VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI-590018

3rd to 8th Semester **BE – Computer Engineering (CE)**

Scheme of Teaching and Examinations

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

(Computer Engineering) (CE)

Scheme of Teaching and Examination (2018)

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT31	Transform Calculus, Fourier Series And Numerical Techniques	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CS32	Data Structures and Applications	CS / IS / AM	3	2	--	03	40	60	100	4
3	PCC	18CS33	Analog and Digital Electronics	CS / IS / AM	3	0	--	03	40	60	100	3
4	PCC	18CS34	Computer Organization	CS / IS / AM	3	0	--	03	40	60	100	3
5	PCC	18CS35	Software Engineering	CS / IS / AM	3	0	--	03	40	60	100	3
6	PCC	18CS36	Discrete Mathematical Structures	CS / IS / AM	3	0	--	03	40	60	100	3
7	PCC	18CSL37	Analog and Digital Electronics Laboratory	CS / IS / AM	--	2	2	03	40	60	100	2
8	PCC	18CSL38	Data Structures Laboratory	CS / IS / AM	--	2	2	03	40	60	100	2
9	HSMC	18KVK39	Balake Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK39	Samskrutika Kannada (Kannada for Administration)									
		OR	**OR**									
		18CPH39	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	**17 OR 18**	**10 OR 08**	**04**	**24 OR 27**	**420 OR 360**	**480 OR 540**	**900**	**24**

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course

18KVK39 Balake Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and **18KAK39** Samskrutika Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a) The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the student have to fulfil the requirements during subsequent semester/s to appear for SEE.

(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE Activity Points to be earned by students admitted to BE/B.Tech/B. Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the eighth semester grade card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

(Computer Engineering) (CE)

Scheme of Teaching and Examination (2018)

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT41	Complex Analysis, Probability And Statistical Methods	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CS42	Design and Analysis of Algorithms	CS / IS / AM	3	2	--	03	40	60	100	4
3	PCC	18CS43	Operating Systems	CS / IS / AM	3	0	--	03	40	60	100	3
4	PCC	18SC44	Microcontroller and Embedded Systems	CS / IS / AM	3	0	--	03	40	60	100	3
5	PCC	18CS45	Object Oriented Concepts	CS / IS / AM	3	0	--	03	40	60	100	3
6	PCC	18CS46	Data Communication	CS / IS / AM	3	0	--	03	40	60	100	3
7	PCC	18CSL47	Design and Analysis of Algorithm Laboratory	CS / IS / AM	--	2	2	03	40	60	100	2
8	PCC	18CSL48	Microcontroller and Embedded Systems Laboratory	CS / IS / AM	--	2	2	03	40	60	100	2
9	HSMC	18KVK49	Baleke Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK49	Samskrutika Kannada (Kannada for Administration)									
		OR	**OR**									
		18CPH49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	**17 OR 18**	**10 OR 08**	**04**	**24 OR 27**	**420 OR 360**	**480 OR 540**	**900**	**24**

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course

18KVK49 Balake Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and **18KAK49** Samskrutika Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP41	Additional Mathematics - II	Mathematics	02	01	--	03	40	60	100	0

(a) The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the student has to fulfil the requirements during subsequent semester/s to appear for SEE.

(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE activity Points: In case students fail to earn the prescribed activity Points, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

[1]TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

(Effective from the academic year 2018 -2019)

SEMESTER – III

Subject Code	**18MAT31**	**CIE Marks**	40
Number of Contact Hours/Week	2:2:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18MAT31) will enable students to:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module 1

Laplace Transform: Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.

Inverse Laplace Transform: Definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.

RBT: L2, L3a

Module 2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

RBT: L1, L2

Module 3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.

Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transformand applications to solve difference equations.

RBT: L1, L2

Module 4

Numerical Solutions of Ordinary Differential Equations(ODE's):

Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge - Kutta method of fourth order, Milne's and Adam-Bashforthpredictor and corrector method (No derivations of formulae)-Problems.

RBT: L1, L2

Module 5

Numerical Solution of Second Order ODE's: Runge -Kutta method and Milne's predictor and corrector method. (No derivations of formulae).

Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.

- Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2016
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017
3. Srimanta Pal et al , Engineering Mathematics, Oxford University Press, 3rd Edition, 2016

Reference Books:

1. C.Ray Wylie, Louis C.Barrett , Advanced Engineering Mathematics, McGraw-Hill Book Co, 6th Edition, 1995
2. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition 2010
3. B.V.Ramana, Higher Engineering Mathematics, McGraw-Hill, 11th Edition,2010
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 6th Edition, 2014

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME – 20

ADDITIONAL MATHEMATICS – I

(Mandatory Learning Course: Common to All Branches)

(A Bridge course for Lateral Entry students under Diploma quota to BE/B.Tech programmes)

(Effective from the academic year 2018 -2019)

SEMESTER – III

Subject Code	**18MATDIP31**	CIE Marks	40
Number of Contact Hours/Week	2:1:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS – 00

Course Learning Objectives: This course (18MATDIP31) will enable students to:

- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.

- To provide an insight into vector differentiation and first order ODE's.

