVIRONMENTAL SCIENCE AND AWARENESS

Course Code	**:** 19HSS 423	**Credits**	**:** 01
L : T : P	**:** 1:0:0	**CIE Marks**	**:** 25
Exam Hours	**:** 02 Hrs	**SEE Marks**	**:** 25

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concepts of environment, ecosystem, biodiversity and its interdependence on human life.
CO2	Develop an insight on types of natural resources and the concept of sustainable development.
CO3	Understand the different control measures of pollution and importance of waste management.
CO4	Think and apply technology as a solution for environment related concerns, keeping in view the different environmental acts and amendments.

Mapping of Course Outcomes to Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	3	3	1	1	1	1
CO2	2	1	1	1	1	3	3	3	1	1	1	3
CO3	3	3	3	3	3	3	3	3	3	1	2	3
CO4	3	3	3	3	3	3	3	3	3	1	3	3

Module No.	Content of Module	Hrs	COs
1	**Introduction to Environment, Ecosystem and biodiversity:** Environment - Components of Environment, Scope and importance of Environmental studies, Ecosystem: Types & Structure of Ecosystem, Energy flow in the ecosystem, Food chains – food webs & ecological pyramids. Biodiversity – Definition, Hot-spots of biodiversity, Threats to biodiversity, Conservation of biodiversity.	05	CO1
2	**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems, Role of an individual in conservation of natural resources, Water conservation, rain water harvesting. Balanced use of resources for sustainable lifestyle – strategies	04	CO2

3	**Environmental Pollution:** Definition, Causes, effects and control measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal Pollution and Nuclear hazards. Role of an individual in prevention of pollution - Waste management – urban and industrial wastes	04	CO3
4	**Social Issues and Environment:** Environmental ethics – issues and possible solutions, Environment protection act – Air (prevention and Control of pollution) act & Water (prevention and Control of pollution) act, Role of government: Swatch Bharat Abhiyan, National Mission for Clean Ganga (NMCG), River rejuvenation, Role of Non-governmental Organizations (NGOs), Global warming and climate change.	04	CO3 CO4
5	**Human Population and Environment:** Population growth & explosion, Family welfare programme, Environment and human health, Human rights, Value education, Role of Technology in protecting environment and human health	05	CO4

Text Books:

1. "Environmental Studies: Basic Concepts" by Ahluwalia, V. K The Energy and Resources Institute (TERI) Publication, 2nd edition, 2016, ISBN: 817993571X, 9788179935712.
2. "Textbook of Environmental Studies for Undergraduate Courses of all branches of Higher Education" by Bharucha, Erach for UGC, New Delhi, 2004. ISBN: 8173715408, 9788173715402.

Reference Books:

1. Handbook of Environmental Engineering by Rao Surampalli, Tian C. Zhang, Satinder Kaur Brar, Krishnamoorthy Hegde, Rama Pulicharla, Mausam Verma; McGraw Hill Professional, 2018. ISBN: 125986023X, 9781259860232
2. Environmental Science and Engineering by P. Venugopala, Prentice Hall of India Pvt. Ltd, New Delhi, 2012 Edition. ISBN: 978-81-203-2893-8.
3. Environmental Science- Working with the earth by G Taylor Miller Jr, Brooks Cole Thompson Publications, 10 thEdition, ISBN: 10: 0534424082
4. Elements of Environmental Science and Engineering by P. Meenakshi, Prentice Hall of India Pvt. Ltd, 2005 Edition, ISBN: 8120327748, 9788120327740.

