

ENGINEERING MATHEMATICS-III

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Comprehend and use of analytical and numerical methods in different engineering fields • Apprehend and apply Fourier Series • Realize and use of Fourier transforms and Z-Transforms • Use of statistical methods in curve fitting applications • Use of numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variation 			
Module -1			Teaching Hours
<p>Fourier Series: Periodic functions, Dirichlet's condition, Fourier series of Periodic functions with period 2π and with arbitrary period $2c$, Fourier series of even and odd functions, Half range Fourier Series, practical Harmonic analysis. Complex Fourier series.</p>			10Hours
Module -2			
<p>Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse transform. Z-transform: Difference equations, basic definition, z-transform - definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.</p>			10 Hours
Module – 3			
<p>Statistical Methods: Correlation and rank Correlation coefficients, Regression and Regression coefficients, lines of regression - problems Curve fitting: Curve fitting by the method of least squares, Fitting of the curves of the form, $y = ax + b, y = ax^2 + bx + c, y = ae^{bx}, y = ax^b$. Numerical Methods: Numerical solution of algebraic and transcendental equations by: Regular-falsi method, Secant method, Newton - Raphson method and Graphical method.</p>			10 Hours
Module-4			
<p>Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences-Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula. Central Difference-Stirling's and Bessel's formulae (all formulae without proof)-Problems. Numerical integration: Simpson's 1/3, 3/8 rule, Weddle's rule (without proof) –Problems.</p>			10 Hours

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem (without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems, Euler's equation, Geodesics, minimal surface of revolution, hanging chain, problems.</p>	10 Hours
Course outcomes:	
<p>After Studying this course, students will be able to</p> <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits • Explain the general linear system theory for continuous-time signals and systems using the Fourier Transform • Analyze discrete-time systems using convolution and the z-transform • Use appropriate numerical methods to solve algebraic and transcendental equations and also to calculate a definite integral • Use curl and divergence of a vector function in three dimensions, as well as apply the Green's Theorem, Divergence Theorem and Stokes' theorem in various applications • Solve the simple problem of the calculus of variations 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 4. Conduct Investigations of Complex Problems 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013. 2. B.V. Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 	
Reference Books:	
<ol style="list-style-type: none"> 1. N. P. Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley. 3. H. K Dass and Er. Rajnish Verma , "Higher Engineering Mathematics", S. Chand, 1st ed. 	

Analog and Digital Electronics
 [As per Choice Based Credit System (CBCS) scheme]
 (Effective from the academic year 2015 -2016)
SEMESTER - III

Subject Code	15CS32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Recall and Recognize construction and characteristics of JFETs and MOSFETs and differentiate with BJT
- Demonstrate and Analyze Operational Amplifier circuits and their applications
- Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques.
- Describe and Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops.
- Describe, Design and Analyze Synchronous and Asynchronous Sequential
- Explain and design registers and Counters, A/D and D/A converters.

Module -1	Teaching Hours
<p>Field Effect Transistors: Junction Field Effect Transistors, MOSFETs, Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. Introduction to Operational Amplifier: Ideal v/s practical Opamp, Performance Parameters, Operational Amplifier Application Circuits: Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter.</p> <p>Text book 1:- Ch 5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1.Ch13: 13.10.Ch 16: 16.3, 16.4. Ch 17: 7.12, 17.14, 17.15, 17.18, 17.19, 17.20, 17.21.</p>	10 Hours
<p>Module -2</p> <p>The Basic Gates: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models.</p> <p>Text book 2:- Ch 2: 2.4, 2.5. Ch3: 3.2 to 3.11.</p>	10 Hours
Module – 3	

<p>Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs.</p> <p>Text book 2:- Ch 4:- 4.1 to 4.9, 4.11, 4.12, 4.14.Ch 6:-6.7, 6.10.Ch 8:- 8.1 to 8.5.</p>	10 Hours
Module-4	
<p>Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.</p> <p>(Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4</p>	10 Hours
Module-5	
<p>Counters: Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.</p> <p>Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10.</p>	10 Hours
Course outcomes:	
<p>After Studying this course, students will be able to</p> <ul style="list-style-type: none"> ● Acquire knowledge of <ul style="list-style-type: none"> ○ JFETs and MOSFETs , Operational Amplifier circuits and their applications. ○ Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique. ○ Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors. ○ Working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters. ● Analyze the performance of <ul style="list-style-type: none"> ○ JFETs and MOSFETs , Operational Amplifier circuits ○ Simplification Techniques using Karnaugh Maps, Quine McClusky Technique. ○ Synchronous and Asynchronous Sequential Circuits. <p>Apply the knowledge gained in the design of Counters, Registers and A/D & D/A converters</p>	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions(partly) 3. Modern Tool Usage 4. Problem Analysis 	

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008.

DATA STRUCTURES AND APPLICATIONS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS - 04

Course objectives: This course will enable students to

- Explain fundamentals of data structures and their applications essential for programming/problem solving
- Analyze Linear Data Structures: Stack, Queues, Lists
- Analyze Non-Linear Data Structures: Trees, Graphs
- Analyze and Evaluate the sorting & searching algorithms
- Assess appropriate data structure during program development/Problem Solving

Module -1

Teaching Hours

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.

10 Hours

Text 1: Ch 1: 1.2, Ch 2: 2.2 -2.7

Text 2: Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14

Ref 3: Ch 1: 1.4

Module -2

Stacks and Queues

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.

10 Hours

Text 1: Ch 3: 3.1 -3.7

Text 2: Ch 6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13

Module - 3

<p>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</p> <p>Text 1: Ch 4: 4.1 -4.8 except 4.6 Text 2: Ch 5: 5.1 – 5.10</p>	10 Hours
Module-4	
<p>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</p> <p>Text 1: Ch 5: 5.1 –5.5, 5.7 Text 2: Ch 7: 7.1 – 7.9</p>	10 Hours
Module-5	
<p>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</p> <p>Text 1: Ch 6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3 Text 2: Ch 8: 8.1 – 8.7, Ch 9:9.1-9.3,9.7,9.9 Reference 2: Ch 16: 16.1 - 16.7</p>	10 Hours
Course outcomes:	
<p>After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Acquire knowledge of <ul style="list-style-type: none"> - Various types of data structures, operations and algorithms. - Sorting and searching operations. - File structures. • Analyse the performance of <ul style="list-style-type: none"> - Stack, Queue, Lists, Trees, Graphs, Searching and Sorting techniques. • Implement all the applications of Data structures in a high-level language. • Design and apply appropriate data structures for solving computing problems. 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions 3. Conduct Investigations of Complex Problems 4. Problem Analysis 	

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

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

Reference Books:

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

COMPUTER ORGANIZATION

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives:			
<p>This course will enable students to</p> <ul style="list-style-type: none"> • Understand the basics of computer organization: structure and operation of computers and their peripherals. • Understand the concepts of programs as sequences or machine instructions. • Expose different ways of communicating with I/O devices and standard I/O interfaces. • Describe hierarchical memory systems including cache memories and virtual memory. • Describe arithmetic and logical operations with integer and floating-point operands. • Understand basic processing unit and organization of simple processor, concept of pipelining and other large computing systems. 			
Module -1			Teaching Hours
<p>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</p> <p>Textbook 1: Ch 1: 1.3, 1.4, 1.6.1, 1.6.2, 1.6.4, 1.6.7. Ch 2: 2.2 to 2.10, 2.12</p>			10Hours
Module -2			
<p>Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.</p> <p>Textbook 1: Ch 4: 4.1, 4.2: 4.2.1 to 4.2.5, 4.4 to 4.7.</p>			10 Hours
Module – 3			
<p>Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.</p> <p>Textbook 1: Ch 5: 5.1 to 5.4, 5.5.1, 5.5.2, 5.6, 5.7, 5.9</p>			10 Hours
Module-4			

<p>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, Floating-point Numbers and Operations.</p> <p>Textbook 1: Ch 2: 2.1, Ch 6: 6.1 to 6.7</p>	<p>10 Hours</p>
<p>Module-5</p>	
<p>Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Embedded Systems and Large Computer Systems: Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller. The structure of General-Purpose Multiprocessors.</p> <p>Textbook 1: Ch 7: 7.1 to 7.5, Ch 9:9.1 to 9.3, Ch 12:12.3</p>	<p>10 Hours</p>
<p>Course outcomes:</p>	
<p>After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Acquire knowledge of <ul style="list-style-type: none"> - The basic structure of computers & machine instructions and programs, Addressing Modes, Assembly Language, Stacks, Queues and Subroutines. - Input/output Organization such as accessing I/O Devices, Interrupts. - Memory system basic Concepts, Semiconductor RAM Memories, Static memories, Asynchronous DRAMS, Read Only Memories, Cache Memories and Virtual Memories. - Some Fundamental Concepts of Basic Processing Unit, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control and Micro programmed Control. - Pipelining, embedded and large computing system architecture. • Analyse and design arithmetic and logical units. • Apply the knowledge gained in the design of Computer. • Design and evaluate performance of memory systems • Understand the importance of life-long learning 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015. 	

UNIX AND SHELL PROGRAMMING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Understand the UNIX Architecture, File systems and use of basic Commands. • Use of editors and Networking commands. • Understand Shell Programming and to write shell scripts. • Understand and analyze UNIX System calls, Process Creation, Control & Relationship. 			
Module -1			Teaching Hours
<p>Introduction, Brief history. Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.</p> <p>Topics from chapter 2 , 3 and 15 of text book 1,chapter 1 from text book 2</p>			10Hours
Module -2			
<p>Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.</p> <p>Topics from chapters 4, 5 and 6 of text book 1</p>			10Hours

Module – 3	
<p>The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.</p> <p>The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.</p> <p>Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9 ,10 of text book 2</p>	10Hours
Module-4	
<p>Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.</p> <p>Topics from chapter 11, 12, 14 of text book 1,chapter 17 from text book2</p>	10Hours
Module-5	
<p>Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example.</p> <p>Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @-variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.</p> <p>Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1</p>	10Hours

Course outcomes:

After studying this course, students will be able to:

- Explain multi user OS UNIX and its basic features
- Interpret UNIX Commands, Shell basics, and shell environments
- Design and develop shell programming, communication, System calls and terminology.
- Design and develop UNIX File I/O and UNIX Processes.
- Perl script writing

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Environment and Sustainability
3. Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009.

Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2nd Edition , Wiley,2014.

DISCRETE MATHEMATICAL STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Prepare for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science. • Understand and apply logic, relations, functions, basic set theory, countability and counting arguments, proof techniques, • Understand and apply mathematical induction, combinatorics, discrete probability, recursion, sequence and recurrence, elementary number theory • Understand and apply graph theory and mathematical proof techniques. 			
Module -1			Teaching Hours
<p>Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems, Textbook 1: Ch 2</p>			10Hours
Module -2			
<p>Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, Textbook 1: Ch 4: 4.1, 4.2 Ch 1.</p>			10 Hours
Module – 3			
<p>Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. Textbook 1: Ch 5:5.1 to 5.3, 5.5, 5.6, Ch 7:7.1 to 7.4</p>			10 Hours
Module-4			

<p>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.</p> <p>Textbook 1: Ch 8: 8.1 to 8.4, Ch 10:10.1 to 10.2</p>	10 Hours
<p>Module-5</p>	
<p>Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes</p> <p>Textbook 1: Ch 11: 11.1 to 11.3, Ch 12: 12.1 to 12.4</p>	10 Hours
<p>Course outcomes:</p>	
<p>After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Verify the correctness of an argument using propositional and predicate logic and truth tables. 2. Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability. 3. Solve problems involving recurrence relations and generating functions. 4. Construct proofs using direct proof, proof by contraposition, proof by contradiction, proof by cases, and mathematical induction. 5. Explain and differentiate graphs and trees 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Conduct Investigations of Complex Problems 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 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
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)
SEMESTER - III

Laboratory Code	15CSL37	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: 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)

Any simulation package like MultiSim / P-spice /Equivalent software may be used.

Faculty-in-charge should demonstrate and explain the required hardware components and their functional Block diagrams, timing diagrams etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-upon analog components; functional block diagram, Pin diagram (if any), waveforms and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-upon Logic design components, pin diagram (if any), Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: *These TWO Laboratory sessions* are used to fill the gap between theory classes and practical sessions. Both sessions are to be evaluated for 20 marks as lab experiments.

Laboratory Experiments:

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

NOTE: hardware and software results need to be compared

Continued:

4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
6. a) Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using basic gates.
7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.
10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC-7447).
11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).

Study experiment

12. To study 4-bit ALU using IC-74181.

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Use various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit.
- Design and demonstrate various combinational logic circuits.
- Design and demonstrate various types of counters and Registers using Flip-flops
- Use simulation package to design circuits.
- Understand the working and implementation of ALU.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Modern Tool Usage

Conduction of Practical Examination:

1. All laboratory experiments (1 to 11 nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script.
4. Marks distribution:
 - a) For questions having part a only- Procedure + Conduction + Viva: **20 + 50 + 10 = 80 Marks**
 - b) For questions having part a and b
 - Part a- Procedure + Conduction + Viva: **10 + 35 + 05 = 50 Marks**
 - Part b- Procedure + Conduction + Viva: **10 + 15 + 05 = 30 Marks**
5. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

DATA STRUCTURES LABORATORY

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Laboratory Code	15CSL38	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 02

Course objectives:

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 experiments in C Language under Linux / Windows environment.

Laboratory Experiments:

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 operations on **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. ExitSupport the program with appropriate functions for each of the above operations

Continued:

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

<p>9. Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes</p> <ol style="list-style-type: none"> Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$ Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) <p>Support the program with appropriate functions for each of the above operations</p> <p>10. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers</p> <ol style="list-style-type: none"> Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 Traverse the BST in Inorder, Preorder and Post Order Search the BST for a given element (KEY) and report the appropriate message Exit <p>11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method <p>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 $H(K) = K \bmod m$ (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.</p>
<p>Course outcomes:</p> <p>On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> 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
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> Engineering Knowledge Problem Analysis Design/Development of Solutions Modern Tool Usage
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments (TWELVE nos) are to be included for practical examination. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80) Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

ENGINEERING MATHEMATICS-IV
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – IV

Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Formulate, solve and analyze engineering problems.
- Apply numerical methods to solve ordinary differential equations.
- Apply finite difference method to solve partial differential equations.
- Perform complex analysis.
- Interpret use of sampling theory.
- Apply joint probability distribution and stochastic process.

