University of Mumbai

Syllabus

B. Tech Computer Engineering
(Second Year Semester III and IV)

From

Academic Year 2015-16
(KJSCE 2014 CBGS Pattern)

K. J. Somaiya College of Engineering, Vidyavihar, Mumbai -77
(Autonomous College Affiliated to University of Mumbai)

Semester III (Computer Engineering)

Sub Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Pract	Tutorial	Theory	TW/ Practical	Tutorial	Total
UCEC301	Applied Mathematics- III	03	-	01	03	-	01	04
UCEC302	Object Oriented Programming Methodology	03	-	-	03	-	-	03
UCEC303	Data Structure	03	-	-	03	-	-	03
UCEC304	Computer Organization and Architecture	03	-	-	03	-	-	03
UCEC305	Discrete Structure and graph Theory	03	-	01	03	-	01	04
UCET301	Digital Design	--	-	02	--	-	02	02
UCEL301	Object Oriented Programming Methodology Lab	-	02	-	-	01	-	01
UCEL302	Data Structure Lab	-	02	-	-	01	-	01
UCEL303	Computer Organization and Architecture Lab	-	02	-	-	01	-	01
UCEL304	Digital Design Lab	-	02	-	-	01	-	01
Audit Course								
UCA301	Audit course	02			-	-	-	00
Total		**15**	**10**	**04**	**15**	**04**	**04**	**23**

Semester III (Computer Engineering)

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Pract.	Oral	Total
		Test 1	Test 2	IA	ESE				
UCEC301	Applied Mathematics- III	15	15	10	60	25	-	-	125
UCEC302	Object Oriented Programming Methodology	15	15	10	60	-	-	-	100
UCEC303	Data Structure	15	15	10	60	-	-	-	100
UCEC304	Computer Organization and Architecture	15	15	10	60	-	-	-	100
UCEC305	Discrete Structure and graph Theory	15	15	10	60	25	-	-	125
UCET301	Digital Design	-	-	-	-	25	-	-	25
UCEL301	Object Oriented Programming Methodology Lab	-	-	-	-	25	25	-	50
UCEL302	Data Structure Lab	-	-	-	-	25	25	-	50
UCEL303	Computer Organization and Architecture Lab	-	-	-	-	25	-	**25**	50
UCEL304	Digital Design Lab	-	-	-	-	**25**	-	25	50
Total		**75**	**75**	**50**	**300**	**175**	**50**	**50**	**775**

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC301	Applied Mathematics- III	03	--	01	03	--	01	04

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC301	Applied Mathematics- III	15	15	10	60	25	--	--	125

Course Prerequisites: Applied Mathematics I & II

Course Outcomes:

After the successful completion of the course the student will be able to :

1. Find Laplace Transform, Inverse Laplace Transform of function & Apply Laplace Transform to solve Differential Equations.
2. Find Fourier series& Fourier Transform & Inverse Fourier Transform.
3. Find Eigen values, Eigen vectors of matrix, apply Cayley Hamilton Theorem,Diagonalise a matrix.
4. Solve examples using operators grad ,div & curl & to evaluate integrals using Green's Theorem, Stokes Theorem & Divergence Theorem.

Module No.	Unit No.	Details of Topic	Hrs.
1		**Laplace Transform**	10
	1.1	Definition of Laplace Transform, Laplace Transform of *sin(at), cos(at), , sinh(at), cosh(at), erf(t),* Heavi-side unit step, dirac-delta function, Laplace Transform of periodic function	
	1.2	Properties of Laplace Transform (without proof): Linearity, first shifting theorem, second shifting theorem, multiplication by t^n, division by t, Laplace Transform of derivatives and integrals, change of scale.	
	1.3	Inverse Laplace Transform: Partial fraction method, convolution theorem(without proof) ,	
	1.4	Applications of Laplace Transform: Solution of ordinary differential equations with constant coefficients.	
2		**Fourier Series**	09
	2.1	Introduction:Definition, Dirichlet's conditions, Euler's formulae	
	2.2	Fourier Series of Functions:Exponential, trigonometric functions, even and odd functions, half range sine and cosine series Parsevel's identities (without proof)	
	2.3	Complex form of Fourier series , Fourier Transform & Inverse Fourier Transform	
3		**Matrices**	10
	3.1	Characteristic equation, Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors	
	3.2	Cayley-Hamilton theorem, examples based on verification of Cayley-Hamilton theorem	
	3.3	Similarity of matrices, Diagonalisation of matrix	
	3.4	Functions of square matrix, derogatory and non-derogatory matrices	
4		**Vector Differentiation and Integration**	10
	4.1	Gradient of scalar point function, divergence and curl of vector point function, Solenoidal and irrotational vector fields	
	4.2	Vector Integral: Line integral, Green s theorem in a plane, Gauss divergence theorem, Stokes theorem (without proof), Scalar and vector product of three and four vectors and their properties	
		Total	**39**

Recommended Books:

1.P. N. Wartikar and J. N. Wartikar, *"A Text Book of Applied Mathematic",* Vol. I & II, VidyarthiGrihaPrakashan

2.B.S. Grewal, *"Higher Engineering Mathematics",* Khanna Publication

3. Erwin Kreysizg, *"Advanced Engineering Mathematics",* John Wiley & Sons, Inc

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC302	Object Oriented Programming Methodology	03	--	--	03	--	--	03

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC302	Object Oriented Programming Methodology	15	15	10	60	--	--	--	100

Course Outcome	After successful completion of the course students should be able to
CO1	Compare the basic object oriented concept with procedure approach
CO2	Solve problems using Java basic constructs (like if else statement, control structures, and data types, array, string, vectors, packages, collection class).
CO3	Implement scenarios using object oriented concepts(Drawing class diagram, relationship between classes)
CO4	Demonstrate programs on interface, exceptions, multithreading and applets.

Module No.	Unit No.	Details of Topic	Hrs.
1.0	**1.1**	**Fundamentals of Object oriented Programming**	(02)
		Introduction, Procedural Programming Approach, Structured Programming Approach, Modular Programming Approach, OOP Approach	
	1.2	**Object Oriented Paradigm**	(03)
		Objects and classes, Function overloading, Data abstraction and Encapsulation, Inheritance and Polymorphism, Function Overriding, Exceptions, Reuse, Coupling and Cohesion, Sufficiency Completeness and Primitiveness.	
2.0	**2.1**	**Java Evolution**	(09)
		History, How java differs from others, Overview of Java language: Introduction, Installing and implementing Java, JVM	
		Constants, variables and data types, Operators and Expressions, Revision of Branching and looping	
		Class Object and Method: member, method, Modifier, Selector, constructer, destructor, iterator, State of an object, Method Overloading, Inheritance, Method Overriding ,Final class, abstract class and method	
3.0	**3.1**	**Arrays, Stings and vectors**	(06)
		Arrays: Arrays : 1D , 2D , Variable Length array, for-each with Array	
		String : String Class, String Buffer Class	
		Vectors : Vector Class and its functions in java	
		Command line Arguments	
4.0	**4.1**	Class Diagram	(04)
	4.2	Implementing Aggregation and Association	
5.0	**5.1**	**Interfaces and Packages**	(07)
		Interfaces : variables in Interfaces, Extending an Interface, Difference between an Abstarct class and an Interface, Packages: Creating Packages, Using Packages, Access Protection, Predefined packages :java.lang : Wrapper class, Collection	
	5.2	java.IO: Buffered Stream Reader/writer, Use of Sacaner class	
	5.3	Exception handling: Exception as objects, Exception hierarchy, Try catch finally Throw, throws, File handling in Java	

6.0	6.1	**MultiThreading**	(04)
		Multi Threading: Thread life cycle, Multi threading advantages and issues, Simple thread program, Thread synchronization.	
7.0	**7.1**	**Applet programming**	(04)
		Applet class, Applet Structure, Applet Life cycle, paint(), repaint(), update(), GUI designing in JAVA	
		Total	**39**

Recommended Books

1. Sachin Malhotra, Saurabh Chaudhary "Programming in Java", Oxford University Press, 2010
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education
3. Herbert schildt, The Complete Reference JAVA2, 2nd ed., TMH, 2002.
4. Ralph Bravaco , Shai Simoson , "Java Programing From the Group Up" ,Tata McGraw-Hill
5. Balagurusamy, E. Programming With Java:A Primer 3E , Tata McGraw-Hill Education, 2006
6. Horstmann, Cornell, Core Java 2: Volume 1-Fundanmentals, Pearson Education, 2000.
7. Jaime Nino, Frederick A. Hosch, 'An introduction to Programming and Object Oriented Design using Java', Wiley Student Edition.

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC303	Data Structures	03	--	--	03	--	--	03

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC303	Data Structures	15	15	10	60	--	--	--	100

Course Outcomes:
After completing this course students will-

1. Explain the different data structures used in problem solving.
2. Use linear and non-linear data structure in domain like compiler construction, DBMS etc
3. Demonstrate sorting and searching methods.
4. Choose the appropriate data structure for specified problem definition.

Module No.	Unit No.	Details of Topic	Hrs.
1.0		**Introduction**	(02)
	1.1	**Introduction to Data Structure** Types of Data Structure, , ADT (Abstract data type)	
2.0		**Linear data structure: Linked Lists**	(10)
	2.1	Linked list as ADT, Memory allocation & De-allocation for a Linked List, Linked List operations, Types of Linked List, Implementation of Linked List. Circular linked list, doubly linked list Application of Linked List: Polynomial manipulation Sparse matrix addition.	
3.0		**Linear data structure: Stacks and Queues**	(10)
	3.1	**Stack**: The Stack as an ADT, Stack operations, Array Representation of Stack, Linked Representation of Stack, Application of stack – Polish Notation application of stack- recursion	
	3.2	**Queues**: The Queue as an ADT, Queue operation, Array Representation of Queue, Linked Representation of Queue, Circular Queue. Priority Queue, Application of Queues – Simulation Double ended queue	
4.0		**Non-Linear data structures: Trees, Graph**	(06)
	4.1	**Trees**: Basic trees concept, Binary tree representation, Binary tree operation, Binary tree traversal, Binary search tree implementation, AVL tree Application on trees- Expression tree, Threaded binary trees	
	4.2	**Graph**: Basic concepts, Graph Representation, Graph traversal (DFS & BFS)	
5.0		**Searching and Sorting**	(04)
	5.1	**Sorting :**Sort Concept, Selection sort, Insertion Sort	
	5.2	**Searching :** Search concept, Hashed List Search, Hashing Methods , Collision Resolution	
6.0		**Advanced Data Structures**	(04)
	6.1	Heap , B Trees, B+ Trees	
		heap applications- priority queue	
		Total	**36**

Recommended Books

1. Data Structures A Psedocode Approach with C, Richard F. Gilberg & Behrouz A. Forouzan, second edition, CENGAGE Learning
2. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C", Pearson Education Asia, Second Edition, 2002, ISBN 978-81-317-0229-1
3. E. Horowitz, S. Sahni, S.Anderson-freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, ISBN 978-81-7371-605-8
4. Introduction to Data Structure and its Applications Jean-Paul Tremblay, P. G. Sorenson

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC304	Computer Organization and Architecture	03	--	--	03	--	--	03

Course Code	Course Name				Examination Scheme				
					Theory Marks		Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC304	Computer Organization and Architecture	15	15	10	60	--	--	--	100

Course Outcomes:

After completing this course, students will be able to:
1- Describe and define the structure of a computer with buses structure.
2-Detail working of the arithmetic logic unit and its sub modules
3-Understand the Central processing unit with addressing modes and working of control unit
4-Learn and evaluate memory organization and cache structure
5- Summarize Input output techniques and multiprocessor configurations

Module No.	Unit No.	Details of Topic	Hrs.
1.0		**Structure of a Computer System**	(03)
	1.1	Introduction of computer system and its sub modules, Basic organization of computer and block level description of the functional units. Von Newman model	
	1.2	Introduction to buses, bus types, and connection I/O devices to CPU and memory, PCI and SCSI	
2.0		**Arithmetic and Logic Unit**	(10)
	2.1	Introduction to Arithmetic and Logical unit and its hardware implementation, Booth's Recoding, Booth's algorithm for signed multiplication, Restoring division and non-restoring division algorithms	
	2.2	Computer Arithmetic: Fixed and Floating point numbers, Signed numbers, Integer Arithmetic, 2's Complement arithmetic, IEEE floating point number representation and operations like addition. Subtraction, multiplication and division. IEEE standards for Floating point representations (Single Precision and Double precision Format)	
3.0		**Central Processing Unit**	(08)
	3.1	CPU architecture, Register organization, Instruction formats and addressing modes(Intel processor).,Basic instruction cycle, Instruction interpretation and sequencing	
	3.2	Control unit, unit Microinstruction, Micro operation, Functioning of micro programmed control unit, RISC and CISC processors, RISC pipelining, RISC and CISC Architecture	
4.0		**Memory Organization**.	(09)
	4.1	Characteristics of memory system and hierarchy, main memory ,ROM, Types of ROM, RAM, SRAM, DRAM, Flash memory, High speed memories	

	4.2	Cache Memory Organization: Address mapping, Replacement Algorithms, Cache Coherence, MESI protocol, Interleaved and associative memories, virtual memory, main memory allocation, segmentation paging, secondary storage ,RAID levels	
5.0		**I/O Organization**	(03)
	5.1	Input /Output Systems, Programmed I/O, Interrupt driven I/O, DMA	
6.0		**Multiprocessor Configurations**	(03)
	6.1	Flynn's classification, Parallel processing concepts, Introduction to pipeline processing and pipeline hazards, design issues of pipeline architecture, Instruction pipelining	
		Total	**36**

Recommended Books

1. 1.W.Stallings William "Computer Organization and Architecture: Designing for Performance", Pearson Prentice Hall Publication, 7thEdition. C.
2. Hamacher, V. Zvonko, S. Zaky ,"Computer Organization", Tata McGraw Hill Publication,5th Edition.
3. Hwang and Briggs," Computer Architecture and Parallel Processing", Tata McGraw Hill Publication
4. A. Tanenbaum," Structured Computer Organization", Prentice Hall Publication, 4th Edition.

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC305	Discrete Structure and Graph Theory	03	--	01	03	--	01	04

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC305	Discrete Structure and Graph Theory	15	15	10	60	25	--	--	125

Course Outcomes:	After completing this course, students will be able to
CO1	Define operations on discrete structures such as sets, relations, posets and functions
CO2	Recognize the use of graph theory in programming applications.
CO3	Solve problems involving recurrence relations.
CO4	Solve the problems using groups and codes in encoding-decoding.

Module No.	Unit No.	Details of Topic	Hrs.
1.0	**1**	**Set Theory**	(03)
	1.1	Sets, Venn diagrams, Operations on Sets	
	1.2	Laws of set theory, Power set and Products	
	1.3	Partitions of sets, The Principle of Inclusion and Exclusion	
2.0	**2**	**Logic**	(04)
	2.1	Propositions and logical operations, Truth tables	
	2.2	Equivalence, Implications	
	2.3	Laws of logic, Normal Forms	
	2.4	Predicates and Quantifiers	
	2.5	Mathematical Induction	
3.0	**3**	**Relations, Digraphs**	(07)
	3.1	Relations, Paths and Digraphs	
	3.2	Properties and types of binary relations	
	3.3	Manipulation of relations, Closures, Warshall's algorithm	
	3.4	Equivalence relations	
4.0	**4**	**Posets and Lattice**	(05)
	4.1	Partial ordered relations (Posets) ,Hasse diagram	
	4.2	Lattice, sublattice	
	4.3	Types of Lattice ,Boolean Algebra	
5.0	**5**	**Functions and Pigeon Hole Principle**	(04)
	5.1	Definition and types of functions: Injective, Surjective and Bijective	
	5.2	Composition, Identity and Inverse	
	5.3	Pigeon-hole principle,Extended Pigeon-hole principle	
6.0	**6**	**Graphs and Subgraphs**	(06)
	6.1	Definitions, Paths and circuits, Types of Graphs , Eulerian and Hamiltonian	
	6.2	Planer graphs	
	6.3	Isomorphism of graphs	
	6.4	Subgraph	
7.0	**7**	**Algebraic Structures**	(08)
	7.1	Algebraic structures with one binary operation: semigroup, monoids and groups	
	7.2	Cyclic groups, Normal subgroups	
	7.3	Hamming Code ,Minimum Distance	
	7.4	group codes ,encoding-decoding techniques	
	7.5	Parity check Matrix ,Maximum Likelihood	
8.0	**8**	**Recurrence Relations**	(02)

	8.1	Recurrence relations.	
		Total	**39**

Recommended Books

1. Bernard Kolman,Busby," Discrete Mathematical Structures",PHI.
2. Kenneth H. Rosen. "Discrete Mathematics and its Applications", Tata McGraw-Hill.
3. Seymour Lipschutz, Marc Lipson "Schaum's Outline of Discrete Mathematics", Revised Third Edition Tata McGraw-Hill.
4. D. S. Malik and M. K. Sen, "Discrete Mathematical Structures", Thompson.
5. C. L. Liu, D. P. Mohapatra, "Elements of Discrete Mathematics" Tata McGrawHill.
6. J. P. Trembley, R. Manohar "Discrete Mathematical Structures with Applications to Computer Science", TataMcgraw-Hill.
7. Y N Singh, "Discrete Mathematical Structures", Wiley-India.

Term Work:
Note: The faculty should conduct 8 tutorials based on the above syllabus

Suggested List of Tutorials:

1. Sets, Mathematical induction.
2. Relation and digraphs.
3. Relation types.
4. Functions.
5. Posets
6. Graph
7. Group
8. Coding theory.

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCET301	Digital Design	--	--	02	--	--	02	02

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCET301	Digital Design	--	--	--	--	25	--	--	25

Course Outcomes:	After completing this course, students will be able to:
CO1	Recall basic gates & logic families and binary, octal & hexadecimal calculations and conversions.
CO2	Use different minimization technique and solve combinational circuits.
CO3	Design synchronous and asynchronous sequential circuits.
CO4	Construct test and debug digital networks using VHDL.

Module No.	Unit No.	Details of Topic	Hrs.
1.0		**Number Systems and Codes:**	(02)
	1.1 1.2 1.3	Revision of Binary, Octal, Decimal and Hexadecimal number Systems and their conversion, Binary Addition and Subtraction (1's and 2's complement method) Gray Code, BCD Code, Excess-3 code, ASCII Code,& Error Detection & Correction Codes,N-radix arithmetic operations	
2.0		**Basic Digital Circuits & Minimization:**	(08)
	2.1 2.2 2.3 2.4 2.5	NOT,AND,OR,NAND,NOR,EX-OR,EX-NOR Gates Solving problems using theorems and properties of Boolean Algebra, Standard SOP and POS form, Reduction of Boolean functions using Algebric method, K -map method (2,3,4 Variable) Quine-McClusky Method, NAND-NOR Realization.	
3.0		**Combinational Logic Design:**	(08)
	3.1 3.2 3.3 3.4	Half and Full Adder, Half and Full Subtractor, Four Bit Binary Adder, one digit BCD Adder, Four Bit Binary Subtractor (1's and 2's compliment method) Code conversion Multiplexers and Demultiplexers, Decoders One bit,Two bit ,4-bit Magnitude Comparator	
4.0		**Sequential Logic Design**	(08)
	4.1 4.2 4.3	Flip Flops:SR, D, JK, JK Master Slave and T Flip Flop, Truth Tables and Excitation Tables,Flip-flop conversion. Counters: Design of Asynchronous and Synchronous Counters, Modulo Counters, UP- DOWN counter, Ring and Johnson Counter. Shift Registers: SISO, SIPO,PIPO,PISO, Bidirectional Shift Register, Universal Shift Register	
		Total	**(26)**

Text Books

1. "Modern Digital Electronics", R. P. Jain, Tata McGraw Hill.
2. "VHDL Primer", J. Bhasker, Pearson Education
3. "Digital Logic and computer Design", M. Morris Mano, PHI.
4. "Digital Logic Applications and Design ",Yarbrough John M ,Cengage Learning
5. "VHDL Programming by Example", Douglas L. Perry, Tata McGraw Hill.
6. "Digital principles and Applications", Donald p Leach, Albert Paul Malvino, TataMcGraw Hill.

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL301	Object Oriented Programming Methodology	--	02	--	--	01	--	01

Course Code	Course Title	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam (ESE)				
UCEL301	Object Oriented Programming Methodology	--	--	--	25	25	--	50

Course Outcome	After successful completion of the course students should be able to
CO1	Compare the basic object oriented concept with procedure approach
CO2	Solve problems using Java basic constructs (like if else statement, control structures, and data types, array, string, vectors, packages, collection class).
CO3	Implement scenarios using object oriented concepts(Drawing class diagram, relationship between classes)
CO4	Demonstrate programs on interface, exceptions, multithreading and applets.

Term Work:
Note: The faculty should conduct 10 experiments based on the above syllabus
The programs should be implemented in Java on Windows or Linux environment.

Suggested List of Experiments:
Divide laboratory work into 3 parts
A. Basic Java structural components and Conditional and control statements:
• To demonstrate the use of command line argument.
• To demonstrate various ways of accepting data through keyboard.
• To understand the working of an array.
• To understand string class and demonstrate its various functions.
B. Perform following practical on some case study like Banking Application, Library Application etc.
• Find out classes, objects and their properties.
• Create and display objects found in above.
• Add methods to classes and implement.
• Refine above objects by adding constructors and local variables.
• Show communication between the objects by calling instance of one object from another class.
• Find relationships like inheritance, association, aggregation, composition.
• Implement above relationships.
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• To implement user defined exceptions in Java.
• Demonstrate the use collection classes like ArrayList/LinkedList/HashSet/TreeSet/Map.
• To illustrate Multithreading in Java.
• Simple programs on Applets and AWT.

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Course Code	CourseTitle	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL302	Data Structure Lab	--	02	--	--	01	--	01

Course Code	CourseTitle	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam(ESE)				
UCEL302	Data Structure Lab	--	--	--	25	25	-	50

Course Outcomes:
After completing this lab course, students will be able to:

1. Explain the different data structures used in problem solving.
2. Use linear and non-linear data structure in domain like compiler construction, DBMS etc
3. Demonstrate sorting and searching methods.
4. Choose the appropriate data structure for specified problem definition.

Term Work:
Note: The faculty should conduct 8-10 experiments based on the above syllabus
The programs should be implemented in C.

Suggested List of Experiments:

1. Implementation of different operations on linked list – concatenate, reverse, count no. of nodes.
2. Implementation of polynomials operations (addition, subtraction) using linked list.
3. Implementations of Infix to Prefix Transformation and its evaluation program.
4. Implementation of double ended queue menu driven program.
5. Implementation of BST program.
6. Implementation of construction of expression tree using postfix expression.
7. Implementation of Graph menu driven program (DFS and BFS).

8. Implementation of Selection, Insertion Sort menu driven program.

9. Implementation of Hashing using collision resolution methods linear and quadratic probing.

10. Implementation of priority queue program using Heap.

11. Implementation of Data structure for problem definition (Student experiment).For example Identify the appropriate data structure to check whether a string is palindrome or not. Justify the same. Write a program to for this operation.

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL303	Computer Organization and Architecture Lab	--	02	--	--	01	--	01

Course Code	CourseTitle	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam (ESE)				
UCEL303	Computer Organization and Architecture Lab	--	--	--	25	--	25	50

Course Outcomes:
After completing this lab course, students will be able to:

- Implement different ALU Techniques
- Simulate memory management techniques
- Understand motherboard and its structure

Term Work:
Note: The faculty should conduct 10 experiments based on the above syllabus
The programs should be implemented in C /C++

Suggested List of Experiments:

1. To study Full Adder (7483).
2. A program for hexadecimal addition and multiplication.
3. A program for Booth's multiplication.

4. A program for Restoring and Non Restoring of Division.
5. A program for LRU page replacement algorithm.
6. A program for FIFO page replacement algorithm
7. A program to simulate the mapping techniques of Cache memory.

   Direct Mapped cache
   Associative Mapped cache
   Set Associative Mapped cache.
8. A program to simulate memory allocation policies.
   First-fit algorithm
   Best-fit algorithm

Course Code	CourseTitle	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL304	Digital Design Lab	--	02	--	--	01	--	01

Course Code	CourseTitle	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam (ESE)				
UCEL304	Digital Design Lab	--	--	--	25	-	25	50

Course Outcomes:

After completing this course, students will be able to:
CO1: Recall basic gates & logic families and binary, octal & hexadecimal calculations and conversions.
CO2: Use different minimization technique and solve combinational circuits.
CO3: Design synchronous and asynchronous sequential circuits.
CO4: Construct test and debug digital networks using VHDL.

Term Work:
Note: The faculty should conduct 10 experiments based on the above syllabus.
Suggested List of Experiments:

1. Introduction to basic gates using ICs
2. Implementation of Boolean expressions using gates
3. Some experiments on implementation of Combinational circuits such as adder, subtractors, Multiplexers, demultiplexers, code convertors etc.
4. Some experiments on implementation of Sequential circuits such as a Flip-Flop, counters etc.
5. Implementation testing and debugging of any circuit in VHDL.

Semester IV (Computer Engineering)

Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Pract	Tutorial	Theory	TW/ Practical	Tutorial	Total
UCEC401	Applied Mathematics- IV	03	-	01	03	-	01	04
UCEC402	Microprocessor	03	-	-	03	-	-	03
UCEC403	Analysis of Algorithm	03	-	-	03	-	-	03
UCEC404	Relational Database Management Systems	03	-	-	03	-	-	03
UCEC405	Digital Communication & Network	03	-	-	03	-	-	03
UCEL401	Microprocessor Lab	-	02	-	-	01	-	01
UCEL402	Analysis of Algorithm Lab	-	02	-	-	01	-	01
UCEL403	Relational Database Management Systems Lab	-	02	-	-	01	-	01
UCEL404	Digital Communication & Network Lab	-	02	-	-	01	-	01
UCEL405	System Lab	-	02	-	-	01		01
UCEA401	Audit Course	-	02	-	-	-	-	-
Total		**15**	**12**	**01**	**15**	**05**	**01**	**21**

Semester IV (Computer Engineering)

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Pract.	Oral	Total
		Test 1	Test 2	IA	ESE				
UCEC401	Applied Mathematics- IV	15	15	10	60	25	-	-	125
UCEC402	Microprocessor	15	15	10	60	-	-	-	100
UCEC403	Analysis of Algorithm	15	15	10	60	-	-	-	100
UCEC404	Relational Database Management Systems	15	15	10	60	-	-	-	100
UCEC405	Digital Communication & Network	15	15	10	60	-	-	-	100
UCEL401	Microprocessor Lab	-	-	-	-	25	25	-	50
UCEL402	Analysis of Algorithm Lab	-	-	-	-	25	25	-	50
UCEL403	Relational Database Management Systems Lab	-	-	-	-	25	25	-	50
UCEL404	Digital Communication & Network Lab	-	-	-	-	25	25	-	50
UCEL405	System Lab	-	-	-	-	25	25	-	50
Total		**75**	**75**	**50**	**300**	**150**	**125**	**-**	**775**

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC401	Applied Mathematics IV	03	--	01	03	--	01	04

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam(ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC401	Applied MathematicsIV	15	15	10	60	25	--	--	125

Course Prerequisites: Applied Mathematics I & II

Course Outcomes:

After the successful completion of the course the student will be able to :

1. Solve examples using Binomial, Poisson&NormalExponential Distribution& find nature of relation between two variables using scatter diagram, correlation coefficient &Regression.
2. Analyze different samples & draw conclusion for population using large &small sample test.
3. Solve examples using M/M/1(Singal Server ,Unlimited & limited Queue Models)
4. Optimize an object function using Simplex method, Big- M method, Lagrangian function & Kuhn-Tucker method

Module No.	Unit No.	Details of Topic	Hrs.
1		**Statistics and Probability Distributions**	**(16)**
	1.1	Correlation, Co-variance, Karl Pearson Coefficient of Correlation & Spearman's Rank Correlation Coefficient (non-repeated & repeated ranks).	
	1.2	Regression Coefficients & lines of regression, Curve fitting of straight line and parabola	
	1.3	Probability distribution for random variables, Expected value, Variance.	
	1.4	Probability Distributions: Binomial, Poisson and Normal & Exponential Distributions.	
		#Self-learning topic Discrete and Continuous random variables, Probability mass and density function	
2		**Sampling Theory**	**(08)**
	2.1	Sampling distribution. Test of Hypothesis. Level of significance, critical region. One tailed and two tailed tests. Interval Estimation of population parameters. Large and small samples.	
	2.2	Difference between sample mean and population means for large samples, Test for significance of the difference between the means of two large samples.	
	2.3	Student's t-distribution: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two Samples, paired t-test.	
	2.4	Chi-square distribution as a Test of Independence, Test of the Goodness of fit and Yate's correction.	
3		**Queuing theory**	**(07)**
	3.1	Introduction, Features of Queuing , solution of Queuing models.M/M/1(Singal Server ,Unlimited Queue Model)	
	3.2	M/M/1 Singal Server ,limited Queue Model	
4		**Mathematical Programming**	**(08)**
	4.1	Types of solution, Standard and Canonical form of LPP, Basic and feasible solutions, simplex method. Artificial variables, Big –M method (method of penalty).	
	4.2	Unconstrained optimization, problems with equality constraints LagrangesMultiplier method.	
	4.3	Problem with inequality constraints Kuhn-Tucker conditions	
		#Self-learning topic LPP by Graphical method	
		Total	**39**

Recommended Books:

1. P.N.Wartilar&J.N.Wartikar, *"A Text Book of Applied Mathematics",* Vol. I & II by Pune, VidyarthiGrihaPrakashan, Pune
2. J.K.Sharma, *"Operation Reasearch".*
3. S C Gupta & V K Kapoor ,*"Fundamentals of Mathematical Statistics",* S. Chand & Co

4.Kreyszig E., *"Advanced Engineering Mathematics",* 9th edition, John Wiley, 2006.

5. Dr. B.S. Grewal ,*"Higher Engg. Mathematics"* by Khanna Publication

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC402	Microprocessor	03	-	-	03	-	-	03

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC402	Microprocessor	15	15	10	60	-	-	-	100

Course Objective:
To explore internal architecture of microprocessor, interface with memory and I/O devices. Through this course, the students will be able to build microprocessor based systems. The concept of multicore processors is also described

Course Outcomes:
After completing this course, students will be able to:

1. Explain the process of Compilation from Assembly language to machine language
2. Build Microprocessor based system using memory chips and peripheral chips
3. Analyze the techniques for faster execution of instructions and enhance performance of microprocessors.
4. Identify and describe multicore processors

Module No.	Unit No.	Details of Topic	Hrs.
1.0		Intel 8086 Architecture :	(08)
	1.1	Introduction to 80x86 microprocessor, Internal Architecture, Generation of physical address, Minimum & Maximum Mode, Ready and Reset pin significance	
	1.2	Study of 8086 supporting chips 8282(Latch), 8284(Clock Generator), 8286(Transreceiver), 8288(Bus Controller). Timing Diagram Read Write Machine Cycles,	
2.0		Assembly Language Programming	(04)
	2.1	Instruction Set of 8086 microprocessor in details, Addressing modes of 8086/88, Programming the 8086 in assembly language, Far and Near procedures, Macros	
	2.2	Mixed mode programming with C-language and assembly.	
3.0		Interrupt Structure	(04)
	3.1	Interrupt Structure , Interrupt service Routine, Interrupt Vector Table, Hardware and Software Interrupts, INTR ,NMI , Interrupt Response, Execution of an ISR, Priority of Interrupts.	
4.0		Interfacing with 8086	(13)
	4.1	Functional Block Diagram and description, Control Word Formats, Operating Modes and Applications of the Peripheral Controller namely 8255-PPI, 8253-PIT, 8259-PIC and 8237-DMAC. Interfacing of the above Peripheral Controllers.	
	4.2	Study of Multiprocessor Configurations namely Tightly Coupled System (TCS) and Loosely Coupled System (LCS).	
5.0		Protected Mode Architecture	(05)
	5.1	Historical evolution of 80286, 386, 486 processor. Programming model and operating modes of 80386DX processor	
	5.2	Address translation mechanism in protected mode ,Memory Management, Protection Mechanism of 80386	
6.0		Introduction to Pentium microprocessor	(05)
	6.1	Pentium RISC features, Pentium super-scalar architecture, Pipeline stages .Branch Prediction.	
	6.2	Data Transfer Mechanism, 8/16/32 bit Data Bus, Instruction and Data caches.	
	6.3	Comparison of Pentium 2, Pentium 3 and Pentium 4 Processors, Comparative study of Multicore Processors i3,i5 and i7	
		Total	**39**

Recommended Text Books:

1) 8086/8088 families: Design Programming and Interfacing: By John Uffenbeck (Pearson Education).

2) Pentium Processor System architecture: Tom shanley& Don Anderson ,Addison-Wesley

3) Advanced Microprocessor: Daniel Tabak, Tata McGraw Hill

Recommended Reference Books:

1)8086 Microprocessor Programming and Interfacing the PC: By Kenneth Ayala

2) Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: By Liu & Gibson (PHI Publication).

3) Microprocessor and Interfacing: By Douglas Hall (TMH Publication).

4) Intel Microprocessors: Barry B. Brey, 8th edition, Pearson Education India

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL401	Microprocessor	--	02	--	--	01	--	01

Course Code	Course Title	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam (ESE)				
UCEL401	Microprocessor	--	--	--	25	25	-	50

Course Outcomes:
After completing this lab course, students will be able to:

- Implement assembly language programs
- Interface microprocessor based system
- Implement the functioning of advanced processors

Term Work:
1. Total eight experiments / practical must be performed out of which five practical must be performed on assemblers for 8086 and three experiments must be performed on interfacing of 8086 with peripheral chips like 8255 PPI, 8253 PIT, 8259 PIC and 8237 DMAC.

2. In addition to eight experiments/practical, two case studies are mandatory, one case study on RISC processor and second case study on CISC processor.

Suggested List of Experiments:

1. To Add two 16 bit numbers, to multiply two 8 bit & to divide two 8 bit numbers.
2. To find Fibonacci series of N given terms
3. To find the value of 2^x and to find the square-root of a number using 8087 instruction set.
4. To write High level program to check whether access is given to read files of segment descriptor

5. Write a program to find type of CPU inside the machine using CPUID instruction.
6. Interfacing 8255 PPI with 8086 to perform different modes of 8255 i.e. basic mode and BSR mode by using trainer kit
7. Interfacing 8259 PPI with 8086 to perform the ICW and OCW command words of 8259 by using trainer kit
8. Interfacing 8253 PPI with 8086
9. Study on RISC processor
10. Study on CISC processor.

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC403	Analysis of Algorithm	03	-	-	03	-	-	03

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC403	Analysis of Algorithm	15	15	10	60	-	-	-	100

Course Outcomes:

After completing this course, students will be able to:

1. Compare and demonstrate the efficiency of algorithms using asymptotic complexity notations
2. Analyze and solve problems for different divide and conquer strategy, greedy method, dynamic programming approach and backtracking and branch & bound policies.
3. Analyze and solve problems for different string matching algorithms

Module No.	Details of Topic	Hrs.
1	**Introduction to analysis of algorithm** •Decision and analysis fundamentals •Performance analysis , space and time complexity •Growth of function – Big –Oh ,Omega , Theta notation •Analysis of selection sort , insertion sort •Randomized algorithms •Recursive algorithms •The substitution method •Recursion tree method	7
2	**Divide and Conquer** •General method •Binary search •Finding minimum and maximum •Merge sort analysis •Quick sort analysis	5
3	**Greedy Method** •General Method •Knapsack problem •Job sequencing with deadlines •Minimum cost spanning trees-Kruskal and prim's algorithm	6

	•Optimal storage on tapes •Single source shortest path	
4	**Dynamic Programming** •General Method •Multistage graphs •all pair shortest path •single source shortest path •Optimal binary search tree •0/1 knapsack •Travelling salesman problem •Matrix chain multiplication	8
5	**Backtracking** •General Method •8 queen problem(N-queen problem) •Sum of subsets •Graph coloring	4
6	**Branch and bound** •General method •15 puzzle problem •0/1 Knapsack	3
7	**String Matching Algorithms** •The naïve string matching Algorithms •String matching with finite automata •Longest common subsequence algorithm	3
	Total	**36**

Recommended Books

1. Ellis horowitz ,sartajSahni , s. Rajsekaran. "Fundamentals of computer algorithms" University Press.
2. T.H.coreman , C.E. Leiserson,R.L. Rivest, and C. Stein, "Introduction to algorithms", 2nd edition , PHI publication 2005
3. Alfred v. Aho , John E. Hopcroft , Jeffrey D. Ullman , "Data structures and Algorithm" Pearson education , fourth impression 2009
4. Michael Gooddrich& Roberto Tammassia, "Algorithm design foundation, analysis and internet examples", Second edition , wiley student edition

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL402	Analysis of Algorithm	--	02	--	--	01	--	01

Course Code	Course Title	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam (ESE)				
UCEL402	Analysis of Algorithm	--	--	--	25	25	--	50

Suggested List of Experiments: (Minimum 10 experiments should be **analyzed** for performance of the algorithms)

Introduction to analysis of algorithm:	Selection sort Insertion sort (for this experiment comparative analysis on the basis of comparison required to sort list is expected for large values of n)
Divide and Conquer	-Binary search -Finding Minimum And Maximum -Merge Sort Analysis -Quick Sort Analysis
Greedy Method	-Knapsack problem -Job Sequencing With Deadlines -Minimum Cost Spanning Trees-Kruskal and Prim's Algorithm -Optimal Storage On Tapes -Single Source Shortest Path
Dynamic Programming	-Multistage graphs -All Pair Shortest Path -Single Source Shortest Path -Optimal Binary Search Tree -0/1 Knapsack -Travelling Salesman problem
Backtracking	-8 Queen Problem(N-Queen Problem) -Sum Of Subsets -Graph Coloring -Knapsack Problem
String Matching Algorithms	-The naïve string matching algorithms - String Matching With Finite Automata -Longest Common Subsequence Algorithm
Branch and bound	-15 Puzzle Problem -0/1 Knapsack

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC403	Relational Database Management Systems (RDBMS)	03	--	--	03	--	--	03

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC403	Relational Database Management Systems (RDBMS)	15	15	10	60	--	--	--	100

Course Prerequisites: Data Structures

Course Outcomes:

After completing this course students will-

1. Design entity-relationship diagram to represent different database application.
2. Convert entity-relationship diagrams into relational tables, populate a relational database and formulate SQL queries on the data Use SQL for creation and query the database.
3. Define and apply integrity constraints and improve database design using normalization techniques.
4. Demonstrate the concept of transaction, concurrency control and recovery techniques.

Module No.	Unit No.	Details of Topic	Hrs.
1.0		**Introduction**	(04)
	1.1	Introduction, Characteristics of databases, File system V/s Database system, Users of Database system, Concerns when using an enterprise database, Data Independence	
	1.2	Data Independence, DBMS system architecture, Database Administrator,	
2.0		**Entity–Relationship Data Model**	(04)
	2.1	Introduction, Benefits of Data Modeling, Types of Models, Phases of Database Modeling, The Entity-Relationship (ER) Model	
	2.2	Enhanced Entity-Relationship (EER)- Generalization, Specialization and Aggregation	
3.0		**Relational Model and Algebra**	(07)
	3.1	Introduction , Data Manipulation , Data Integrity, Advantages of the Relational Model	
	3.2	Relational Algebra , Relational Algebra Queries	
	3.3	Mapping the ER and EER Model to the Relational Model	
4.0		**Structured Query Language (SQL)**	(09)
	4.1	Overview of SQL , Data Definition Commands	
	4.2	Set operations, aggregate function, null values, Data Manipulation commands	
	4.3	Data Control commands , Views in SQL	
	4.4	Nested and complex queries,	
	4.5	Domain Constraints, Referential integrity,	
	4.6	Assertions Trigger.	
	4.7	Security and authorization in SQL	
5.0		**Relational–Database Design**	(06)
	5.1	First Normal Form, Pitfalls in Relational-Database designs	
	5.2	Function Dependencies, Armstrong Axioms	
	5.3	2nd , 3rd , BCNF and 4th normal form	
	5.4	Decomposition, desirable properties of decomposition	
	5.5	Overall database design process	
6.0		**Transactions Management and Concurrency**	(08)
	6.1	Transaction concept, Transaction states, ACID properties	
	6.2	Implementation of atomicity and durability, Concurrent Executions	
	6.3	Serializability, Recoverability, Implementation of isolation	
	6.4	Concurrency Control: Lock-based ,Timestamp-based, Validation-	

		based protocols, Deadlock handling	
	6.5	Recovery System: Failure Classification, Storage structure, Recovery & atomicity ,Log based recovery, Shadow paging,	
	6.6	Database Security	
		Total	**38**

Recommended Books

5. G. K. Gupta :"Database Management Systems", McGraw – Hill.
6. Elmasri and Navathe, "Fundamentals of Database Systems", Pearson Education
7. Raghu Ramakrishnan, Johannes Gerhke, "Database Management Systems" McGraw Hill
8. Korth, Silberchatz, Sudarshan, "Database System Concepts" McGraw Hill, 6th Edition.

Course Code	CourseTitle	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL403	Relational Database Management Systems Lab (RDBMS)	--	02	--	--	01	--	01

Course Code	CourseTitle	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam(ESE)				
UCEL403	Relational Database Management Systems Lab (RDBMS)	--	--	--	25	25	--	50

Course Outcomes:
After completing this lab course, students will be able to:

- Design and draw ER diagram for the real life problem with software tool.
- Create and update database and tables with different DDL and DML statements.
- Implement and execute advance queries.
- Apply advance concepts for refinement of database.

Term Work:
Note: The faculty should conduct experiments based on the above syllabus in SQL, Oracle or any database management system.

Suggested List of Experiments:

1. ER Diagram and Relational Model.
2. Data Definition Language commands.
3. Data Manipulation Language commands.
4. Simple Queries
5. In Built functions
6. Nested queries and join queries
7. Views.

8. Triggers.

9. Transaction and Concurrency control in PL-SQL.

10. Mini project- Creating a Two-tier client-server database applications using JDBC or ODBC for a case study

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEC405	Digital Communication and Networks	03	--	--	03	--	--	03

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEC405	Digital Communication and Networks	15	15	10	60	--	--	--	100

Course Prerequisites: Basic Electronics

Course Outcomes:

After completing this course students will-

1. Explain the fundamentals of the Digital communication and Information theory e.g. modulation, information, entropy, sampling theorem, Shannon's theorem etc.
2. Explain the fundamentals of the data communication networks, reference models, topologies, physical media, devices, simulators and identify their use in day to day networks.
3. Describe Data Link Layer, MAC layer technologies & protocols and implement the functionalities like error control, flow control.
4. Describe the Network layer concepts and implement primitives related to addressing.
5. Analyze the network on different performance metrics.

Module No.	Unit No.	Details of Topic	Hrs.
1.0		**Introduction**	(06)
	1.1	The importance of Communication, Elements of communication system, Types of Electronics communication (Analog, Digital, Simplex, Half-Duplex, Full-Duplex)	
	1.2	Definition of modulation, Need of modulation, Antennas, Electromagnetic spectrum, Bandwidth, Signal Types	
	1.3	Noise: internal, External, Noise calculation	
2.0		**Information Theory and Coding**	(06)
	2.1	Information, Uncertainty , Entropy, Information Rate, Average Code word length, Sampling theorem (PCM,ADM,DM)	
	2.2	Data Rate Limits, Shannon-Hartley theorem, Shannon –Fano theorem, Huffman coding	
	2.4	Introduction to Multiplexing FDM, TDM, , CDM, WDM	
3.0		**Digital Modulation Techniques**	(06)
	3.1	Line coding schemes.(NRZ,RZ etc.)	
	3.2	Digital Modulation: ASK, PSK, FSK, QPSK; Modem and its types	
	3.3	Spread Spectrum, Frequency hopping spread spectrum, Direct sequence spread spectrum,	
4.0		**Introduction of network**	(06)
	4.1	Types of Networks: LAN, WAN, MAN. Network Topology	
	4.2	Network Software: Protocol hierarchy, Design Issues for layers, Connection oriented and connectionless services, Reliable and Un Reliable services	
	4.3	OSI and TCP/IP reference model, Comparison of OSI and TCP/IP reference model	
	4.4	Overview of connecting devices, NIC, Repeater, Hub, Bridge, Router, Gateway	
	4.5	Network Address (Physical and logical, Port)	
5.0		**Data Link Layer**	(06)
	5.1	Error Control: Types of Errors, Redundancy, Detection Vs Correction, FEC Vs Retransmission, Coding, Modular Arithmetic, Block Coding, Linear Block Codes, Cyclic Codes, Checksum, Hamming Code.	
	5.2	Framing, and Flow Control; Flow control Protocols: Stop-	
		and-wait, Go-Back-N, Selective-Repeat, Piggybacking	
	5.3	HDLC, PPP.	
6.0		**Medium Access Control, Ethernet and LAN**	(06)

	6.1	MAC address	
	6.2	Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA,	
	6.3	Controlled Access, Channelization,	
	6.4	IEEE standards, different Ethernets.	
		Total	**36**

Recommended Books

9. B. A. Forouzan, "Data Communication and Networking", Tata McGraw Hill edition, Third Edition
10. A. S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition
11. Taub and Schilling, "Principles of Digital Communication", Tata McGraw Hill edition, Third Edition.
12. Kennedy, "Electronics Communication", Tata McGraw Hill edition, Third Edition
13. William Stallings, "Data Communication and Networking", Pearson Education

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL404	Digital Communication and Networking Lab	--	02	--	--	01	--	01

Course Code	Course Title	Examination Scheme						
		Theory Marks			Term Work	Practical	Oral	Total
		Test 1	Test 2	End Sem. Exam (ESE)				
UCEL404	Digital Communication and Networking Lab	--	--	--	25	25	--	50

Course Outcomes:

After completing this lab course, students will be able to:

1. Implement and verify different modulation techniques using trainer kit
2. Simulate a simple computer Network using NS-2.
3. Implement Error Detection and Correction Techniques using C.
4. Implement Flow Control Techniques using C.

Term Work:

Note: The faculty should conduct 10 experiments based on the above syllabus
The programs should be implemented in C and NS-2 (Windows or Linux environment).

Suggested List of Experiments:

9. Sampling and Reconstruction
10. Time Division Multiplexing (TDM)
11. Data formats
12. BASK , BFSK and BPSK
13. Program to implement Hamming Codes
14. CRC
15. Checksum
16. Program to implement Flow control algorithms: Stop and Wait, Go-Back-N, Selective Repeat

Course Code	Course Title	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
UCEL405	System Lab	--	02	--	--	01	--	01

Course Code	Course Title	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Continuous assessment			End Sem. Exam (ESE)				
		Test 1	Test 2	In semester Assessment (IA)					
UCEL405	System Lab	--	--	--	--	25	25	--	50

Course Prerequisites: Basic Electronics

Course Outcomes:
After completing this course students will-

1. To acquire the fundamental concepts of a basic electronic components.
2. To identify and exploit different input/output devices and memory management in various processors.
3. To learn servicing and maintenance of computer system.
4. To model the importance of networking in wired and wireless communication

Module No.	Unit No.	Details of Topic	Hrs.
1.0		**Basic Electronic components**	**(02)**
	1.1	Significance of current, voltage, power, resistance and capacitors, diode, LED and transistors.	
2.0		**Input /Output Devices**	**(02)**
	2.1	Keyboard, mouse, Printer, monitor, scanner, speaker, plotter, joystick etc.	
3.0		**Storage Devices**	**(02)**
	3.1	CD, DVD, Pen Drive, HDD Installation and configurations.	
4.0		**Types of Cards**	**(02)**
	4.1	Introduction to card	
	4.2	Display card, Sound Card, NIC, TV Tuner Card, NIC card and modem.	
5.0		**Memory Types**	**(02)**
	5.1	Different types of memories.	
	5.2	Installing & Upgrading memory.	
	5.3	L1 & L2 cache memory	
6.0		**Motherboard**	**(02)**
	6.1	Introduction to motherboard,	
	6.2	Types of Motherboard,	
	6.3	Jumper setting, DIP switch setting, Checking MB BIOS,	
	6.4	Installing Checking & replacing motherboard.	
7.0		**Power supply**	**(02)**
	7.1	Introduction to power supply,	
	7.2	Types of power supply,	
	7.3	Installation & trouble shooting	
8.0		**Servicing and Maintenance**	**(02)**
	8.1	Assembling and Dismantling of PC,	
	8.2	Software installation and virus protection,	
	8.3	Preventive maintenance- Cleaning the equipment,	
	8.4	servicing of equipment,	
	8.5	fine tuning the system.	
9.0		**Introduction to Networking**	**(02)**
	9.1	Types of network : LAN, WAN, MAN	
	9.2	Types of communication, Synchronous, Asynchronous	
	9.3	Modes of communication: Simplex, Half Duplex, Full Duplex	
	9.4	Network Component: Router, switch, hub, Repeater, Bridge, Modem etc.	

10		**Transmission Media**	**(02)**
	10.1	Wired: Co-axial cable, fiber optics, twisted pair etc.	
	10.2	Wireless: Radio waves, Infrared, Microwave, Bluetooth, Wi-Fi etc.	
11		**Network Troubleshooting**	**(02)**
	11.1	Troubleshooting processes, tools Common connectivity problems with cards, cables, and selected hardware Network performance problems	
		Total	**22**

Recommended Text Books:

1) **IBM –PC by Govindrajalu ,TMH**

Reference Books:

1) **Data communications and networking by Behrouz A Forouzan**