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	**Tests**	**Assignments**	**Quiz**
Marks (out of 50)	**15**	**05**	**05**
Remember	5	2	2
Understand	5	2	2
Apply	5	1	1
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

SEE – Semester End Examination (25 Marks)

Bloom's Category	Tests
Remember	10
Understand	10
Apply	5
Analyze	0
Evaluate	0
Create	0

OBJECT ORIENTED PROGRAMMING WITH JAVA

Course Code : 19CSE43 | **Credits : 04**
L:T:P : 3:1:0 | **CIE Marks : 50**
Exam Hours : 3 | **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand and apply basic constructs of Java for development of simple programs.
CO2	Apply OOP principles and proper program structuring to develop programs.
CO3	Implement polymorphism and inheritance for an application program.
CO4	Build applications using multithreading and handle exceptions appropriately.
CO5	Create applications using Java collections.
CO6	Design and implement programs on I/O functions.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	1	1	-	2	2	3	3	3	3
CO2	3	3	-	1	1	-	2	2	3	3	3	3
CO3	3	3	-	1	1	-	2	2	3	3	3	3
CO4	3	3	-	1	1	-	2	3	3	3	3	3
CO5	3	3	-	1	1	-	2	3	3	3	3	3
CO6	3	3	-	1	1	-	2	3	3	3	3	3

Module No	Module Contents	Hours	COs
1	**Introduction to Java:** Basics of Java programming - Dissecting the "Hello, World" Program, Compiling and Running a Java Program, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.	**9**	**CO1**
2	**Objects and Classes:** Working with Objects, Implementing Classes, Object Construction, Static Variables and Methods, Constructors, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, this reference, nested classes.	**9**	**CO2**
3	**Inheritance and Polymorphism:** Inheritance and types, Super and sub class, Overriding, Polymorphism, Dynamic binding, Casting objects, Instance of operator, Abstract class, Interface, Package , Object class	**9**	**CO3**
4	**Exception Handling**: Exception Types , Uncaught Exceptions, Using try and catch, Multi catch clauses, Nested try statements, throw, throws, finally, Java's Built-in Exceptions.	**9**	**CO4**

	Threads: The java Thread Model, The main Thread, Creating a Thread, Creating multiple Threads, Thread Priorities, Synchronization, Interthread Communication, Suspending, resuming and Stopping Threads, using Multithreading.		
5	**I/O basics:** Reading input, writing output, Reading and Writing files **The Collections Framework:** Collections Overview, The Collection Interfaces- The List Interface, The Set Interface, The Queue Interface, The Collection Classes – Array ListClass, Linked List Class, Treeset Class	**9**	**CO5, CO6**

Text Book(s):

1. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition, 2018
2. Cay S. Horstmann, Core Java® SE 9 for the Impatient, Addison Wesley, Second Edition, 2018

Reference Book(s):

1. Cay S. Horstmann, Core Java™ Volume I—Fundamentals, Prentice Hall, Tenth Edition, 2015
2. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.
3. Ken Kousen, Modern Java Recipes, O'Reilly Media, Inc., 2017

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	**Tests**	**Assignments**	**Quizzes**	**Co-Curricular**
Marks (Out of 50)				
L1: Remember	2.5			
L2: Understand	2.5			
L3: Apply	5	5	5	
L4: Analyze	5	5	5	
L5: Evaluate	5			
L6: Create	5	5		

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Marks (Out of 50)**
L1: Remember	5
L2: Understand	5
L3: Apply	10
L4: Analyze	10
L5: Evaluate	10
L6: Create	10

ARM PROCESSOR

Course Code : 19CSE44 **Credits : 03**
L:T:P : 3:0:0 **CIE Marks : 50**
Exam Hours : 3 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand ARM family and its history.
CO2	Gain knowledge in Cortex M3 architecture.
CO3	Apply Cortex M3 instructions set to solve a problem.
CO4	Develop assembly language and embedded C language applications.
CO5	Realize the concepts of memory hierarchy.
CO6	Use exceptions and interrupt concepts to develop an application

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	2	-	-	2	-	2
CO2	3	3	3	3	-	-	2	-	3	2	-	2
CO3	3	3	3	3	-	-	2	-	3	2	-	2
CO4	3	3	3	3	-	-	2	-	3	2	-	2
CO5	3	3	3	3	3	-	2	-	3	2	-	2
CO6	3	3	3	3	3	-	2	-	3	2	-	2

Module No	Module Contents	Hours	COs
1	**ARM CORTEX Processors:** Introduction, Overview of ARM family Processor Evolution, Introduction to embedded system design, Cortex-M family processor, Architecture, Thumb-2 Technology.	9	CO1
2	**Fundamentals of Cortex-M3 architecture:** Registers, Special Registers, Operation Mode, Memory Map, Stack Memory Operations	9	CO2
3	**Instruction Sets:** Data Transfer, Branch Instructions, Barrier Instructions, other Instructions, Cortex-M3 assembly Programming, CMSIS.	9	C03, C04
4	**INTRODUCTION TO EMBEDDED C:** C-looping structures, Register allocation, Function calls, Pointer aliasing, structure arrangement, bit fields, unaligned data, inline functions and inline assembly, portability issues, Embedded Systems programming in C, Binding & Running Embedded C program in Keil IDE.	9	C03, C04

5	**Memory System, Exceptions and Interrupts:** Memory System Features Overview, Memory Maps, Memory endianness, Memory Access Attributes, Default Memory Access Permissions, Exception Types, Interrupt Management, Priorities, Exception sequence, NVIC and SCB registers for exception control, Interrupt Masking	9	CO5, CO6

Text Book(s):

1. The Definitive Guide to ARM Cortex-M3 and Cortex M4 Processor, Joseph Yiu, 3rd Edition, 2018, Newness Publication
2. The Designer's Guide to the Cortex-M Processor Family - A Tutorial Approach, Trevor Martin, 2nd Edition , 2013, Newness Publication

Reference Book(s):

1. ARM System On Chip Architecture, Steve Furber, 2nd edition, 2012, Pearson Education.
2. Embedded C, Michael J. Pont, 2007, Pearson Education

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	**Tests**	**Assignments**	**Quizzes**	**Co-Curricular**
Marks (Out of 50)	**25**	**10**	**05**	-
L1: Remember	-	-	-	-
L2: Understand	05	-	-	-
L3: Apply	10	05	05	-
L4: Analyze	05	05	05	-
L5: Evaluate	05	05	-	-
L6: Create	-	-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Marks (Out of 50)**
L1: Remember	10
L2: Understand	10
L3: Apply	15
L4: Analyze	10
L5: Evaluate	05
L6: Create	-

COMPUTER ORGANIZATION

Course Code : 19CSE45 | **Credits : 04**
L: T: P : 4:0:0 | **CIE Marks : 50**
Exam Hours : 3 | **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain technical knowledge on construction of computers, functional units and their interactions.
CO2	Understand the merits and pitfalls in computer performance measurements.
CO3	Recognize the importance of memory hierarchy on computer cost/ performance
CO4	Realize the representation of data and computations at machine level.
CO5	Understand internal structure of a processor and generation of control signals.
CO6	Identify various ways to perform input, output operations.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	1	1	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	3
CO3	3	3	2	1	1	1	-	-	-	-	2	3
CO4	3	3	2	1	1	-	-	-	-	-	-	3
CO5	3	3	2	1	1	-	1	-	-	-	-	3
CO6	3	3	2	1	1	-	-	1	-	-	2	3

Module No	Module Contents	Hours	COs
1	Introduction: Functional units, Basic operational concepts, Number representation and arithmetic operations and characters, Memory locations and addresses, Memory operations, Instructions and Instruction sequence, Addressing modes, Bus Structure, Bus operation, Arbitration	**9**	
2	Computer Arithmetic: Addition subtraction of signed numbers, Design of fast adders, Multiplication of unsigned and signed numbers, Fast multiplication, Integer Division, Floating point numbers and operations	**9**	
3	Computer Memory System &Input/Output Organization: Characteristics of Memory System, The Memory hierarchy, Elements of cache design: Cache addresses, Cache size, Mapping function, Performance considerations – Hit-ratio and Miss penalty – Caches on the processor	**9**	

	chip, Semiconductor main memory: Organization, DRAM and SRAM,Accessing I/O devices, Interrupts		
4	Basic Processing Unit: Fundamental concepts, Instruction execution, Hardware components, Instruction fetch and execution steps, control signals, hardwired control, CISC style processors	**9**	
5	Pipelining:Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Resource Limitations, Performance Evaluation, Superscalar Operation	**9**	

TEXT BOOKS:

1. Computer Organization and Embedded Systems , Carl Hamacher, ZvonksVranesic, SafeaZaky, McGraw Hill, Sixth Edition, 2012.
2. Computer Organization and Architecture, William Stallings, Pearson/PHI, Eighth edition, 2013

Reference Book(s):

1. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Elsevier, Fifth Edition, 2012.
2. Structured Computer Organization, Andrew S. Tanenbaum, PHI/Pearson, Sixth Edition 2013
3. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication, 2013

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**Quizzes**	**Co-Curricular**
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	10	-	-	-
Apply	10	10	-	5
Analyze	-	-	5	-
Evaluate	-	-	-	5
Create	-	-	-	-

SEE- Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

OBJECT ORIENTED PROGRAMMING WITH JAVA LAB

Course Code : 19CSL46 **Credits : 02**
L:T:P : 0:0:2 **CIE Marks : 25**
Exam Hours : 3 **SEE Marks : 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Apply basic constructs for development of simple Java programs.
CO2	Apply OOP principles and proper program structuring to develop programs.
CO3	Implement polymorphism and inheritance for an application program.
CO4	Build applications using multithreading, swings and handle exceptions appropriately.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	1	1	-	1	2	3	3	3	3
CO2	3	3	-	1	1	-	1	2	3	3	3	3
CO3	3	3	-	1	1	-	1	2	3	3	3	3
CO4	3	3	-	1	1	-	1	2	3	3	3	3

Exp. No	Experiment	Hours	COs
1	Java Program to demonstrate overloading, math class and arrays	**4**	**CO1**
2	Write a Java Program to define a class, describe its constructor, overload the Constructors and instantiate its object, and use static members.	**4**	**CO2**
3	Write a Java program to demonstrate String class, String Buffer class and its methods	**4**	**CO2**
4	Write a Java program to demonstrate nested classes and array of objects		
5	Write a Java Program to implement inheritance and demonstrate use of method overriding	**4**	**CO3**
6	Write a Java Program to implement multilevel inheritance by applying various access controls to its data members and methods		
7	Write a program to demonstrate use of implementing interfaces	**4**	**CO3**
8	Write a program to demonstrate use of extending interfaces		
9	Write a Java program to implement the concept of importing classes from user defined package and creating packages Write a Java Program to demonstrate dynamic binding, generic programming	**4**	**CO3**
10	Write a program to implement the concept of threading by	**4**	**CO4**

	extending Thread Class		
11	Write a program to implement the concept of threading by implementing Runnable Interface		
12	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	**4**	**CO4**
13	Write a program to implement the concept of Exception Handling using predefined exception	**4**	**CO4**
14	Write a program to implement the concept of Exception Handling by creating user defined exceptions		
15	Write a program to demonstrate File I/O Operations	**4**	**CO5**
16	Write a program to demonstrate Array ListClass, LinkedList Class, Treeset Class	**4**	**CO5**

Reference Material(s):

1. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition, 2018
2. Cay S. Horstmann, Core Java® SE 9 for the Impatient, Addison Wesley, Second Edition, 2018
3. Cay S. Horstmann, Core Java™ Volume I—Fundamentals, Prentice Hall, Tenth Edition, 2015
4. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.
5. Ken Kousen, Modern Java Recipes, O'Reilly Media, Inc., 2017

CIE – Continuous Internal Evaluation: Theory (25 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 25)	**25**
L1: Remember	
L2: Understand	
L3: Apply	10
L4: Analyze	5
L5: Evaluate	
L6: Create	10

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks (Out of 50)
L1: Remember	
L2: Understand	
L3: Apply	20
L4: Analyze	10
L5: Evaluate	
L6: Create	20

ARM PROCESSOR LAB

Course Code : 19CSL47 **Credits : 02**
L:T:P : 0:0:2 **CIE Marks : 25**
Exam Hours: 3 **SEE Marks : 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand the instruction set of 32- bit microcontroller ARM Cortex M3 and the software tool required for programming in assembly and C language.
CO2	Develop assembly language programs for different problem statements.
CO3	Develop C language programs for different applications.
CO4	Perform floating-point operations, Interface external hardware with ARM Cortex M3.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	-	2	-	-	2	-	2
CO2	3	3	3	1	-	-	2	-	3	2	-	2
CO3	3	3	3	1	-	-	2	-	3	2	-	2
CO4	3	3	3	1	-	-	2	-	3	2	-	2

Exp. No	Experiment	Hours	COs
1	Program to sort a given array of N elements is ascending / descending order using bubble sort.	4	CO1, CO2
2	Program to perform addition, multiplication and division operations	4	CO2
3	Program to generate Fibonacci series of N numbers	4	CO2
4	Program to compute factorial and ${}^{n}C_{r}$ using recursion	4	CO2
5	Program to find square and cube of a floating point number	4	CO2, CO4
6	Program to perform floating point addition and Subtraction	4	CO2, CO4
7	Program to display a message using Internal UART	4	CO3
8	Program to Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction	4	CO3, CO5
9	Program to Interface a DAC and generate Sinusoidal and Triangular waveforms	4	CO3, CO5
10	Program to display the given message on a 7-segment LED interface, with an appropriate delay in between	4	CO3, CO5
11	Program to Interface a 4x4 keyboard and display the key pressed on an LCD	4	CO3, CO5

Reference Material(s):

1. An Engineers Introduction to the LPC2100 series, Trevor Martin, Hitex (UK) Ltd
2. LPC 214x User manual (UM10139) :- www.nxp.com
3. LPC 17xx User manual (UM10360) :- www.nxp.com

CIE – Continuous Internal Evaluation: LAB (25 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 25)	**25**
L1: Remember	-
L2: Understand	05
L3: Apply	05
L4: Analyze	10
L5: Evaluate	05
L6: Create	-

SEE – Semester End Examination: LAB (25 Marks)

Blooms Taxonomy	**Marks (Out of 25)**
L1: Remember	-
L2: Understand	05
L3: Apply	05
L4: Analyze	10
L5: Evaluate	05
L6: Create	-

MINI PROJECT in JAVA

Course Code : 19CSE48 | **Credits : 02**
L:T:P : 0:0:0 | **CIE Marks: 25**
Exam Hours : 03 | **SEE Marks: 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand the technological needs and/ or societal needs.
CO2	Design and develop an algorithm by applying JAVA-programming features.
CO3	Analyze and evaluate the algorithm performance metrics.
CO4	Test, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	2	2
CO2	3	3	3	3	3	2	2	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	2	2	2
CO4	3	3	3	3	3	2	2	2	2	2	2	2

The student shall be capable of identifying a problem related to the field of Computer Science and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The code developed towards the project will be reviewed by the panel of experts during the course of the semester. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	**Mini Project**
Marks (out of 25)	
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	25
Create	-

SEE- Semester End Examination (25 Marks)

Blooms Category Marks (out of 25)	Tests
Remember	-
Understand	-
Apply	15
Analyze	-
Evaluate	10
Create	-

APPENDIX A

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

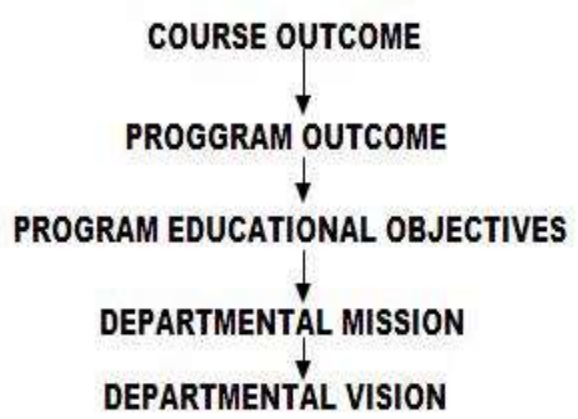
There are three educational Outcomes as defined by the National Board of Accredition:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum, each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX B

The Graduate Attributes of NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDIX C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.