Module 1

Teaching Hours

Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Picard's method, Taylor's series method, modified Euler's method, Runge-Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae). Numerical solution of simultaneous first order ordinary differential equations, Picard's method, Runge-Kutta method of fourth order

10 Hours

Module 2

Numerical Methods: Numerical solution of second order ordinary differential equations, Picard's method, Runge-Kutta method and Milne's method. **Special Functions:** Bessel's functions- basic properties, recurrence relations, orthogonality and generating functions. Legendre's functions - Legendre's polynomial, Rodrigue's formula, problems.

10 Hours

Module 3

Complex Variables: Function of a complex variable, limits, continuity, differentiability,. Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem with proof and problems. **Transformations:** Conformal transformations, discussion of transformations: $w = z^2$, $w = e^z$, $w = z + (a^2/z)$ and bilinear transformations.

10 Hours

Module 4

Probability Distributions: Random variables (discrete and continuous), probability functions. Poisson distributions, geometric distribution, uniform distribution, exponential and normal distributions, Problems. **Joint probability distribution:** Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.

10 Hours

Module 5

Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **Stochastic process:** Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.

10 Hours

Course Outcomes: The students should be able to:
<ul style="list-style-type: none"> • Use appropriate numerical methods to solve first and second order ordinary differential equations. • Use Bessel's and Legendre's function which often arises when a problem possesses axial and spherical symmetry, such as in quantum mechanics, electromagnetic theory, hydrodynamics and heat conduction. • State and prove Cauchy's theorem and its consequences including Cauchy's integral formula. • Compute residues and apply the residue theorem to evaluate integrals. • Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous statistical methods.
Graduate Attributes
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Life-Long Learning • Conduct Investigations of Complex Problems
Question paper pattern:
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
Text Books:
<ol style="list-style-type: none"> 1. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
Reference Books:
<ol style="list-style-type: none"> 1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013. 3. H. K Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand, 1st ed, 2011.

SOFTWARE ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CS42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • 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. • 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. • Recognize the need for agile software development, describe agile methods, apply agile practices and plan for agility. 			
Module 1			Teaching Hours
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).			12 Hours
Module 2			
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).			11 Hours
Module 3			
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 Hours

9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).		
Module 4		
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)		10 Hours
Module 5		
Agile Software Development: Coping with Change (Sec 2.3), The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref “ The SCRUM Primer, Ver 2.0 ”) and Extreme Programming (Sec 3.3). Plan-driven and agile development (Sec 3.2). Agile project management (Sec 3.4), Scaling agile methods (Sec 3.5):		8 Hours
Course Outcomes: The students should be able to:		
<ul style="list-style-type: none"> • 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. 		
Graduate Attributes		
<ul style="list-style-type: none"> • Project Management and Finance • Conduct Investigations of Complex Problems • Modern Tool Usage • Ethics 		
Question paper pattern:		
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>		
Text Books:		
<ol style="list-style-type: none"> 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. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf 		
Reference Books:		
<ol style="list-style-type: none"> 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 		
Web Reference for eBooks on Agile:		
<ol style="list-style-type: none"> 1. http://agilemanifesto.org/ 2. http://www.jamesshore.com/Agile-Book/ 		

DESIGN AND ANALYSIS OF ALGORITHMS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course 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

Teaching Hours

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)

10 Hours

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)

10 Hours

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).

10 Hours

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).

10 Hours

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

10 Hours

concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).	
Course Outcomes: The students should be able to:	
<ul style="list-style-type: none"> • 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. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<p>T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin., 2nd Edition, 2009. Pearson. T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press</p>	
Reference Books:	
<ol style="list-style-type: none"> 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) 	

MICROPROCESSORS AND MICROCONTROLLERS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Make familiar with importance and applications of microprocessors and microcontrollers
- Expose architecture of 8086 microprocessor and ARM processor
- Familiarize instruction set of ARM processor

Module 1

Teaching Hours

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

Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7

10 Hours

Module 2

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

Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2

10 Hours

Module 3

Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. **Memory and Memory interfacing:** Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. **8255 I/O programming:** I/O addresses MAP of x86 PC's, programming and interfacing the 8255.

Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4

10 Hours

Module 4

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 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5

10 Hours

Module 5

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

Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2)

10 Hours

Course Outcomes: The students should be able to:

- Differentiate between microprocessors and microcontrollers
- Design and develop assembly language code to solve problems
- Gain the knowledge for interfacing various devices to x86 family and ARM processor
- Demonstrate design of interrupt routines for interfacing devices

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

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

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

OBJECT ORIENTED CONCEPTS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Learn fundamental features of an object oriented language of C++ 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

Teaching Hours

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

Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2

10 Hours

Module 2

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 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5

10 Hours

Module 3

Classes, Inheritance, Exceptions, Packages and Interfaces: 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. Packages, Access Protection, Importing Packages, Interfaces.

Text book 2: Ch:6 Ch: 8 Ch:9 Ch:10

10 Hours

Module 4

Multi Threaded Programming, Event Handling: 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, read-write problem, producer consumer problems. **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.

Text book 2: Ch 11: Ch: 22

10 Hours

Module 5

The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting;

10 Hours

Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. 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 21: Ch: 29 Ch: 30	
Course Outcomes: The students should be able to:	
<ul style="list-style-type: none"> • 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 Applets and swings. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Programming Knowledge • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Sourav Sahay, Object Oriented Programming with C++ , Oxford University Press,2006 (Chapters 1, 2, 4) 2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30) 	
Reference Book:	
<ol style="list-style-type: none"> 1. Mahesh Bhawe 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, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. 4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, 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. 	
Note: Every institute shall organize a bridge organize on C++ either in the vacation or in the beginning of even semester.	

DATA COMMUNICATION			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • 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; • Illustrate TCP/IP protocol suite and switching criteria. • Demonstrate Medium Access Control protocols for reliable and noisy channels. • Expose wireless and wired LANs along with IP version. 			
Contents			Teaching Hours
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, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).			10 Hours
Module 2			
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion, Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching.			10 Hours
Module 3			
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).			10 Hours
Module 4			
Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.			10 Hours
Module 5			
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols : Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.			10 Hours
Course Outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Illustrate basic computer network technology. • Identify the different types of network topologies and protocols. • Enumerate the layers of the OSI model and TCP/IP functions of each layer. • Make out the different types of network devices and their functions within a network 			

- Demonstrate the skills of subnetting and routing mechanisms.

Graduate Attributes

1. Engineering Knowledge
2. Design Development of solution(Partly)
3. Modern Tool Usage
4. Problem Analysis 10904383

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: 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 ALGORITHM LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CSL47	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course 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.

Description

Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans/Eclipse IDE tool can be used for development and demonstration.

Experiments

1	A	Create a Java class called <i>Student</i> with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>nStudent</i> objects and print the USN, Name, Branch, and Phone of 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 super class called <i>Staff</i> with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.
	B	Write a Java class called <i>Customer</i> 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 <i>a</i> and <i>b</i> . Compute <i>a/b</i> and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> 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 and prints; third thread will print the value of cube of the number.
4		Sort a given set of <i>n</i> 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 undirected graph using (a) Kruskal's algorithm (b) Prim's algorithm . Implement the program in Java language.
9	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
10	(a) Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ 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. (b) Design and implement the presence of Hamiltonian Cycle in an undirected Graph G of n vertices.
Course Outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.) • Implement a variety of algorithms such as sorting, 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 structures to solve real-world problems. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis 	

- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

All laboratory experiments (TEN problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot.

To generate the data set use random number generator function.

Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80). Change of experiment is allowed only once and marks allotted to the procedure

**MICROPROCESSOR AND MICROCONTROLLER
LABORATORY**

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CSL48	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM. To give the knowledge and practical exposure on connectivity and execute of interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

Description

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

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

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element “X” in a list of ‘n’ 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of ‘n’ 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that ‘n’ and ‘r’ are non-negative integers.
5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider’s Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

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

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: The students should be able to:

- Learn 80x86 instruction sets and gains the knowledge of how assembly language works.
- Design and implement programs written in 80x86 assembly language
- Know functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

- All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.
- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- PART –B: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS51	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the principles of management, organization and entrepreneur. • Discuss on planning, staffing, ERP and their importance • Infer the importance of intellectual property rights and relate the institutional support 			
Module – 1			Teaching Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection			10 Hours
Module – 2			
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.			10 Hours
Module – 3			
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.			10 Hours
Module – 4			
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation			10 Hours
Module – 5			
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Define management, organization, entrepreneur, planning, staffing, ERP and outline 			

their importance in entrepreneurship

- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS52	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstration of application layer protocols • Discuss transport layer services and understand UDP and TCP protocols • Explain routers, IP and Routing Algorithms in network layer • Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard • Illustrate concepts of Multimedia Networking, Security and Network Management 			
Module – 1			Teaching Hours
<p>Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP.</p> <p>T1: Chap 2</p>			10 Hours
Module – 2			
<p>Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.</p> <p>T1: Chap 3</p>			10 Hours
Module – 3			
<p>The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing,</p>			10 Hours

Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7	
Module – 4	
Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G:LTE, Mobility management: Principles, Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols. T1: Chap: 6 : 6.4-6.8	10 Hours
Module – 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case studies: Netflix, You Tube and Kankan. Network Support for Multimedia: Dimensioning Best-Effort Networks, Providing Multiple Classes of Service, Diffserv, Per-Connection Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission T1: Chap: 7: 7.1,7.2,7.5	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain principles of application layer protocols • Recognize transport layer services and infer UDP and TCP protocols • Classify routers, IP and Routing Algorithms in network layer • Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard • Describe Multimedia Networking and Network Management 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .	
Reference Books:	
<ol style="list-style-type: none"> 1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition 2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning 	

DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS53	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Provide a strong foundation in database concepts, technology, and practice. • Practice SQL programming through a variety of database problems. • Demonstrate the use of concurrency and transactions in database • Design and build database applications for real world problems. 			
Module – 1			Teaching Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10			10 Hours
Module – 2			
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5			10 Hours
Module – 3			
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.			10 Hours
Module – 4			
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal			10 Hours

<p>Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms</p> <p>Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6</p>	
<p>Module – 5</p>	
<p>Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures</p> <p>Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.</p>	<p>10 Hours</p>
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS. • Use Structured Query Language (SQL) for database manipulation. • Design and build simple database systems • Develop application to interact with databases. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Database systems Models, Languages, Design and Application Programming, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013. 2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. 	

AUTOMATA THEORY AND COMPUTABILITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS54	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce core concepts in Automata and Theory of Computation • Identify different Formal language Classes and their Relationships • Design Grammars and Recognizers for different formal languages • Prove or disprove theorems in automata theory using their properties • Determine the decidability and intractability of Computational problems 			
Module – 1			Teaching Hours
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10			10 Hours
Module – 2			
Regular Expressions (RE): what is a RE?, Kleene’s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4			10 Hours
Module – 3			
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12.4, 12.5, 12.6			10 Hours
Module – 4			
Context-Free and Non-Context-Free Languages: Where do the Context-Free Languages(CFL) fit, Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, Deterministic CFLs. Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Textbook 1: Ch 13: 13.1 to 13.5, Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.6			10 Hours
Module – 5			
Variants of Turing Machines (TM), The model of Linear Bounded automata: Decidability: Definition of an algorithm, decidability, decidable languages,			10 Hours

<p>Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Textbook 2: Ch 9.7 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation • Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models). • Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers. • Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness. • Classify a problem with respect to different models of Computation. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013 2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012. 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013 2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013 3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013 4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998 5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012 6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012. 	

OBJECT ORIENTED MODELING AND DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS551	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe the concepts involved in Object-Oriented modelling and their benefits. • Demonstrate concept of use-case model, sequence model and state chart model for a given problem. • Explain the facets of the unified process approach to design and build a Software system. • Translate the requirements into implementation for Object Oriented design. • Choose an appropriate design pattern to facilitate development procedure. 			
Module – 1			Teaching Hours
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; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. Text Book-1: Ch 1, 2, 3 and 4			8 Hours
Module – 2			
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. Text Book-2:Chapter- 6:Page 210 to 250			8 Hours
Module – 3			
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. Text Book-1:Chapter- 10,11,and 12			8 Hours
Module – 4			
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. Text Book-2: Chapter 8: page 292 to 346			8 Hours

Module – 5	
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only). Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Describe the concepts of object-oriented and basic class modelling. • Draw class diagrams, sequence diagrams and interaction diagrams to solve problems. • Choose and apply a befitting design pattern for the given problem. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005 2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005. 3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education,2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007. 2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007. 3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013 	

INTRODUCTION TO SOFTWARE TESTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS552	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Differentiate the various testing techniques. • Analyze the problem and derive suitable test cases. • Apply suitable technique for designing of flow graph. • Explain the need for planning and monitoring a process. 			
Module – 1			Teaching Hours
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Textbook 3: Ch 1:1.2 - 1.5, 3; Textbook 1: Ch 1			8 Hours
Module – 2			
Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Textbook 1: Ch 2, 5, 6 & 7, Textbook 2: Ch 3			8 Hours
Module – 3			
Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Structural Testing: Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. T2:Chapter 16, 12 T1:Chapter 9 & 10			8 Hours
Module – 4			
Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the			8 Hours

process, the quality team. T2: Chapter 17, 20.	
Module – 5	
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations. T2: Chapter 21 & 22, T1 : Chapter 12 & 13	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Derive test cases for any given problem • Compare the different testing techniques • Classify the problem into suitable testing model • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004. 3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015 5. Naresh Chauhan, Software Testing, Oxford University press. 	

ADVANCED JAVA AND J2EE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CS553	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Identify the need for advanced Java concepts like Enumerations and Collections
- Construct client-server applications using Java socket API
- Make use of JDBC to access database through Java Programs
- Adapt servlets to build server side programs
- Demonstrate the use of JavaBeans to develop component-based Java software

Module – 1

Teaching Hours

Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

8 Hours

Module – 2

The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.

