B. E. COMMON TO ALL PROGRAMMES
SEMESTER - IV

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS
(Common to all programs)
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18MAT41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

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

Module-2

Conformal transformations: Introduction. Discussion of transformations: $w = Z^2$, $w = e^z$, $w = z + \frac{1}{z}$, $(z \neq 0)$.Bilinear transformations- Problems.
Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

Module-3

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

Module-4

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.
Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-
$y = ax + b$, $y = ax^b$and$y = ax^2 + bx + c$.

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

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

- Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- Fit a suitable curve for given data and analyze the relationship between two variables using statistical methods.
- Utilize conformal transformation and complex integral arising in fluid flow visualization and image processing.
- Apply the knowledge of joint probability distributions in attempting engineering problems for feasible random events and also Understand the concepts of sampling theory and apply it to related real life problems.

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Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition,2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C.Barrett	McGraw-Hill	6th Edition 1995
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill	11th Edition,2010
4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

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

DESIGN AND ANALYSIS OF ALGORITHMS
SEMESTER – IV

Course Code	**18CS42**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03

CREDITS –4

Module 1	**Contact 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).** **RBT: L1, L2, L3**	10
Module 2	
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum **(T2:3.1, 3.3, 3.4)**, Merge sort, Quick sort **(T1:4.1, 4.2)**, Strassen's matrix multiplication **(T2:3.8)**, Advantages and Disadvantages of divide and conquer. **Decrease and Conquer Approach:** Topological Sort. **(T1:5.3).** **RBT: L1, L2, L3**	10
Module 3	
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines **(T2:4.1, 4.3, 4.5). Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm **(T1:9.1, 9.2)**. **Single source shortest paths:** Dijkstra's Algorithm **(T1:9.3)**. **Optimal Tree problem:** Huffman Trees and Codes **(T1:9.4)**. **Transform and Conquer Approach:** Heaps and Heap Sort **(T1:6.4)**. **RBT: L1, L2, L3**	10
Module 4	
Dynamic Programming: General method with Examples, Multistage Graphs **(T2:5.1, 5.2)**. **Transitive Closure:** Warshall's Algorithm, **All Pairs Shortest Paths:** Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem **((T1:8.2, 8.3, 8.4)**, Bellman-Ford Algorithm **(T2:5.4)**, Travelling Sales Person problem **(T2:5.9)**, Reliability design **(T2:5.8)**. **RBT: L1, L2, L3**	10
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)**. **Programme and Bound:** Assignment Problem, Travelling Sales Person problem **(T1:12.2)**, **0/1 Knapsack problem (T2:8.2, T1:12.2):** LC Programme and Bound solution **(T2:8.2)**, FIFO Programme and Bound solution **(T2:8.2)**. **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes **(T2:11.1)**. **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Describe computational solution to well-known problems like searching, sorting etc.
- Estimate the computational complexity of different algorithms
- Devise an algorithm using appropriate design strategies for problem solving.
- Analyze space and time tradeoffs for algorithms using both approaches
- Develop solutions using Backtracking for some of NP complete problems
- Develop solutions using Backtracking for some of NP complete problems

Question Paper Pattern:

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

Textbooks:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education).

OPERATING SYSTEMS SEMESTER – IV			
Course Code	**18CS43**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Module 1	**Contact 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 **Text book 1: Chapter 1, 2.1, 2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.10, 3.1, 3.2, 3.3, 3.4** **RBT: L1, L2, L3**	08
Module 2	
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. **Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors. **Text book 1: Chapter 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, 5.5, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7** **RBT: L1, L2, L3**	08
Module 3	
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **Text book 1: Chapter 7, 8.1 to 8.6** **RBT: L1, L2, L3**	08
Module 4	
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **Text book 1: Chapter 91. To 9.6, 10.1 to 10.5** **RBT: L1, L2, L3**	08

Module 5	
Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. **Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication. **Text book 1: Chapter 12.1 to 12.6, 21.1 to 21.9** **RBT: L1, L2, L3**	08

Course Outcomes: The student will be able to :

- Identify various types of Operating Systems, its need and services.
- Apply suitable techniques for process scheduling, synchronization and thread management.
- Make use of different methods for preventing or avoiding deadlock and managing memory efficiently.
- Interview the benefits of virtual memory; explore file system and directory structures.
- Experiment with different disk management schemes and realize the concepts of Operating System with case studies

Question Paper Pattern:

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

Textbooks:

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

Reference Books:

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

MICROCONTROLLER AND EMBEDDED SYSTEMS SEMESTER – IV			
Course Code	**18CS44**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Module 1	**Contact Hours**
Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions **Text book 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5** **RBT: L1, L2**	08
Module 2	
Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants **ARM programming using Assembly language:** Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs **Text book 1: Chapter 3:Sections 3.1 to 3.6 (Excluding 3.5.2), Chapter 6(Sections 6.1 to 6.6)** **RBT: L1, L2**	08
Module 3	
Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. **Text book 2:Chapter 1(Sections 1.2 to 1.6),Chapter 2(Sections 2.1 to 2.6)** **RBT: L1, L2**	08
Module 4	
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational quality attributes ,non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling, embedded firmware design and development **Text book 2: Chapter-3, Chapter-4, Chapter-7 (Sections 7.1, 7.2 only), Chapter-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)** **RBT: L1, L2**	08

Module 5	
RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan. **Text book 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.4, 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 (block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

- Apply ARM processor architecture concept to the assembly language programming
- Apply ARM processor programming concept to solve complex problem
- Illustrate the Applicability of the Embedded system
- Illustrate the Design process of Embedded system
- Comprehend the real time operating system used for the Embedded system

Question Paper Pattern:

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

Textbooks:

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

Reference Books:

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

OBJECT ORIENTED CONCEPTS SEMESTER – IV			
Course Code	**18CS45**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Module 1	**Contact 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. **Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.3** **RBT: L1, L2**	08
Module 2	
Class and Objects (contd): Objects and arrays, Namespaces, Nested classes, Constructors, Destructors. **Introduction to Java**: Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. **Text book 1:Ch 2: 2.4 to 2.6Ch 4: 4.1 to 4.2** **Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5** **RBT: L1, L2**	08
Module 3	
Classes, Inheritance, Exception Handling: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. **Inheritance:** inheritance basics, using super, creating multi level hierarchy, method overriding. **Exception handling:** Exception handling in Java. **Text book 2: Ch:6 Ch: 8 Ch:10** **RBT: L1, L2, L3**	08
Module 4	
Packages and Interfaces: Packages, Access Protection, Importing Packages .Interfaces. **Multi Threaded Programming:** Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, producer consumer problems. **Text book 2: CH: 9 Ch 11:** **RBT: L1, L2, L3**	08
Module 5	
Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. **Swings:** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet;	08

Jlabel and ImageIcon; JTextField; The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable. **Text book 2: Ch 22: Ch: 29 Ch: 30** **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Learn fundamental features of object oriented language and programming in C++.
- Learn how to set up JDK environment to create, debug and run simple Java programs.
- Create and handle run-time errors using Exception handling mechanism, create and work with packages and interfaces.
- Create multi-threading programs and event handling mechanisms.
- Introduce event driven Graphical User Interface (GUI) programming using Applets.

Question Paper Pattern:

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

Textbooks:

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

Reference Books:

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

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

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

DATA COMMUNICATION SEMESTER – IV			
Course Code	**18CS46**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Module 1	**Contact Hours**
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, **Networks Models**: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer-1:** Data and Signals**,** Digital Signals, Transmission Impairment, Data Rate limits, Performance. **Textbook1: Ch 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6** **RBT: L1, L2**	08
Module 2	
Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding). **Physical Layer-2:** Analog to digital conversion (only PCM), Transmission Modes, **Analog Transmission**: Digital to analog conversion. **Textbook1: Ch 4.1 to 4.3, 5.1** **RBT: L1, L2**	08
Module 3	
Bandwidth Utilization: Multiplexing and Spread Spectrum, **Switching**: Introduction, Circuit Switched Networks and Packet switching. **Error Detection and Correction**: Introduction, Block coding, Cyclic codes, Checksum, **Textbook1: Ch 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.4** **RBT: L1, L2**	08
Module 4	
Data link control: DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only). **Media Access control**: Random Access, Controlled Access and Channelization, **Introduction to Data-Link Layer:** Introduction, Link-Layer Addressing, ARP **IPv4 Addressing and subnetting:** Classful and CIDR addressing, DHCP, NAT **Textbook1: Ch 9.1, 9.2, 11.1, 11.2 11.4, 12.1 to 12.3, 18.4** **RBT: L1, L2**	08
Module 5	
Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit	08

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

Course Outcomes: The student will be able to :

- Identify the different types of network topologies and protocols.
- Construct the different line coding schemes, Transmission modes.
- Apply different error detection and correction methods for digital data and construct the different switching circuits, link addressing.
- Distinguish different data link protocols and select suitable media access control protocol for data transmission.
- Identify the architecture of wired and wireless Local Area Networks (LANs).