Module 1

Complex Trigonometry: Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
Vector Algebra: Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.
RBT: L2, L2

Module 2

Differential Calculus: Review of successive differentiation-illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.
RBT: L1, L2

Module 3

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.
RBT: L1, L2

Module 4

Integral Calculus: Review of elementary integral calculus. Reduction formulae for $\sin^n x$, $\cos^n x$ (with proof) and $\sin^m x \cos^n x$ (without proof) and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.
RBT: L1, L2

Module 5

Ordinary differential equations (ODE's. Introduction-solutions of first order and first degree differential equations: exact, linear differential equations. Equations reducible to exact and Bernoulli's equation.
RBT: L1, L2

Course Outcomes: The student will be able to :

- Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
- Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
- Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
- Learn techniques of integration including the evaluation of double and triple integrals.
- Identify and solve first order ordinary differential equations.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2016

2. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 6th Edition, 2014
3. RohitKhurana , Engineering Mathematics Vol.I, Cengage Learning, 1st Edition,2015.

DATA STRUCTURES AND APPLICATIONS
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	**18CS32**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs

CREDITS –4

Course Learning Objectives: This course (18CS32) will enable students to:

- Explain fundamentals of data structures and their applications essential for programming/problem solving.
- Illustrate linear representation of data structures: Stack, Queues, Lists, Trees and Graphs.
- Demonstrate sorting and searching algorithms.
- Find suitable data structure during application development/Problem Solving.

Module 1

Introduction: Data Structures, Classifications (Primitive &Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays.
Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices.
Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.
Textbook 1: Chapter 1: 1.2, Chapter 2: 2.2 - 2.7Text Textbook 2: Chapter 1: 1.1 - 1.4, Chapter 3: 3.1 - 3.3, 3.5, 3.7, Chapter 4: 4.1 - 4.9, 4.14Reference 3: Chapter 1: 1.4
RBT: L1, L2, L3

Module 2

Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression.
Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. **Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples.
Textbook 1: Chapter 3: 3.1 -3.7Textbook 2: Chapter 6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13
RBT: L1, L2, L3

Module 3

Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. 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. Programming Examples
Textbook 1: Chapter 4: 4.1 – 4.6, 4.8, Textbook 2: Chapter 5: 5.1 – 5.10,
RBT: L1, L2, L3

Module 4

Trees: 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 – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples
Textbook 1: Chapter 5: 5.1 –5.5, 5.7; Textbook 2: Chapter 7: 7.1 – 7.9
RBT: L1, L2, L3

Module 5

Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search.
Sorting and Searching: 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
Textbook 1: Chapter 6 : 6.1 –6.2, Chapter 7:7.2, Chapter 8 : 8.1-8.3
Textbook 2: Chapter 8 : 8.1 – 8.7, Chapter 9 : 9.1-9.3, 9.7, 9.9
Reference 2: Chapter 16 : 16.1 - 16.7
RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Use different types of data structures, operations and algorithms
- Apply searching and sorting operations on files
- Use stack, Queue, Lists, Trees and Graphs in problem solving
- Implement all data structures in a high-level language for problem solving.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Ellis Horowitz and SartajSahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Reference Books:

1. Gilberg&Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
2. ReemaThareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013
4. A M Tenenbaum, Data Structures using C, PHI, 1989
5. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.

ANALOG AND DIGITAL ELECTRONICS

(Effective from the academic year 2018 -2019)

SEMESTER – III

Subject Code	**18CS33**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18CS33) will enable students to:

- Explain the use of photoelectronics devices, 555 timer IC, Regulator ICs and uA741 opamap IC
- Make use of simplifying techniques in the design of combinational circuits.
- Illustrate combinational and sequential digital circuits
- Demonstrate the use of flipflops and apply for registers
- Design and test counters, Analog-to-Digital and Digital-to-Analog conversion techqniues.

Module 1

Photodiodes, Light Emitting Diodes and Optocouplers ,BJT Biasing :Fixed bias ,Collector to base Bias , voltage divider bias, Operational Amplifier Application Circuits: Multivibrators using IC-555, Peak Detector, Schmitt trigger, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-to-Voltage and Voltage-to-Current Converter , Regulated Power Supply Parameters, adjustable voltage regulator ,D to A and A to D converter. **Text Book 1 :Part A:Chapter 2(Section 2.9,2.10,2.11), Chapter 4(Section 4.2 ,4.3,4.4),Chapter 7 (section (7.2,7.3.1,7.4,7.6 to 7.11), Chapter 8 (section (8.1,8.5), Chapter 9**

RBT: L1, L

Module 2

Karnaugh maps: minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, determination of minimum expressions using essential prime implicants, Quine-McClusky Method: determination of prime implicants, The prime implicant chart, petricks method, simplification of incompletely specified functions, simplification using map-entered variables

Text book 1:Part B: Chapter 5 (Sections 5.1 to 5.4) Chapter 6(Sections 6.1 to 6.5)
RBT: L1, L2

Module 3

Combinational circuit design and simulation using gates: Review of Combinational circuit design, design of circuits with limited Gate Fan-in ,Gate delays and Timing diagrams, Hazards in combinational Logic, simulation and testing of logic circuits

Multiplexers, Decoders and Programmable Logic Devices: Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices, Programmable Logic Arrays, Programmable Array Logic.

Text book 1:Part B: Chapter 8,Chapter 9 (Sections 9.1 to 9.6)
RBT: L1, L2

Module 4

Introduction to VHDL: VHDL description of combinational circuits, VHDL Models for multiplexers, VHDL Modules. Latches and Flip-Flops: Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop 3,SR Flip Flop, J K Flip Flop, T Flip Flop, Flip Flop with additional inputs, Asynchronous Sequential Circuits

Text book 1:Part B: Chapter 10(Sections 10.1 to 10.3),Chapter 11 (Sections 11.1 to 11.9)
RBT: L1, L2

Module 5

Registers and Counters: Registers and Register Transfers, Parallel Adder with accumulator, shift registers, design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops, sequential parity checker, state tables and graphs

Text book 1:Part B: Chapter 12(Sections 12.1 to 12.5),Chapter 13(Sections 13.1,13.3
RBT: L1, L2

Course Outcomes: The student will be able to :

- Design and analyze application of analog circuits using photo devices, timer IC, power supply and regulator IC and op-amp.
- Explain the basic principles of A/D and D/A conversion circuits and develop the same.
- Simplify digital circuits using Karnaugh Map , and Quine-McClusky Methods
- Explain Gates and flip flops and make us in designing different data processing circuits, registers and counters and compare the types.
- Develop simple HDL programs

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Charles H Roth and Larry L Kinney, Raghunandan G H, Analog and Digital Electronics, Cengage Learning,2019

Reference Books:

1. Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino&GoutamSaha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
3. M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.
4. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008

COMPUTER ORGANIZATION

(Effective from the academic year 2018 -2019)

SEMESTER – III

Subject Code	**18CS34**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18CS34) will enable students to:

- Explain the basic sub systems of a computer, their organization, structure and operation.
- Illustrate the concept of programs as sequences of machine instructions.
- Demonstrate different ways of communicating with I/O devices and standard I/O interfaces.
- Describe memory hierarchy and concept of virtual memory.

- Describe arithmetic and logical operations with integer and floating-point operands.
- Illustrate organization of a simple processor, pipelined processor and other computing systems.

Module 1

Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

Text book 1: Chapter1 – 1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7), Chapter2 – 2.2 to 2.10
RBT: L1, L2, L3

Module 2

Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.

Text book 1: Chapter4 – 4.1, 4.2, 4.4, 4.5, 4.6, 4.7
RBT: L1, L2, L3

Module 3

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations.

Text book 1: Chapter5 – 5.1 to 5.4, 5.5(5.5.1, 5.5.2), 5.6
RBT: L1, L2, L3

Module 4	
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division. **Text book 1: Chapter2-2.1, Chapter6 – 6.1 to 6.6** **RBT: L1, L2, L3**	08
Module 5	

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control.

Pipelining: Basic concepts of pipelining,

Text book 1: Chapter7, Chapter8 – 8.1
RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Explain the basic organization of a computer system.
- Demonstrate functioning of different sub systems, such as processor, Input/output,and memory.
- Illustrate hardwired control and micro programmed control, pipelining, embedded and other computing systems.
- Design and analyse simple arithmetic and logical units.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

• The students will have to answer 5 full questions, selecting one full question from each module.
Textbooks:
1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and12)
Reference Books:
1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.

SOFTWARE ENGINEERING (Effective from the academic year 2018 -2019) **SEMESTER – III**			
Subject Code	**18CS35**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			
Course Learning Objectives: This course (18CS35) will enable students to: • Outline software engineering principles and activities involved in building large software programs.Identify ethical and professional issues and explain why they are of concern to software engineers. • Explain the fundamentals of object oriented concepts • Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. Differentiate system models, use UML diagrams and apply design patterns. • Discuss the distinctions between validation testing and defect testing. • Recognize the importance of software maintenance and describe the intricacies involved in software evolution.Apply estimation techniques, schedule project activities and compute pricing. • Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved.			
Module 1			
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. **Software Processes**: Models: Waterfall Model **(Sec 2.1.1)**, Incremental Model **(Sec 2.1.2)** and Spiral Model **(Sec 2.1.3)**. Process activities. **Requirements Engineering**: Requirements Engineering Processes **(Chap 4)**. Requirements Elicitation and Analysis **(Sec 4.5).** Functional and non-functional requirements **(Sec 4.1)**. The software Requirements Document **(Sec 4.2)**. Requirements Specification **(Sec 4.3)**. Requirements validation **(Sec 4.6)**. Requirements Management **(Sec 4.7)**. **RBT: L1, L2, L3**			
Module 2			
What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. **Introduction, Modelling Concepts and Class Modelling:** What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and			

Inheritance; A sample class model; Navigation of class models;
Textbook 2: Ch 1,2,3. RBT: L1, L2 L3

Module 3

System Models: Context models **(Sec 5.1)**. Interaction models **(Sec 5.2)**. Structural models **(Sec 5.3)**. Behavioral models **(Sec 5.4)**. Model-driven engineering **(Sec 5.5)**.
Design and Implementation: Introduction to RUP **(Sec 2.4)**, Design Principles **(Chap 17)**. Object-oriented design using the UML **(Sec 7.1)**. Design patterns **(Sec 7.2)**. Implementation issues **(Sec 7.3)**. Open source development **(Sec 7.4)**.
RBT: L1, L2, L3

Module 4

Software Testing: Development testing **(Sec 8.1)**, Test-driven development **(Sec 8.2)**, Release testing **(Sec 8.3)**, User testing **(Sec 8.4)**. Test Automation **(Page no 42, 70,212, 231,444,695)**.
Software Evolution: Evolution processes **(Sec 9.1)**. Program evolution dynamics **(Sec 9.2)**. Software maintenance **(Sec 9.3)**. Legacy system management **(Sec 9.4)**.
RBT: L1, L2, L3

Module 5

Project Planning: Software pricing **(Sec 23.1)**. Plan-driven development **(Sec 23.2)**. Project scheduling **(Sec 23.3)**: Estimation techniques **(Sec 23.5)**. **Quality management**: Software quality **(Sec 24.1)**. Reviews and inspections **(Sec 24.3)**. Software measurement and metrics **(Sec 24.4)**. Software standards **(Sec 24.2), RBT: L1, L2, L**

Course Outcomes: The student will be able to :

- Design a software system, component, or process to meet desired needs within realistic constraints.
- Assess professional and ethical responsibility
- Function on multi-disciplinary teams
- Use the techniques, skills, and modern engineering tools necessary for engineering practice
- Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.

Reference Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

DISCRETE MATHEMATICAL STRUCTURES (Effective from the academic year 2018 -2019) SEMESTER – III			
Subject Code	**18CS36**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs
CREDITS –3			

Course Learning Objectives: This course (18CS36) will enable students to:

- Provide theoretical foundations of computer science to perceive other courses in the programme.
- Illustrate applications of discrete structures: logic, relations, functions, set theory and counting.
- Describe different mathematical proof techniques,
- Illustrate the importance of graph theory in computer science

Module 1

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.
Text book 1: Chapter2 , RBT: L1, L2, L3

Module 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, Combinations with Repetition.
Text book 1: Chapter4 – 4.1, Chapter1, RBT: L1, L2, L3

Module 3

Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.
Relations: Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders –Hasse Diagrams, Equivalence Relations and Partitions.
Text book 1: Chapter5 , Chapter7 – 7.1 to 7.4
RBT: L1, L2, L3

Module 4

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.
Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.
Text book 1: Chapter8 – 8.1 to 8.4, Chapter10 – 10.1, 10.2
RBT: L1, L2, L3

Module 5

Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism,
Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes
Text book 1: Chapter11 – 11.1 to 11.2 Chapter12 – 12.1 to 12.4
RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Use propositional and predicate logic in knowledge representation and truth verification.
- Demonstrate the application of discrete structures in different fields of computer science.
- Solve problems using recurrence relations and generating functions.

- Application of different mathematical proofs techniques in proving theorems in the courses.
- Compare graphs, trees and their applications.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education. 2004.

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. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.
5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

ANALOG AND DIGITAL ELECTRONICS LABORATORY

(Effective from the academic year 2018 -2019)

SEMESTER – III

Subject Code	**18CSL37**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	3 Hrs
Credits – 2			

Course Learning Objectives: This course (18CSL37) will enable students to:

This laboratory course enable students to get practical experience in design, assembly and evaluation/testing of

- Analog components and circuits including Operational Amplifier, Timer, etc.
- Combinational logic circuits.
- Flip - Flops and their operations
- Counters and registers using flip-flops.
- Synchronous and Asynchronous sequential circuits.
- A/D and D/A converters

Descriptions (if any):

- Simulation packages preferred: Multisim, Modelsim, PSpice or any other relevant.
- For Part A (Analog Electronic Circuits) students must trace the wave form on Tracing sheet / Graph sheet and label trace.
- Continuous evaluation by the faculty must be carried by including performance of a student in both hardware implementation and simulation (if any) for the given circuit.
- A batch not exceeding 4 must be formed for conducting the experiment. For simulation individual student must execute the program.

Laboratory Programs:

PART A (Analog Electronic Circuits)	
1.	Design an astablemultivibratorciruit for three cases of duty cycle (50%, <50% and >50%) using NE 555 timer IC. Simulate the same for any one duty cycle.
2.	Using ua 741 Opamp, design a 1 kHz Relaxation Oscillator with 50% duty cycle. And simulate the same.
3.	Using ua 741 opamap, design a window comparate for any given UTP and LTP. And simulate the same.
PART B (Digital Electronic Circuits)	
4.	Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates. And implement the same in HDL.
5.	Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC. And implement the same in HDL.
6.	Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table. And implement the same in HDL.
7.	Design and implement code converter I)Binary to Gray (II) Gray to Binary Code using basic gates.
8.	Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
9.	Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC-7447)

Laboratory Outcomes: The student should be able to:

- Use appropriate design equations / methods to design the given circuit.
- Examine and verify the design of both analog and digital circuits using simulators.
- Make us of electronic components, ICs, instruments and tools for design and testing of circuits for the given the appropriate inputs.
- Compile a laboratory journal which includes; aim, tool/instruments/software/components used, design equations used and designs, schematics, program listing, procedure followed, relevant theory, results as graphs and tables, interpreting and concluding the findings.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
  a) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  b) For laboratories having PART A and PART B
     i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
     ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

DATA STRUCTURES LABORATORY

(Effective from the academic year 2018 -2019)

SEMESTER – III

Subject Code	**18CSL38**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	3 Hrs

Credits – 2

Course Learning Objectives: This course (18CSL38) will enable students to:

This laboratory course enable students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Asymptotic performance of algorithms.
- Linear data structures and their applications such as stacks, queues and lists
- Non-Linear data structures and their applications such as trees and graphs
- Sorting and searching algorithms

Descriptions (if any):

- Implement all the programs in 'C / C++'Programming Language and Linux / Windows as OS.

Programs List:

1.	Design, Develop and Implement a menu driven Program in C for the following array operations. a. Creating an array of N Integer Elements b. Display of array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position(POS) e. Exit. Support the program with functions for each of the above operations.
2.	Design, Develop and Implement a Program in C for the following operationson Strings. a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.
3.	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
4.	Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.

5.	Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks
6.	Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7.	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: *USN, Name, Branch, Sem, PhNo* a. Create a SLL of N Students Data by using *front insertion*. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit
8.	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: *SSN, Name, Dept, Designation, Sal, PhNo* a. Create a DLL of N Employees Data by using *end insertion*. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit
9.	Design, Develop and Implement a Program in C for the following operationson Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z-4yz^5+3x^3yz+2xy^5z-2xyz^3$ b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations
10.	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers . a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit
11.	Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities

	a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method
12.	Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Laboratory Outcomes: The student should be able to:

- Analyze and Compare various linear and non-linear data structures
- Code, debug and demonstrate the working nature of different types of data structures and their applications
- Implement, analyze and evaluate the searching and sorting algorithms
- Choose the appropriate data structure for solving real world problems

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
  c) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  d) For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

18KVK39 Balake Kannada

18KAK39 SamskrutikaKannada

Syllabus of these subjects are available on web portal of VTU at

https://vtu.ac.in/en/b-e-scheme-syllabus/#1553774212657-ea19bad3-a58d

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

(Effective from the academic year 2018 -2019)

SEMESTER – IV

Subject Code	**18MAT41**	**CIE Marks**	40
Number of Contact Hours/Week	2:2:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18MAT41) will enable students to:

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module 1

Calculus of complex functions: Review offunction of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in cartesian and polar forms and consequences. Construction of analytic functions : Milne-Thomson method-Problems.

RBT: L1, L2

Module 2

Conformal transformations: Introduction. Discussion of transformations: $w= z^2$, $w= e^z$, $w = z + \frac{1}{z}, (z \neq 0)$. Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

RBT: L1, L2

Module 3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

RBT: L1, L2, L3

Module 4

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-

$y = ax + b, y = ax^b$ & $y = ax^2 + bx + c.$

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems.

RBT: L1, L2, L3

Module 5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

RBT:L2, L3, L4

Course Outcomes: The student will be able to :

- Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2016
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017
3. Srimanta Pal et al , Engineering Mathematics, Oxford University Press, 3rd Edition, 2016

Reference Books:

1. C.Ray Wylie, Louis C.Barrett , Advanced Engineering Mathematics, McGraw-Hill Book Co, 6th Edition, 1995
2. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition 2010
3. B.V.Ramana, Higher Engineering Mathematics, McGraw-Hill, 11th Edition,2010
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 6th Edition, 2014

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME – 20

ADDITIONAL MATHEMATICS – II

(Mandatory Learning Course: Common to All Branches)

(A Bridge course for Lateral Entry students under Diploma quota to BE/B.Tech programmes)

(Effective from the academic year 2018 -2019)

SEMESTER – IV

Subject Code	**18MATDIP41**	**CIE Marks**	40
Number of Contact Hours/Week	2:1:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS – 0

Course Learning Objectives: This course (18MATDIP41) will enable students to:

- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

Module 1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and eigen vectors of a square matrix. Problems.

RBT: L2, L2

Module 2

Numerical Methods: Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)-Illustrative examples. Numerical integration: Simpson's one third rule and Weddle's rule (without proof) Problems.

RBT: L1, L2, L3

Module 3

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.*[Particular Integral restricted to R(x)=* e^{ax}, sin *ax* /cos *ax for* $f(D)_{y=R(x)}$.]

RBT: L1, L2

Module 4

Partial Differential Equations(PDE's):- Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

RBT: L1, L2

Module 5

Probability: Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes's theorem, problems.

RBT: L1, L2

Course Outcomes: The student will be able to :

- Solve systems of linear equations using matrix algebra.
- Apply the knowledge of numerical methods in modelling and solving engineering problems.
- Make use of analytical methods to solve higher order differential equations.
- Classify partial differential equations and solve them by exact methods.
- Apply elementary probability theory and solve related problems.

Question Paper Pattern:

- The question paper will have ten questions.

- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2016
2. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 6th Edition, 2014
3. RohitKhurana , Engineering Mathematics Vol.I, Cengage Learning, 1st Edition, 2015.

DESIGN AND ANALYSIS OF ALGORITHMS

(Effective from the academic year 2018 -2019)

SEMESTER – IV

Subject Code	**18CS42**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	3 Hrs

CREDITS –4

Course Learning Objectives: This course (18CS42) will enable students to:

- Explain various computational problem solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis.

Module 1

Introduction: What is an Algorithm? **(T2:1.1),** Algorithm Specification **(T2:1.2),** Analysis Framework **(T1:2.1),Performance Analysis**: Space complexity, Time complexity **(T2:1.3)**. **Asymptotic Notations:** Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples **(T1:2.2, 2.3, 2.4).Important Problem Types:**Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. **Fundamental Data Structures:**Stacks, Queues, Graphs, Trees, Sets and Dictionaries. **(T1:1.3,1.4).**

RBT: L1, L2, L3

Module 2

Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum **(T2:3.1, 3.3, 3.4)**, Merge sort, Quick sort **(T1:4.1, 4.2)**, Strassen's matrix multiplication **(T2:3.8)**, Advantages and Disadvantages of divide and conquer. **Decrease and Conquer Approach:** Topological Sort. **(T1:5.3).**

RBT: L1, L2, L3

Module 3

Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines **(T2:4.1, 4.3, 4.5).Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm **(T1:9.1, 9.2)**. **Single source shortest paths:** Dijkstra's Algorithm **(T1:9.3)**. **Optimal Tree problem:**Huffman Trees and Codes **(T1:9.4)**. **Transform and Conquer Approach:** Heaps and Heap Sort **(T1:6.4)**.

RBT: L1, L2, L3

Module 4
Dynamic Programming: General method with Examples, Multistage Graphs **(T2:5.1, 5.2)**. **Transitive Closure:**Warshall's Algorithm, **All Pairs Shortest Paths:**Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem **((T1:8.2, 8.3, 8.4)**, Bellman-Ford Algorithm **(T2:5.4)**, Travelling Sales Person problem **(T2:5.9)**, Reliability design **(T2:5.8)**. **RBT: L1, L2, L3**
Module 5
Backtracking: General method **(T2:7.1)**, N-Queens problem **(T1:12.1)**, Sum of subsets problem **(T1:12.1)**, Graph coloring**(T2:7.4)**, Hamiltonian cycles **(T2:7.5)**. **Branch and Bound:** Assignment Problem, Travelling Sales Person problem **(T1:12.2)**, **0/1 Knapsack problem (T2:8.2, T1:12.2):** LC Branch and Bound solution **(T2:8.2)**, FIFO Branch and Bound solution **(T2:8.2)**. **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes **(T2:11.1)**. **RBT: L1, L2, L3**
Course Outcomes: The student will be able to :
• Describe computational solution to well known problems like searching, sorting etc. • Estimate the computational complexity of different algorithms. • Devise an algorithm using appropriate design strategies for problem solving.
Question Paper Pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Textbooks:
1. Introduction to the Design and Analysis of Algorithms, AnanyLevitin:, 2rd Edition, 2009. Pearson. 2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press
Reference Books:
1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI. 2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education).

OPERATING SYSTEMS

(Effective from the academic year 2018 -2019)

SEMESTER – IV

Subject Code	**18CS43**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18CS43) will enable students to:

- Introduce concepts and terminology used in OS
- Explain threading and multithreaded systems
- Illustrate process synchronization and concept of Deadlock
- Introduce Memory and Virtual memory management, File system and storage techniques

Module 1

Introduction to operating systems, 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; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. **Process Management** Process concept; Process scheduling; Operations on processes; Inter process communication

Text book 1: Chapter 1, 2.1, 2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.10, 3.1, 3.2, 3.3, 3.4

RBT: L1, L2, L3

Module 2

Multi-threaded Programming: 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.

Text book 1: Chapter 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, 5.5, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7

RBT: L1, L2, L3

Module 3

Deadlocks : 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.

Text book 1: Chapter 7, 8.1 to 8.6

RBT: L1, L2, L3

Module 4

Virtual Memory Management: 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.

Text book 1: Chapter 91. To 9.6, 10.1 to 10.5

RBT: L1, L2, L3

Module 5

Secondary Storage Structures, Protection: 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 book 1: Chapter 12.1 to 12.6, 21.1 to 21.9
RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Demonstrate need for OS and different types of OS
- Apply suitable techniques for management of different resources
- Use processor, memory, storage and file system commands
- Realize the different concepts of OS in platform of usage through case studies

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006

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.

MICROCONTROLLER AND EMBEDDED SYSTEMS

(Effective from the academic year 2018 -2019)
SEMESTER – IV

Subject Code	**18CS44**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18CS44) will enable students to:

- Understand the fundamentals of ARM based systems, basic hardware components, selection methods and attributes of an embedded system.
- Program ARM controller using the various instructions
- Identify the applicability of the embedded system
- Comprehend the real time operating system used for the embedded system

Module 1

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

Text book 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5

RBT: L1, L2

Module 2

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

ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs

Text book 1: Chapter 3:Sections 3.1 to 3.6 (Excluding 3.5.2), Chapter 6(Sections 6.1 to 6.6)

RBT: L1, L2

Module 3

Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.

Text book 2:Chapter 1(Sections 1.2 to 1.6),Chapter 2(Sections 2.1 to 2.6)

RBT: L1, L2

Module 4

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational quality attributes ,non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling, embedded firmware design and development

Text book 2: Chapter-3, Chapter-4, Chapter-7 (Sections 7.1, 7.2 only), Chapter-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)

RBT: L1, L2

Module 5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan.

Text book 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.4 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 (block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

RBT: L1, L2

Course Outcomes: The student will be able to :

- Describe the architectural features and instructions of ARM microcontroller
- Apply the knowledge gained for Programming ARM for different applications.
- Interface external devices and I/O with ARM microcontroller.
- Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

- Develop the hardware /software co-design and firmware design approaches.
- Demonstrate the need of real time operating system for embedded system applications

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.

Reference Books:

1. Raghunandan..G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
2. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.
4. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.

OBJECT ORIENTED CONCEPTS

(Effective from the academic year 2018 -2019)

SEMESTER – IV

Subject Code	**18CS45**	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18CS45) will enable students to:

- Learn fundamental features of object oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Create multi-threaded programs and event handling mechanisms.
- Introduce event driven Graphical User Interface (GUI) programming using applets and swings.

Module 1

Introduction to Object Oriented Concepts:

A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. **Class and Objects:** Introduction, member functions and data, objects and functions.

Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.3

RBT: L1, L2

Module 2

Class and Objects (contd):

Objects and arrays, Namespaces, Nested classes, Constructors, Destructors.

Introduction to Java: Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords,

Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.
Text book 1:Ch 2: 2.4 to 2.6Ch 4: 4.1 to 4.2
Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5
RBT: L1, L2

Module 3

Classes, Inheritance,Exception Handling: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. **Inheritance:** inheritance basics, using super, creating multi level hierarchy, method overriding. **Exception handling:** Exception handling in Java.
Text book 2: Ch:6 Ch: 8 Ch:10
RBT: L1, L2, L3

Module 4

Packages and Interfaces: Packages, Access Protection,ImportingPackages.Interfaces.
Multi ThreadedProgramming: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, producer consumer problems.
Text book 2: CH: 9 Ch 11:
RBT: L1, L2, L3

Module 5

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.
Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.
Text book 2: Ch 22: Ch: 29 Ch: 30
RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Explain the object-oriented concepts and JAVA.
- Develop computer programs to solve real world problems in Java.
- Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using swings.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006
2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.

Reference Books:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806
2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.

3. Stanley B.Lippmann, JoseeLajore, C++ Primer, 4th Edition, Pearson Education, 2005.
4. RajkumarBuyya,SThamarasiselvi, xingchenchu, Object oriented Programming with java, Tata McGraw Hill education private limited.
5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

Mandatory Note: Every institute shall organize bridge course on C++, either in the vacation or in the beginning of even semester for a minimum period of ten days (2hrs/day). Maintain a copy of the report for verification during LIC visit.

Faculty can utilize open source tools to make teaching and learning more interactive.

DATA COMMUNICATION

(Effective from the academic year 2018 -2019)

SEMESTER – IV

Subject Code	**18CS46**	CIE Marks	40
Number of Contact Hours/Week	3:0:0	SEE Marks	60
Total Number of Contact Hours	40	Exam Hours	3 Hrs

CREDITS –3

Course Learning Objectives: This course (18CS46) will enable students to:

- Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Explain with the basics of data communication and various types of computer networks;
- Demonstrate Medium Access Control protocols for reliable and noisy channels.
- Expose wireless and wired LANs.

Module 1

Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, **Networks Models**: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer-1:** Data and Signals**,** Digital Signals, Transmission Impairment, Data Rate limits, Performance.

Textbook1: Ch 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6

RBT: L1, L2

Module 2

Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding). **Physical Layer-2:** Analog to digital conversion (only PCM), Transmission Modes, **Analog Transmission**: Digital to analog conversion.

Textbook1: Ch 4.1 to 4.3, 5.1

RBT: L1, L2

Module 3

Bandwidth Utilization: Multiplexing and Spread Spectrum,

Switching: Introduction, Circuit Switched Networks and Packet switching.

Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum,

Textbook1: Ch 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.4

RBT: L1, L2

Module 4

Data link control: DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only). **Media Access control**: Random Access, Controlled Access and Channelization,

Introduction to Data-Link Layer: Introduction, Link-Layer Addressing, ARP
IPv4 Addressing and subnetting: Classful and CIDR addressing, DHCP, NAT
Textbook1: Ch 9.1, 9.2, 11.1, 11.2 11.4, 12.1 to 12.3, 18.4
RBT: L1, L2

Module 5

Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet,
Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.
Other wireless Networks: Cellular Telephony
Textbook1: Ch 13.1 to 13.5, 15.1 to 15.3, 16.2
RBT: L1, L2

Course Outcomes: The student will be able to :

- Explain the various components of data communication.
- Explain the fundamentals of digital communication and switching.
- Compare and contrast data link layer protocols.
- Summarize IEEE 802.xx standards

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013.

Reference Books:

1. Alberto Leon-Garcia and IndraWidjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

(Effective from the academic year 2018 -2019)

SEMESTER – IV

Subject Code	**18CSL47**	CIE Marks	40
Number of Contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab Contact Hours	36	Exam Hours	3 Hrs

Credits – 2

Course Learning Objectives: This course (18CSL47) will enable students to:

- Design and implement various algorithms in JAVA
- Employ various design strategies for problem solving.
- Measure and compare the performance of different algorithms.

Descriptions (if any):

- Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans / Eclipse or IntellijIdea Community Edition IDE tool can be used for development and demonstration.
- **Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.**

Programs List:

1.	
a.	Create a Java class called ***Student***with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create *nStudent* objects and print the USN, Name, Branch, and Phoneof these objects with suitable headings.
b.	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
2.	
a.	Design a superclass called ***Staff*** with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely ***Teaching*** (domain, publications), ***Technical*** (skills), and ***Contract*** (period). Write a Java program to read and display at least 3 *staff* objects of all three categories.
b.	Write a Java class called ***Customer*** to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as "/".
3.	
a.	Write a Java program to read two integers *a*and*b*. Compute *a*/*b* and print, when *b* is not zero. Raise an exception when *b* is equal to zero.
b.	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number andprints; third thread will print the value of cube of the number.

4.	Sort a given set of ***n*** integer elements using **Quick Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000 and record the time taken to sort. Plot a graph of the time taken versus ***n***on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
5.	Sort a given set of ***n*** integer elements using **Merge Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000, and record the time taken to sort. Plot a graph of the time taken versus ***n***on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6.	Implement in Java, the **0/1 Knapsack** problem using (a) Dynamic Programming method (b) Greedy method.
7.	From a given vertex in a weighted connected graph, find shortest paths to other vertices using **Dijkstra's algorithm**. Write the program in Java.
8.	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Kruskal'salgorithm.** Use Union-Find algorithms in your program
9.	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Prim's algorithm**.
10.	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using **Floyd's algorithm**. (b) Implement **Travelling Sales Person problem** using Dynamic programming.
11.	Design and implement in Java to find a **subset** of a given set **S** = {S_1, S_2,.....,S_n} of ***n*** positive integers whose SUM is equal to a given positive integer ***d***. For example, if S ={1, 2, 5, 6, 8} and ***d***= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.
12.	Design and implement in Java to find all **Hamiltonian Cycles** in a connected undirected Graph G of *n* vertices using backtracking principle.
Laboratory Outcomes: The student should be able to:	
• Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.) • Implement a variety of algorithms such assorting, graph related, combinatorial, etc., in a high level language. • Analyze and compare the performance of algorithms using language features. • Apply and implement learned algorithm design techniques and data structuresto solve real-world problems.	
Conduct of Practical Examination:	
• Experiment distribution	

- For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
- For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
  e) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  f) For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

MICROCONTROLLER AND EMBEDDED SYSTEMS LABORATORY (Effective from the academic year 2018 -2019) SEMESTER – IV			
Subject Code	**18CSL48**	CIE Marks	40
Number of Contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab Contact Hours	36	Exam Hours	3 Hrs
Credits – 2			

Course Learning Objectives: This course (18CSL48) will enable students to:

- Develop and test Program using ARM7TDMI/LPC2148
- Conduct the experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' &Keil Uvision-4 tool/compiler.

Descriptions (if any):

Programs List:

PART A Conduct the following experiments by writing program using ARM7TDMI/LPC2148 using an evaluation board/simulator and the required software tool.

1.	Write a program to multiply two 16 bit binary numbers.
2.	Write a program to find the sum of first 10 integer numbers.
3.	Write a program to find factorial of a number.
4.	Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM
5.	Write a program to find the square of a number (1 to 10) using look-up table.
6.	Write a program to find the largest/smallest number in an array of 32 numbers .
7.	Write a program to arrange a series of 32 bit numbers in ascending/descending order.
8.	Write a program to count the number of ones and zeros in two consecutive memory locations.

PART –B Conduct the following experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' &Keil Uvision-4 tool/compiler.

9.	Display "Hello World" message using Internal UART.
10.	Interface and Control a DC Motor.
11.	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
12.	Determine Digital output for a given Analog input using Internal ADC of ARM controller.
13.	Interface a DAC and generate Triangular and Square waveforms.
14.	Interface a 4x4 keyboard and display the key code on an LCD.

15.	Demonstrate the use of an external interrupt to toggle an LED On/Off.
16.	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between

Laboratory Outcomes: The student should be able to:

- Develop and test program using ARM7TDMI/LPC2148
- Conduct the following experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' &Keil Uvision-4 tool/compiler.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accoradance with university regulations)*
  g) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  h) For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

18KVK39 Balake Kannada

18KAK39 SamskrutikaKannada

Syllabus of these subjects are available on web portal of VTU at

https://vtu.ac.in/en/b-e-scheme-syllabus/#1553774212657-ea19bad3-a58d

Constitution of India, Professional Ethics and Cyber Law (CPC)

(Common to all branches)
[As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018-19)

Semester : III / IV	CIE Marks: 40
Course Code : 18CPC39/49	SEE Marks: 60
Contact Hours/Week: 02	Exam: 03 hours
Credit: 01	

Course Learning Objectives: This course will enable the students

- To know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- To understand engineering ethics and their responsibilities, identify their individual roles and ethical responsibilities towards society.
- To know about the cybercrimes and cyber laws for cyber safety measures.

Module- I

Introduction to Indian Constitution:

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

Module-II

Union Executive and State Executive

Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States.

Module-III

Elections, Amendmentsand Emergency Provisions:

Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.

Constitutional special provisions:

Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

Module– IV

Professional / Engineering Ethics:

Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institutionof Engineers (India): Profession, Professionalism, ProfessionalResponsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.

Module- V

Internet Laws, Cyber Crimes and Cyber Laws:

Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

Course Outcomes:

On completion of this course, students will be able to,

CO 1: Have constitutional knowledge and legal literacy.
CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers. CO 3: Understand the the cybercrimes and cyber laws for cyber safety measures.

Question paper pattern for SEE and CIE:

1. The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ).
2. For the award of 40 CIE marks, refer the University regulations 2018.

Textbooks:

1. Shubham Singles, Charles E. Haries, and et al: **"Constitution of India, Professional Ethics and Human Rights"** by Cengage Learning India, Latest Edition – 2019.
2. Alfred Basta and et al: **"Cyber Security and Cyber Laws"** by Cengage Learning India - 2018. Chapter – 19, Page No's: 359 to 383.

Reference Books:

1. Durga Das Basu (DD Basu): "**Introduction to the Constitution of India**", (Students Edition.) Prentice –Hall, 2008.
2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "**Engineering Ethics**", Prentice –Hall, 2004.