8 Hours

Module – 3

String Handling :The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() toCharArray(), String Comparison, equals() and equalsIgnoreCase(), regionMatches() startsWith() and endsWith(), equals() Versus == , compareTo() Searching Strings, Modifying a String, substring(), concat(), replace(), trim(), Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(),append(), insert(), reverse(), delete() and deleteCharAt(), replace(), substring(), Additional StringBuffer Methods, StringBuilder

8 Hours

Text Book 1: Ch 15

Module – 4	
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects Text Book 1: Ch 31 Text Book 2: Ch 11	8 Hours
Module – 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. Text Book 2: Ch 06	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs • Build client-server applications and TCP/IP socket programs • Illustrate database access and details for managing information using the JDBC API • Describe how servlets fit into Java-based web application architecture • Develop reusable software components using Java Beans 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. 2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007. 2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004. 3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015. 	

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS554	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain principles of algorithms analysis approaches • Compare and contrast a number theoretic based strategies. • Describe complex signals and data flow in networks • Apply the computational geometry criteria. 			
Module – 1			Teaching Hours
Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations; Amortized analysis: Aggregate, Accounting, and Potential methods, String Matching Algorithms: Naive Algorithm; Robin-Karp Algorithm, String matching with Finite Automata, Knuth-Morris-Pratt and Boyer-Moore Algorithms			8 Hours
Module – 2			
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization, - Huffman Codes, Polynomials. FFT-Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials			8 Hours
Module – 3			
DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.			8 Hours
Module – 4			
Computational Geometry-I: Geometric data structures using, C, Vectors, Points, Polygons, Edges Geometric objects in space; Finding the intersection of a line and a triangle, Finding star-shaped polygons using incremental insertion.			8 Hours
Module – 5			
Computational Geometry-II: Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the principles of algorithms analysis approaches • Apply different theoretic based strategies to solve problems • Illustrate the complex signals and data flow in networks with usage of tools • Describe the computational geometry criteria. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer FIVE full questions, selecting ONE full question from each			

module.

Text Books:

1. Thomas H. Cormen et al: Introduction to Algorithms, Prentice Hall India, 1990
2. Michael J. Laszlo: Computational Geometry and Computer Graphics in C' Prentice Hall India, 1996

Reference Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, University Press, Second edition, 2007
2. Kenneth A Berman & Jerome L Paul, Algorithms, Cengage Learning, First Indian reprint, 2008

COMPUTER NETWORK LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL57	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonstrate operation of network and its management commands
- Simulate and demonstrate the performance of GSM and CDMA
- Implement data link layer and transport layer protocols.

Description (If any):

For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Lab Experiments:

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.

- Implement, analyze and evaluate networking protocols in NS2 / NS3

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from part A and part B with lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva: 80
Part A: 10+25+5 =40
Part B: 10+25+5 =40
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL58	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

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

PART-B: Mini Project (Max. Exam Mks. 30)

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

Lab Experiments:

Part A: SQL Programming

1	<p>Consider the following schema for a Library Database: BOOK(<u>Book_id</u>, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(<u>Book_id</u>, Author_Name) PUBLISHER(<u>Name</u>, Address, Phone) BOOK_COPIES(<u>Book_id</u>, <u>Branch_id</u>, No-of_Copies) BOOK_LENDING(<u>Book_id</u>, <u>Branch_id</u>, <u>Card_No</u>, Date_Out, Due_Date) LIBRARY_BRANCH(<u>Branch_id</u>, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
2	<p>Consider the following schema for Order Database: SALESMAN(<u>Salesman_id</u>, Name, City, Commission) CUSTOMER(<u>Customer_id</u>, Cust_Name, City, Grade, Salesman_id) ORDERS(<u>Ord_No</u>, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Count the customers with grades above Bangalore's average.

	<ol style="list-style-type: none"> 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
3	<p>Consider the schema for Movie Database:</p> <p>ACTOR(<u>Act_id</u>, Act_Name, Act_Gender) DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone) MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role) RATING(<u>Mov_id</u>, Rev_Stars)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	<p>Consider the schema for College Database:</p> <p>STUDENT(<u>USN</u>, SName, Address, Phone, Gender) SEMSEC(<u>SSID</u>, Sem, Sec) CLASS(<u>USN</u>, <u>SSID</u>) SUBJECT(<u>Subcode</u>, Title, Sem, Credits) IAMARKS(<u>USN</u>, <u>Subcode</u>, <u>SSID</u>, Test1, Test2, Test3, FinalIA)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	<p>Consider the schema for Company Database:</p> <p>EMPLOYEE(<u>SSN</u>, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(<u>DNo</u>, DName, MgrSSN, MgrStartDate) DLOCATION(<u>DNo</u>, <u>DLoc</u>) PROJECT(<u>PNo</u>, PName, PLocation, DNo) WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.

	<ol style="list-style-type: none"> 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
<p>Part B: Mini project</p>	
<ul style="list-style-type: none"> • For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include; health care, education, industry, transport, supply chain, etc. 	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Create, Update and query on the database. • Demonstrate the working of different concepts of DBMS • Implement, analyze and evaluate the project developed for an application. 	
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments from part A are to be included for practical examination. 2. Mini project has to be evaluated for 30 Marks. 3. Report should be prepared in a standard format prescribed for project work. 4. Students are allowed to pick one experiment from the lot. 5. Strictly follow the instructions as printed on the cover page of answer script. 6. Marks distribution: <ol style="list-style-type: none"> a) Part A: Procedure + Conduction + Viva: 10 + 35 + 5 = 50 Marks b) Part B: Demonstration + Report + Viva voce = 15 + 10 + 05 = 30 Marks 7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. 	

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS61	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the concepts of Cyber security • Illustrate key management issues and solutions. • Familiarize with Cryptography and very essential algorithms • Introduce cyber Law and ethics to be followed. 			
Module – 1			Teaching Hours
Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction, Modes of Operation, MAC and Other Applications, Attacks, Linear Cryptanalysis.			10 Hours
Module – 2			Teaching Hours
Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications, Elliptic Curve Cryptography and Advanced Encryption Standard - Elliptic Curve Cryptography, Applications, Practical Considerations, Advanced Encryption Standard (AES).			10 Hours
Module – 3			Teaching Hours
Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPsec-Security at the Network Layer – Security at Different layers: Pros and Cons, IPsec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.			10 Hours
Module – 4			Teaching Hours
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware - Preliminaries Viruses, Worm Features, Internet Scanning Worms, Topological Worms, Web Worms and Case Study, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Instruction Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS-Security, SAML, Other Standards.			10 Hours

Module – 5	
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Discuss cryptography and its need to various applications • Design and develop simple cryptography algorithms • Understand cyber security and need cyber Law 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25 	
Reference Books:	
<ol style="list-style-type: none"> 1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015 2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition 3. Cyber Law simplified- Vivek Sood, Mc-GrawHill, 11th reprint , 2013 4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindra kumar, Cengage learning 	

COMPUTER GRAPHICS AND VISUALIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS62	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain hardware, software and OpenGL Graphics Primitives. • Illustrate interactive computer graphic using the OpenGL. • Design and implementation of algorithms for 2D graphics Primitives and attributes. • Demonstrate Geometric transformations, viewing on both 2D and 3D objects. • Infer the representation of curves, surfaces, Color and Illumination models 			
Module – 1			Teaching Hours
Overview: Computer Graphics and OpenGL: Computer Graphics:Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms (Bresenham's). Text-1:Chapter -1: 1-1 to 1-9,2-1 to 2-9 (Excluding 2-5),3-1 to 3-5,3-9,3-20			10 Hours
Module – 2			
Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4			10 Hours
Module – 3			
Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong			10 Hours

model, Corresponding openGL functions. Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3	
Module – 4	
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, back face detection, depth buffer method and OpenGL visibility detection functions. Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1 to 9-3, 9-14	10 Hours
Module – 5	
Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions. Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10 Text-2:Chapter 3: 3-1 to 3.11: Input& interaction	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design and implement algorithms for 2D graphics primitives and attributes. • Illustrate Geometric transformations on both 2D and 3D objects. • Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models. • Decide suitable hardware and software for developing graphics packages using OpenGL. 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011 2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008 	
Reference Books:	
<ol style="list-style-type: none"> 1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education 2. Xiang, Plastock : Computer Graphics , sham’s outline series, 2nd edition, TMG. 3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning 4. M M Raiker, Computer Graphics using OpenGL, Filip learning/Elsevier 	

SYSTEM SOFTWARE AND COMPILER DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS63	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define System Software such as Assemblers, Loaders, Linkers and Macroprocessors • Familiarize with source file, object file and executable file structures and libraries • Describe the front-end and back-end phases of compiler and their importance to students 			
Module – 1			Teaching Hours
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Macroprocessors: Basic macro processor functions, machine independent macro processor features, Macro processor design options, implementation examples Text book 1: Chapter 1: (1.1-1.3.2), Chapter2: 2.1- 2.4 ,Chapter4			10 Hours
Module – 2			
Loaders and Linkers: Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Loader Design Options, Implementation Examples. System File and Library Structure: Introduction, Library And File Organization, Design Of A Record Source Program File Structure, Object Code, Object File, Object File Structure, Executable File, Executable File Structure, Libraries, Image File Structure . Text book 1 : Chapter 3 , Reference 1: Chapter 5			10 Hours
Module – 3			
Lexical Analysis: Introduction, Alphabets And Tokens In Computer Languages, Representation, Token Recognition And Finite Automata, Implementation, Error Recovery. Text book 2: Chapter 1(1.1-1.5), Chapter 3(3.1-3.5)			10 Hours
Module – 4			
Syntax Analysis: Introduction, Role Of Parsers, Context Free Grammars, Top Down Parsers, Bottom-Up Parsers, Operator-Precedence Parsing Text book 2: Chapter 4 (4.1 – 4.6)			10 Hours
Module – 5			
Syntax Directed Translation, Intermediate code generation, Code generation Text book 2: Chapter 5 (5.1-5.2),6.1-6.4,8.1-8.7			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain system software such as assemblers, loaders, linkers and macroprocessors • Design and develop lexical analyzers, parsers and code generators • Utilize lex and yacc tools for implementing different concepts of system software 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012
2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books:

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Loudon, Cengage Learning
3. System software and operating system by D. M. Dhamdhare TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS64	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • 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			Teaching Hours
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			10 Hours
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.			10 Hours
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.			10 Hours
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.			10 Hours
Module – 5			
Secondary Storage Structures, Protection: Mass storage structures; Disk			10 Hours

<p>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.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • 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 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006. 	
<p>Reference Books</p>	
<ol style="list-style-type: none"> 1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhare, 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. 	

DATA MINING AND DATA WAREHOUSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS651	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define multi-dimensional data models. • Explain rules related to association, classification and clustering analysis. • Compare and contrast between different classification and clustering algorithms 			
Module – 1			Teaching Hours
Data Warehousing & modeling: Basic Concepts: Difference between Operational Database systems and Data warehouse, Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse ,Data mart and virtual warehouse, Extraction, Transformation and loading, Metadata Repository, Data warehouse design and usage: Business Analysis framework, Data warehouse design process and usage for information processing, Online analytical processing to multidimensional data mining. Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.			8 Hours
Module – 2			
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,			8 Hours
Module – 3			
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.			8 Hours
Module – 4			
Classification : Basics: General approach to solve classification problem, Decision Trees Induction, Model Over fitting, Evaluating the performance of a classifier, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.			8 Hours
Module – 5			
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Identify data mining problems and implement the data warehouse 			

- Write association rules for a given data pattern.
- Choose between classification and clustering solution.

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS652	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To Learn How to add functionality to designs while minimizing complexity. • What code qualities are required to maintain to keep code flexible? • To Understand the common design patterns. • To explore the appropriate patterns for design problems 			
Module – 1			Teaching Hours
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm			8 Hours
Module – 2			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			8 Hours
Module – 3			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			8 Hours
Module – 4			
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.			8 Hours
Module – 5			
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and implement codes with higher performance and lower complexity • Be aware of code qualities needed to keep code flexible • Experience core design principles and be able to assess the quality of a design with respect to these principles. • Capable of applying these principles in the design of object oriented systems. • Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary. • Be able to select and apply suitable patterns in specific contexts 			
Question paper pattern:			

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnath rammath, universities press,2013
2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

OPERATION RESEARCH [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS653	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate optimization problem as a linear programming problem. • Solve optimization problems using simplex method. • Formulate and solve transportation and assignment problems. • Apply game theory for decision making problems. 			
Module – 1			Teaching Hours
Introduction, Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.			8 Hours
Module – 2			
Simplex Method – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.			8 Hours
Module – 3			
Simplex Method – 2: Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.			8 Hours
Module – 4			
Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel’s Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.			8 Hours
Module – 5			
Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Select and apply optimization techniques for various problems. • Model the given problem as transportation and assignment problem and solve. • Apply game theory for decision support system. 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014

Reference Books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002
2. S D Sharma, Operation Research, Kedar Nath Ram Nath Publishers.

DISTRIBUTED COMPUTING SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS654	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain distributed system, their characteristics, challenges and system models. • Describe IPC mechanisms to communicate between distributed objects • Illustrate the operating system support and File Service architecture in a distributed system • Analyze the fundamental concepts, algorithms related to synchronization. 			
Module – 1			Teaching Hours
Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models			8 Hours
Module – 2			
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication Distributed Objects and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications			8 Hours
Module – 3			
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation , Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System			8 Hours
Module – 4			
Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections			8 Hours
Module – 5			
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed deadlocks			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the characteristics of a distributed system along with its and design challenges • Illustrate the mechanism of IPC between distributed objects • Describe the distributed file service architecture and the important characteristics of SUN NFS. • Discuss concurrency control algorithms applied in distributed transactions 			
Question paper pattern:			
The question paper will have TEN questions.			

There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

Reference Books:

1. Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. Sunita Mahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015

SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15CSL67	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To make students familiar with Lexical Analysis and Syntax Analysis phases of Compiler Design and implement programs on these phases using LEX & YACC tools and/or C/C++/Java
- To enable students to learn different types of CPU scheduling algorithms used in operating system.
- To make students able to implement memory management - page replacement and deadlock handling algorithms

Description (If any):

Exercises to be prepared with minimum three files (Where ever necessary):

- i. Header file.
- ii. Implementation file.
- iii. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use **data input file** where ever it is possible

Lab Experiments:

1.
 - a) Write a LEX program to recognize valid **arithmetic expression**. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
 - b) Write YACC program to evaluate **arithmetic expression** involving operators: +, -, *, and /
2. Develop, Implement and Execute a program using YACC tool to recognize all strings ending with **b** preceded by **n a's** using the grammar $a^n b$ (note: input **n** value)
3. Design, develop and implement YACC/C program to construct **Predictive / LL(1) Parsing Table** for the grammar rules: $A \rightarrow aBa$, $B \rightarrow bB / \epsilon$. Use this table to parse the sentence: **abba\$**
4. Design, develop and implement YACC/C program to demonstrate **Shift Reduce Parsing** technique for the grammar rules: $E \rightarrow E+T / T$, $T \rightarrow T * F / F$, $F \rightarrow (E) / id$ and parse the sentence: **id + id * id**.
5. Design, develop and implement a C/Java program to generate the machine code using

Triples for the statement $A = -B * (C + D)$ whose intermediate code in three-address form:

$$T1 = -B$$

$$T2 = C + D$$

$$T3 = T1 + T2$$

$$A = T3$$

6. a) Write a LEX program to eliminate **comment lines** in a C program and copy the resulting program into a separate file.
b) Write YACC program to recognize valid **identifier, operators and keywords** in the given text (C program) file.
 7. Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
 8. Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results.
 9. Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.
 10. a) Design, develop and implement a C/C++/Java program to simulate a **numerical calculator**
b) Design, develop and implement a C/C++/Java program to simulate **page replacement technique**
- Note:** In Examination, for question No 10: Students may be asked to execute any one of the above (10(a) or 10(b)- Examiner choice)

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Implement and demonstrate Lexer's and Parser's
- Evaluate different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **20 + 50 + 10 (80)**
- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero**

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CSL68	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstrate simple algorithms using OpenGL Graphics Primitives and attributes. • Implementation of line drawing and clipping algorithms using OpenGL functions • Design and implementation of algorithms Geometric transformations on both 2D and 3D objects. 			
Description (If any):			
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Lab Experiments:			
PART A			
Design, develop, and implement the following programs using OpenGL API			
<ol style="list-style-type: none"> 1. Implement Brenham’s line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8 2. Create and rotate a triangle about the origin and a fixed point. Refer:Text-1: Chapter 5-4 3. Draw a colour cube and spin it using OpenGL transformation matrices. Refer:Text-2: Modelling a Coloured Cube 4. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Refer:Text-2: Topic: Positioning of Camera 5. Clip a lines using Cohen-Sutherland algorithm Refer:Text-1: Chapter 6.7 Refer:Text-2: Chapter 8 6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. Refer:Text-2: Topic: Lighting and Shading 7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. Refer: Text-2: Topic: sierpinski gasket. 8. Develop a menu driven program to animate a flag using Bezier Curve algorithm Refer: Text-1: Chapter 8-10 9. Develop a menu driven program to fill the polygon using scan line algorithm 			
Project:			
PART –B (MINI-PROJECT) :			
<p>Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.</p> <p>(During the practical exam: the students should demonstrate and answer Viva-Voce)</p> <p>Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.</p>			

Course outcomes: The students should be able to:

- Apply the concepts of computer graphics
- Implement computer graphics applications using OpenGL
- Animate real world problems using OpenGL

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 30 Marks as per 6(b).
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva:10 + 35 +5 =50 Marks
 - b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Reference books:

1. Donald Hearn & Pauline Baker: Computer Graphics-OpenGL Version,3rd Edition, Pearson Education,2011
2. Edward Angel: Interactive computer graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2011
3. M M Raikar, Computer Graphics using OpenGL, Phillip Learning / Elsevier, Bangalore / New Delhi (2013)

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS661	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Learn to setup Android application development environment • Illustrate user interfaces for interacting with apps and triggering actions • Interpret tasks used in handling multiple activities • Identify options to save persistent application data • Appraise the role of security and performance in Android applications 			
Module – 1			Teaching Hours
Get started, Build your first app, Activities, Testing, debugging and using support libraries			8 Hours
Module – 2			
User Interaction, Delightful user experience, Testing your UI			8 Hours
Module – 3			
Background Tasks, Triggering, scheduling and optimizing background tasks			8 Hours
Module – 4			
All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders			8 Hours
Module – 5			
Permissions, Performance and Security, Firebase and AdMob, Publish			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Create, test and debug Android application by setting up Android development environment • Implement adaptive, responsive user interfaces that work across a wide range of devices. • Infer long running tasks and background work in Android applications • Demonstrate methods in storing, sharing and retrieving data in Android applications • Analyze performance of android applications and understand the role of permissions and security • Describe the steps involved in publishing Android application to share with the world 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details (Download pdf file from the above link)			

Reference Books:

1. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015.
3. J F DiMarzio, “Beginning Android Programming with Android Studio”, 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
4. Anubhav Pradhan, Anil V Deshpande, “ Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS662	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Interpret the data in the context of the business. • Identify an appropriate method to analyze the data • Show analytical model of a system 			
Module – 1			Teaching Hours
<p>Introduction to Data Analytics and Decision Making: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step Modeling Process.Describing the Distribution of a Single Variable:Introduction,Basic Concepts, Populations and Samples, Data Sets,Variables,and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools,Charts for Numerical Variables, Time Series Data, Outliers and Missing Values,Outliers,Missing Values, Excel Tables for Filtering,Sorting,and Summarizing.</p> <p>Finding Relationships among Variables: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables.</p>			10 Hours
Module – 2			
<p>Probability and Probability Distributions:Introduction,Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Subjective Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation.</p> <p>Normal,Binormal,Poisson,and Exponential Distributions:Introduction,The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density,Standardizing:Z-Values,Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution.</p>			10 Hours
Module – 3			
<p>Decision Making under Uncertainty:Introduction,Elements of Decision Analysis, Payoff Tables, Possible Decision Criteria, Expected Monetary</p>			10 Hours

<p>Value(EMY),Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In,Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility Maximization Used?</p> <p>Sampling and Sampling Distributions: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling.</p>	
<p>Module – 4</p>	
<p>Confidence Interval Estimation: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters.</p> <p>Hypothesis Testing:Introduction,Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence.</p>	<p>10 Hours</p>
<p>Module – 5</p>	
<p>Regression Analysis: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships,Outliers,Unequal Variance, No Relationship,Correlations:Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained:R-Square,Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit.</p> <p>Regression Analysis: Statistical Inference:Introduction,The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table,Multicollinearity,Include/Exclude Decisions, Stepwise Regression,Outliers,Violations of Regression Assumptions,Nonconstant Error Variance,Nonnormality of Residuals,Autocorrelated Residuals ,Prediction.</p>	<p>10 Hours</p>
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Explain the importance of data and data analysis • Interpret the probabilistic models for data • Define hypothesis, uncertainty principle 	

- Evaluate regression analysis

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cengage Learning

Reference Books:

MOBILE COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS663	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe the wireless communication. • Illustrate operations involved in Mobile IP. • Discover the concepts of mobile computing and databases. 			
Module – 1			Teaching Hours
Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices Mobile System Networks, Data Dissemination, Mobility Management, Security Cellular Networks and Frequency Reuse, Mobile Smartphone, Smart Mobiles, and Systems Handheld Pocket Computers, Handheld Devices, Smart Systems, Limitations of Mobile Devices Automotive Systems			8 Hours
Module – 2			8 Hours
GSM-Services and System Architecture, Radio Interfaces of GSM, Protocols of GSM Localization, Call Handling Handover, Security, New Data Services, General Packet Radio Service High-speed Circuit Switched Data, DECT, Modulation, Multiplexing, Controlling the Medium Access Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Coding Methods, Code Division Multiple Access, IMT-2000 3G Wireless Communication Standards, WCDMA 3G Communications Standards ,CDMMA2000 3G Communication Standards, I-mode, OFDM, High Speed Packet Access (HSPA) 3G Network Long-term Evolution, WiMax Rel 1.0 IEEE 802.16e, Broadband Wireless Access, 4G Networks, Mobile Satellite Communication Networks			8 Hours
Module – 3			8 Hours
IP and Mobile IP Network Layers, Packet Delivery and Handover Management Location Management, Registration, Tunnelling and Encapsulation, Route Optimization Dynamic Host Configuration Protocol, VoIP, IPsec Conventional TCP/IP Transport Layer Protocols, Indirect TCP, Snooping TCP Mobile TCP, Other Methods of Mobile TCP-layer Transmission ,TCP over 2.5G/3G Mobile Networks			8 Hours
Module – 4			8 Hours
Data Organization, Database Transactional Models – ACID Rules, Query Processing Data Recovery Process, Database Hoarding Techniques , Data Caching, Client-Server Computing for Mobile Computing and Adaptation Adaptation Software for Mobile Computing, Power-Aware Mobile Computing, Context-aware Mobile Computing			8 Hours
Module – 5			8 Hours
Communication Asymmetry, Classification of Data-delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing techniques, Digital Audio Broadcasting (DAB), Digital Video Broadcasting			8 Hours

Synchronization, Synchronization Software for Mobile Devices, Synchronization Software for Mobile Devices SyncML-Synchronization Language for Mobile Computing, Sync4J (Funambol), Synchronized Multimedia Markup Language (SMIL)	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Summarize various mobile communication systems. • Describe various multiplexing systems used in mobile computing. • Indicate the use and importance of data synchronization in mobile computing 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Raj kamal: Mobile Computing, 2ND EDITION, Oxford University Press, 2007/2012 2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003 	
Reference Books:	
<ol style="list-style-type: none"> 1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010. 2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009. 	

PYTHON APPLICATION PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15CS664	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programming in Python.

Module – 1	Teaching Hours
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Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions	8 Hours
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Module – 2	8 Hours
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Iteration, Strings, Files	8 Hours
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Module – 3	8 Hours
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Lists, Dictionaries, Tuples, Regular Expressions	8 Hours
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Module – 4	8 Hours
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Classes and objects, Classes and functions, Classes and methods	8 Hours
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Module – 5	8 Hours
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Networked programs, Using Web Services, Using databases and SQL	8 Hours
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Course outcomes: The students should be able to:

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Question paper pattern:

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 1 – 13, 15)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015.

(<http://greenteapress.com/thinkpython2/thinkpython2.pdf>) (Chapters 15, 16, 17)
(Download pdf files from the above links)

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011. ISBN-13: 978-9350232873
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
5. Reema Thareja, "Python Programming using problem solving approach", Oxford university press, 2017

SERVICE ORIENTED ARCHITECTURE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS665	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Compare various architecture for application development • Illustrate the importance of SOA in Application Integration • Learn web service and SOA related tools and governance 			
Module – 1			Teaching Hours
SOA BASICS: Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise -Wide SOA, Strawman Architecture For Enterprise-Wide-SOA-Enterprise, SOA-Layers, Application Development Process, SOA Methodology For Enterprise Text 1: Ch2: 2.1 – 2.4; Ch3:3.1-3.7; Ch4: 4.1 – 4.5			8 Hours
Module – 2			
Enterprise Applications; Architecture Considerations, Solution Architecture for enterprise application, Software platforms for enterprise Applications; Package Application Platforms, Enterprise Application Platforms, Service-oriented-Enterprise Applications; Considerations for Service-Oriented Enterprise Applications, Patterns for SOA, Pattern-Based Architecture for Service-Oriented Enterprise Application(java reference model only). Composite Applications, SOA programming models. Text 1: Ch5:5.1, 5.2, 6.1, 6.2 (PageNo 74-81), 7.1 – 7.5			8 Hours
Module – 3			
SOA ANALYSIS AND DESIGN; Need For Models, Principles of Service Design, Design of Activity Services, Design of Data services, Design of Client services and Design of business process services, Technologies of SOA; Technologies For Service Enablement, Technologies For Service Integration, Technologies for Service orchestration. Text 1: Ch 8: 8.1 – 8.6, 9.1 – 9.3			8 Hours
Module – 4			
Business case for SOA; Stakeholder OBJECTIVES, Benefits of SOA, Cost Savings, Return on Investment, SOA Governance, Security and implementation; SOA Governance, SOA Security, approach for enterprise wide SOA implementation, Trends in SOA; Technologies in Relation to SOA, Advances in SOA. Text 1: Ch 10: 10.1 -10.4, Ch 11: 11.1 to 11.3, Ch12:12.2, 12.3			8 Hours
Module – 5			
SOA Technologies-PoC; Loan Management System(LMS), PoC-Requirements Architectures of LMS SOA based integration; integrating existing application, SOA best practices, Basic SOA using REST. Role of WSDL,SOAP and			8 Hours

JAVA/XML Mapping in SOA. Text 1:Page No 245-248; ReferenceBook:Chapter3; Text 1:Page No 307-310 Text 2: Ch 3, Ch4	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Compare the different IT architecture • Analysis and design of SOA based applications • Implementation of web service and realization of SOA • Implementation of RESTful services 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Shankar Kambhampaly, “Service–Oriented Architecture for Enterprise Applications”,Wiley Second Edition, 2014. 2. Mark D. Hansen, “SOA using Java Web Services”, Practice Hall, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Waseem Roshen, “SOA-Based Enterprise Integration”, Tata McGraw-HILL, 2009. 	

MULTI-CORE ARCHITECTURE AND PROGRAMMING

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – VI

Subject Code	15CS666	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03**Course objectives:** This course will enable students to

- Explain the recent trends in the field of Computer Architecture and describe performance related parameters
- Illustrate the need for quasi-parallel processing.
- Formulate the problems related to multiprocessing
- Compare different types of multicore architectures

Module – 1**Teaching Hours**

Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading** : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

8 Hours**Module – 2**

Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. **Threading and Parallel Programming Constructs:** Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features

8 Hours**Module – 3**

Threading APIs :Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

8 Hours**Module – 4**

OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared

8 Hours

Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance	
Module – 5	
Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify the issues involved in multicore architectures • Explain fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Point out the salient features of different multicore architectures and how they exploit parallelism • Illustrate OpenMP and programming concept 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006	
Reference Books:	
NIL	