Question Paper Pattern:

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

Textbooks:

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

Reference Books:

1. Alberto Leon-Garcia and 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 ALGORITHMS LABORATORY
SEMESTER – IV

Course Code	**18CSL47**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03
Credits – 2			

Descriptions (if any):

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

Programs List:

1.	
a.	Create a Java class called ***Student*** with the following details as variables within it. (i) USN (ii) Name (iii) Programme (iv) Phone Write a Java program to create *nStudent* objects and print the USN, Name, Programme, and Phoneof these objects with suitable headings.
b.	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
2.	
a.	Design a superclass called ***Staff*** with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely ***Teaching*** (domain, publications), ***Technical*** (skills), and ***Contract*** (period). Write a Java program to read and display at least 3 *staff* objects of all three categories.
b.	Write a Java class called ***Customer*** to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as "/".
3.	
a.	Write a Java program to read two integers *a* and*b*. Compute *a*/*b* and print, when *b* is not zero. Raise an exception when *b* is equal to zero.
b.	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number andprints; third thread will print the value of cube of the number.
4.	Sort a given set of ***n*** integer elements using **Quick Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000 and record the time taken to sort. Plot a graph of the time taken versus ***n***on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

5.	Sort a given set of ***n*** integer elements using **Merge Sort** method and compute its time complexity. Run the program for varied values of *n*> 5000, and record the time taken to sort. Plot a graph of the time taken versus ***n***on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6.	Implement in Java, the **0/1 Knapsack** problem using (a) Dynamic Programming method (b) Greedy method.
7.	From a given vertex in a weighted connected graph, find shortest paths to other vertices using **Dijkstra's algorithm**. Write the program in Java.
8.	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Kruskal'salgorithm.** Use Union-Find algorithms in your program
9.	Find Minimum Cost Spanning Tree of a given connected undirected graph using **Prim's algorithm**.
10.	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using **Floyd's algorithm**. (b) Implement **Travelling Sales Person problem** using Dynamic programming.
11.	Design and implement in Java to find a **subset** of a given set **S** = {Sl, S2,.....,Sn} of ***n*** positive integers whose SUM is equal to a given positive integer ***d***. For example, if S ={1, 2, 5, 6, 8} and ***d***= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.
12.	Design and implement in Java to find all **Hamiltonian Cycles** in a connected undirected Graph G of *n* vertices using backtracking principle.

Laboratory Outcomes: The student should be able to:

- Experiment with object oriented concepts of JAVA programming language.
- Construct the JAVA program by using the approach of Divide and Conquer such as Merge Sort, Quick Sort.
- Make use of Greedy method to solve knapsack and minimum cost spanning tree using JAVA programming.
- Apply Dynamic Programming techniques to solve All pair's shortest path (Floyd's algorithm) and Travelling sales person (TSP) problem using JAVA programming.
- Choose the Backtracking techniques to solve Sum of subset problem and Hamiltonian cycles using JAVA programming.

Conduct of Practical Examination:

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

MICROCONTROLLER AND EMBEDDED SYSTEMS LABORATORY
SEMESTER – IV

Course Code	**18CSL48**	**CIE Marks**	40
Number of Contact Hours/Week	0:2:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03

Credits – 2

Programs List:

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

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

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

9.	Display “Hello World” message using Internal UART.
10.	Interface and Control a DC Motor.
11.	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
12.	Determine Digital output for a given Analog input using Internal ADC of ARM controller.
13.	Interface a DAC and generate Triangular and Square waveforms.
14.	Interface a 4x4 keyboard and display the key code on an LCD.
15.	Demonstrate the use of an external interrupt to toggle an LED On/Off.
16.	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between

Laboratory Outcomes: The student should be able to:

- Demonstrate different instructions of ARM7/TDMI/LPC2148 using Keil µvision-4 tool/compiler.
- Apply the knowledge of assembly language programming to solve problems using ARM7/TDMI/LPC2148 instruction set.
- Illustrate various ports, configuration registers of 32 bit microcontroller ARM7/TDMI/LPC2148.
- Illustrate various input/output devices to interface with ARM7/TDMI/LPC2148 evaluation board.
- Demonstrate interfacing of various hardware devices using embedded C and evaluation board ARM7/TDMI/LPC2148.

Conduct of Practical Examination:

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Courseed to change in accoradance with university regulations)*

g) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 =

100 Marks

h) For laboratories having PART A and PART B
   i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
   ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks