ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
Tel: 040-27098811.04027070471 (Direct).Fax:04027073346
Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

SCHEME OF INSTRUCTION AND EVALUATION
SEMESTER-I

Subjects.	Code	Paper	Paper Title	THPW	Theory	T*/Pr	IA	ESE	Total Marks	Credits
1.Core	MCS 401	I	Abstract Algebra	6	5	1	30	70	100	5
2.Core	MCS 402	II	Mathematical Analysis	6	5	1	30	70	100	5
3.Core	MCS 403	III	Differential Equations	5	4	1	30	70	100	4
4.Core	MCS 404	IV	Operating Systems	4	4		30	70	100	4
5.Core	MCS 405	V	Programming in JAVA	4	4		30	70	100	4
6.Lab-1	MCS 434	Lab-1	Operating Systems Lab	-	--	2	....	25	25	1
7.LAb-2	MCS 435	Lab-2	Programming in JAVA Lab	-	--	2	....	25	25	1
			Total:	32			150	400	550	24

T* -Tutorial Class for Problem Solving Session.

THPW - Teaching Hours per week

IA- Internal Assessment (IA Test 30 Marks) = Two Internal Assessments of 15 Marks Each

ESE- End Semester Examination of duration - 3 hours for 70 Marks

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Technological University

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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SCHEME OF INSTRUCTION AND EVALUATION
SEMESTER - II

Subjects.	Code	Paper	Paper Title	THPW	Theory	T*/Pr	IA	ESE	Total Marks	Credits
1.Core	MCS 401	I	Linear Algebra	6	5	1	30	70	100	5
2.Core	MCS 402	II	Complex Analysis	6	5	1	30	70	100	5
3.Core	MCS 403	III	Discrete Mathematics	5	4	1	30	70	100	4
4.Core	MCS 404	IV	Computer Networks	4	4		30	70	100	4
5.Core	MCS 404	V	Programming in Python	4	4		30	70	100	4
6.Lab-1	MCS 434	Lab-1	Computer Networks Lab-1	-	--	2	....	25	25	1
7.LAb-2	MCS 435	Lab-2	Programming in Python Lab-2	-	--	2	....	25	25	1
			Total:	32			150	400	550	24

T* -Tutorial Class for Problem Solving Session.

THPW - Teaching Hours per week

IA- Internal Assessment (IA Test 30 Marks) = Two Internal Assessments of 15 Marks Each

ESE- End Semester Examination of duration - 3 hours for 70 Marks

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Semester I

Subject Code: MCS 401	
No. of credits	**5**
Instructional hours	**5+ 1 T* hrs/w**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 + 70)**

Paper-I: Abstract Algebra

Course Objectives: The course aims to:

1. Introduce students to the fundamental concepts of abstract algebra, including groups, rings, and fields.
2. Develop a deep understanding of structural properties of algebraic systems such as solvable groups, nilpotent groups, and finite abelian groups. 3. Familiarize students with advanced topics like ideals, homomorphisms, unique factorization domains, principal ideal domains and Euclidean domains.
4. Train students in logical reasoning, theorem proving and abstract thinking through the study of group theory and ring theory
5. Provide a strong foundation for research and application of algebra in mathematics and allied fields such as computer science, cryptography and coding theory.

Course Outcomes: After successful completion of this course, students will be able to:

1. Understand and apply the concepts of automorphisms, conjugacy, solvable and nilpotent groups.
2. Analyze group structures using direct products, Sylow's theorems, and classification of finite abelian groups.
3. Demonstrate proficiency in working with ideals, homomorphisms, maximal and prime ideals, and Zorn's lemma in algebraic settings.
4. Explore ring theory by studying unique factorization domains, principal ideal domains, Euclidean domains, and polynomial rings over UFDs.
5. Apply abstract algebraic methods to solve problems in advanced mathematics, and theoretical Computer science.

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Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
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Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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Unit-I
Automorphisms - Conjugacy and G - sets - Normal series Solvable groups - Nilpotent groups. **(Pages 104 to 128 of [1])**

Unit-II
Structure theorems of groups: Direct product - Finitely generated abelian groups - Invariants of a finite abelian group - Sylow's theorems - Groups of orders p2, pq . **(Pages 138 to 155)**

Unit-III
Ideals and homomorphism's - Sum and direct sum of ideals, Maximal and prime ideals - Nilpotent and nil ideals - Zorn's lemma **(Pages 179 to 211).**

Unit-IV
Unique factorization domains - Principal ideal domains - Euclidean domains - Polynomial rings over UFD -Rings of Fractions.**(Pages 212 to 228)**

Text Book:
Basic Abstract Algebra by P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul.

References:
[1] Topics in Algebra by I.N. Herstein.
[2] Elements of Modern Algebra by Gilbert & Gilbert.
[3] Abstract Algebra by Jeffrey Bergen.
[4] Basic Abstract Algebra by Robert B Ash.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
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Dr. N. KISHAN
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Osmania University, Hyd-07.

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Semester -I

Subject Code: MCS 402	
No. of credits	**5**
Instructional hours	**5+ 1 T* hrs/w**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 + 70)**

Paper-II: Mathematical Analysis

Course Objectives:

1. Understand the fundamental concepts of metric spaces, including compactness, connectedness, and perfect sets.
2. Develop a conceptual understanding of continuity, limits, and properties of continuous and monotonic functions.
3. Apply the theory of the Riemann-Stieltjes integral to real and vector-valued functions.
4. Analyze the convergence of sequences and series of functions and explore their impact on integration and differentiation,

Course Outcomes:

1. Describe and classify metric space structures.
2. Explain and examine the role of continuity and discontinuity in function behavior across different topological structures.
3. Compute the Riemann-Stieltjes integral and apply it to practical examples involving rectifiable curves and vector functions.
4. Evaluate the uniform convergence of sequence of functions and apply the Stone-Weierstrass theorem and contraction principle in problem-solving.

Dr. M.A. SRINIVAS
Professor & Head
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Jawaharlal Nehru Technological University
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Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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Unit-I
Basic Topology: Metric spaces - Compact sets - Perfect sets - Connected sets. **(Page Nos 24-46)**

Unit-II
Continuity : Limits of functions - Continuous functions - Continuity and compactness, Continuity and connectedness -Discontinuities - Monotone functions, **(Pages 83 to 102)**

Unit-III
The Riemann - Steiltjes integral: Definition and Existence of the Integral - Properties of the integral, Integration of vector valued functions - Rectifiable curves.**(Pages 120 to 133 and 135 to 142)**

Unit-IV
Sequences and series of functions: Discussion of main problem, Uniform convergence - Uniform convergence and continuity - Uniform convergence and integration - Uniform convergence and differentiation, The stone weierstrass Theorem, the contraction Principle **(pages 143 - 154, 159-161, 165 - 166 and 220 - 221)**

Text Book:
[1] Principles of Mathematical Analysis, (3rd Edition) By Walter Rudin, Mc Graw - Hill International Edition.

References:
[1] The Real Numbers by John Stillwel.
[2] Real Analysis by Barry Simon
[3] Mathematical Analysis Vol - I by D J H Garling.
[4] Measure and Integral by Richard L.Wheeden and Anton

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
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Osmania University, Hyd-07.

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SEMESTER-I

Subject Code: MCS 403	
No. of credits	**5**
Instructional hours	**5+ 1 T* hrs/w**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 + 70)**

Paper-III: Differential Equations

Course Objectives

1. To understand the existence and uniqueness of solutions and power series methods for solving ordinary differential equations.
2. To study the properties and applications of special functions such as Legendre's and Bessel's functions. solving first-order non-linear and higher-order linear partial differential equations.
3. To introduce methods for 4. To learn techniques for solving second-order PDEs with variable coefficients, including the separation of variables method.

Course Outcomes: After successful completion of this course, students will be able to

1. Use Picard's method of successive approximations and the Frobenius method for finding series solutions to ODES
2. Apply the properties, recurrence relations, and generating functions of Legendre and Bessel polynomials.
3. solve non-linear PDEs using Charpit's and Cauchy's methods of characteristics.
4. classify any second-order PDE, then convert it into its canonical form and use the separation of variables method to solve the heat, wave, and Laplace equations.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University

Dr. N. KISHAN
M.Sc. Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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Unit- I

Existence and Uniqueness of Solution: Power series solution of ODE : Picard's method of successive approximations - Picard's theorem. Ordinary and singular points - Series solution about an ordinary point - Series solution about singular point - Frobenius method.

Unit- II

Legendre's and Bessel's Functions, Boundary Value Problems : Lengendre's equation and its solution - Lengendre's function of the first kind and its properties - Generating function - Orthogonal properties - Recurrence relations - Laplace's definite integrals for $P_n(x)$, Rodrigue's formula.

Bessel's Functions: Bessel's equation and its solution – Bessel's function of the first kind and its properties – Recurrence relations - Generating function- Orthogonality.

Boundary Value Problems: Sturm – Liouville problem.

Unit- III

Non-Linear PDE of Order One:Charpit's method-Cauchy's method of characteristics for solving nonlinear partial differential equations -Higher order linear partial differential equations with constant coefficients.

Unit- IV

Partial Differential Equations of order two with variable coefficients - Canonical forms - Classification of second order partial differential equations - Separation of variables method of solving the one dimensional heat equation, wave equation and Laplace equation.

Text Book:

Ordinary and Partial Differential Equations by M.D. Raisingania, S. Chand Company Ltd., NewDelhi, 19th edition.

References:

1. Differential Equations with Application and Historical Notes by George F Simmons 2nd edition, Tata Mc.Graw-Hill Edition.
2. Textbook of Ordinary Differential Equations by S.G.Deo, V.LakshmiKantham, V.Raghavendra, TataMc.Graw Hill Pub. Company Ltd.
3. Elements of Partial Differential Equations by Ian Sneddon, Mc.Graw-Hill International Edition.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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SEMESTER -I

Subject Code: MCS 404	
No. of credits	**4**
Instructional hours	**4 hrs/wk**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**3 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 +70)**

Paper IV: Operating System

Course Objectives: The Course aims to

1. To introduce the principles, functions, and architecture of modern operating systems.
2. To develop an understanding of process management, memory management, file systems, and device management.
3. To expose students to concurrency, synchronization, and deadlock handling techniques.
4. To provide insights into advanced OS concepts such as distributed systems, virtualization, and security.

Course Outcomes: After successful completion of this course, students will be able to

1. Explain the structure, services, and functions of modern operating systems.
2. Analyze process scheduling, synchronization, and deadlock handling techniques.
3. Evaluate memory management, file systems, and storage strategies.
4. Demonstrate understanding of advanced OS concepts including distributed systems, virtualization, and security.

Unit – I Introduction to Operating Systems and Process Management, Operating System Fundamentals: Objectives, Functions, Services and Types of OS(Batch, Multi programming, Multitasking, real-time, distributed).
System Structure: OS Components, System Calls, Architecture (Monolithic), Layered, Micro Kernel, Modular).
Process Management: Process States, PCB, Scheduling (FCFS, SJF, Priority, Round Robin, Multilevel Queue), Threads (User-level and Kernel- Level) **Page Nos 4 - 74, 81- 91, 105 - 115.**

Unit – II Interprocess Communication, Synchronization and Deadlocks, Interprocess Communication : Message Passing, Shared Memory, Sockets. Synchronization: Critical Section Problem. Semaphores, Monitor, Classical Problems(Producer - Consumer, Readers-Writers, Dining, Philosophers) Deadlocks: Necessary Conditions, Prevention, Avoidance(Bankers Algorithm), Detection and Recovery Strategies. **Page Nos: 123-149, 199-217, 257-316, P35-P44,** 317-343)

Dr. M.A. SRINIVAS
Professor & Head

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
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Unit – III Memory Management: Allocation Strategies, Paging, Segmentation, Virtual Memory, Page Replacement Algorithms (FIFO, LRU, Optimal, LFU), Thrashing and Working Set Model.
File Systems: Organization, Access Methods, Directory Structures, Allocation Methods, Free-Space Management.Secondary Storage: Disk Structure, Disk Scheduling(FCFS, SSTF SCAN, C-SCAN, LOOK, C-LOOK).(Page Nos:349-383, 389-440, 456-463)

Unit – IV
Security and Protection: Goals, Access Control, Authentication, Threats, Encryption. **Distributed Operating Systems**: Features, Models, Distributed File Systems (Google FS, HDFS). Cloud-based OS: Virtualization Concepts, VMs vs.Containers, Resource Management. Case Studies: Linux Internals, Windows Architecture Overview, Android OS.
(Page Nos: 621 - 690, 733-767, 775-884)

Text Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts Wiley (10e)

References
1. Andrew S. Tanenbaum, Modern Operating Systems
2. William Stallings, Operating Systems – Internals and Design Principles
3. D M. Dhandhere, Operating Systems-A Concept Based Approach Mc Grawhill.
4. Remzi H.Arpaci-Dusseau, Andrea C.Arpaci-Dusseau, operating Systems: Three Easy Pieces (OSTEP), Arpaci-Dusseau Books.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

SEMESTER -I

Subject Code: MCS 434	
No. of credits	**1**
Instructional hours	**2 hrs/wk**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**25 marks**
Max.marks	**25**

Paper-IV: Operating Systems Lab

Course Objectives: The Course aims to

1. To provide hands-on experience with basic operating system functionalities.
2. To enable students to implement CPU scheduling, memory management, file management, and disk scheduling algorithms.
3. To develop skills in process synchronization and inter-process communication.
4. To strengthen practical knowledge of Linux system calls, shell scripting, and OS concepts through simulation.

Course Outcomes: After successful completion of this course, students will be able to

1. Apply Linux shell scripting for automation of system-level tasks.
2. Simulate and analyze CPU scheduling, memory allocation, and page replacement algorithms.
3. Implement inter-process communication and synchronization mechanisms using semaphores, monitors, and shared memories.
4. Design and develop a simple operating system simulator integrating multiple OS functionalities.

List of Programs:

1. Write a shell script to display system information (date, time, user details, memory, and disk usage).
2. Write a shell script to implement basic file operations: create, copy, delete, and search.
3. Write a C program to simulate First-Come-First-Serve (FCFS) CPU Scheduling Algorithm.
4. Write a C program to simulate Shortest Job First (SJF) CPU Scheduling Algorithm (non-preemptive and preemptive).
5. Write a C program to simulate Priority Scheduling Algorithm.
6. Write a C program to simulate Round Robin Scheduling Algorithm.
7. Write a C program to simulate Producer-Consumer problems using semaphores.
8. Write a C program to implement the Dining Philosophers problem using semaphores/monitors.
9. Write a C program to simulate Readers-Writers problem.
10. Write a C program to implement Inter-process communication using shared memory/message queues.
12. Write a C program to simulate First Fit, Best Fit, and Worst Fit memory allocation strategies.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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ARTS & SCIENCE COLLEGE FOR WOMEN
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13. Write a C program to simulate Paging Technique of Memory Management.
14. Write a C program to simulate Page Replacement Algorithms: FIFO, LRU, and Optimal.
Linked.
15. Write a C program to simulate File Allocation Strategies: Sequential, Indexed, and

SCAN, LOOK.
16. Write a C program to simulate Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-

17. Mini Project: Develop a simple OS Simulator integrating process scheduling, memory management, and file system modules.

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Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
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Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

SEMESTER - I

Subject Code: MCS 405	
No. of credits	**4**
Instructional hours	**4 hrs/wk**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**3 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 +70)**

Paper –V: programming in java

Course Objectives:
1. Understand Web Application and Enterprise Application Development.
2. Learn Database Integration, Web Services Development.
3. Understand building Real-World Applications.

Course Outcomes: After successful completion of this course, students will be able to
1. Identify the syntax and semantics of Java programming concepts.
2. Write programs using classes, objects, inheritance, encapsulation and polymorphism.
3. Apply the concepts of multithreading, exception handling mechanisms to develop efficient Program.
4. Design event driven GUI using APPLET, AWT and Swing Components.
5. Discuss the RMI Architecture and Design Application using RMI Interfaces and classes.
6. Describe JDBC and Hibernate to provide a program level interface for communicating with database

Unit- I

Java Programming- Fundamentals: History of Java, comments. Data typ types, Variables. Constants. Scope and Lifetime of variables. Operators. Type conversion and casting. Enumerated types. Control flow: block scope. conditional statements, loops, break and continue statements, arrays, simple java standalone programs, class, object and its methods. constructors and its types methods, static fields and methods, access control, this reference. overloading methods and constructors, recursion, garbage collection, exploring string class. Inheritance - Inheritance types, super keyword, preventing inheritance: final classes and methods. Polymorphism - method overloading and overriding, abstract classes and methods. Interfaces- Interfaces Vs Abstract classes, defining an interface, implementing interfaces. accessing implementations through

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Department of Mathematics
Osmania University, Hyd-07.

interface references, extending interface. Packages- Defining, creating and accessing a package, importing packages.**(TextBook1 - Page Nos: 3-202)**

Unit- II

Exception handling- Define Exception, advantages of exception handling, the classitication of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of trs catch, throw, throws and finally, creating own exception sub classes. Multithreading -Define Thread, multithreading, thread life cycle, creating threads interrupting threads, thread priorities, synchronizing threads, inter-thread communication. Deadlock. Files- Streams-Byte streams, Character streams. Text input output. Binary input/output, random access file operations, File management using File class **(TextBook2 - Page Nos: 26-62, 247-254)**

Unit-III

GUI Programming with Java- The AWT class hierarchy, Introduction to Swing. Swing VSAWT. Hierarchy for Swing components, Containers - Jframe, JApplet, JDialog, JPanel, Overview of some Swing components - Jbutton, JLabel, JTextField, JTextArea, simple Swing applications, Layout management - Layout manager types - border, grid and flow. Event Handling- Events, Event sources. Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, Examples: Handling a button cli Handling Mouse events, Adapter classes. Remote Method Invocation (RMI): Introduction. Remote Method Invocation, Java RMI Interfaces and Classes, an Application, Compiling the Program, Generating Stub Classes, Running the Program, Callback with an Application. **(TextBook2 - Page Nos: 182-210, 348 -372)**

Unit- IV

Servlet - Server -Side Java, Servlet Alternatives, Servlet Strengths, Servlet Architecture, Servlet Life Cycle, GenericServlet, HttpServlet, Servlet Example, Passing Parameters to Servlets, Retrieving Parameters, Cookies, Filters.

Java Database Connectivity (JDBC) - Introduction, JDBC Drivers, JDBC Architecture, JDBC Classes and Interfaces, Loading a Driver, Making a Connection, Execute SQL Statement, SOL Statements, Retrieving Result, Getting Database Information, Scrollable and Updatable Resultset, Result Set Metadata.

Hibernate Introduction, Writing POJO Class, Creating a Table, Writing a Hibernate Application, Compiling and Running Application, Book Application Using Annotation, Object Life Cycle, HQL, Using Native SQL Query, Named Queries, Generating DDL, Generator Class, Hibernate Tools.

(Text Book2 - Page Nos: 557-575, 625-647, 657-685)

Dr. M.A. SRINIVAS
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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Text Book:

1. Java Complete Reference by Herbertt Schildt. (7e) 2. Advanced Java programming by Uttam K. Roy.

References:

1. Core Java Vol. II - Advanced Features by Cay S. Horstmans, Gray Coronell. 2. Java EE 7 for Beginners by Sharanam Shah, Vaishali Shah.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
Tel: 040-27098811.04027070471 (Direct).Fax:04027073346
Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

SEMESTER - I

Subject Code: MCS 435	
No. of credits	**1**
Instructional hours	**2 hrs/wk**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**25 marks**
Max.marks	

PAPER-VI Programming in Java Lab

Course Objectives: The Course aims to

1. To write programs using abstract classes.
2. To write programs for solving real world problems using java collection frame work.
3. To write multithreaded programs.
4. To write GUI programs using swing controls in Java.
5. To introduce java compiler and eclipse platform.
6. To impart hands-on experience with java programming.
7. To Write Java Advanced Programs.

Course Outcomes: After successful completion of this course, students will be able to

1. Discuss OOP concepts and basics of Java programming.
2. Apply OOP and Java programming in problem solving.
3. Develop applications on files, exceptions, threads and applets.
4. Create different programs using packages.
5. Construct GUI based applications using AWT/Swing Components.
6. Evaluate inheritance using Java.
7. Design Interactive applications using RMI, Servlets and Hibernate technologies.

List of Programs

1. a. Write a program to check whether a number is Armstrong or not
   b. Write Program to demonstrate Class and Constructors in Java

2. a. Write a Program to perform Method Overloading.
   b. Write a program to show the concept of Inheritance.

3. a. Write a program to show various string operations.
   b. Write a Program to demonstrate the interface in java

4. Write a program to show the concept of packages

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
...Technological University

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ARTS & SCIENCE COLLEGE FOR WOMEN
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5. Write a Java Program for creating threads using thread class

6. Write a Java Program illustrating thread priority and yield method

7. Write a program to show the concept of Applets.

8. Write a Program to demonstrate Exception Handling

9. Create GUI to present a set of choices for a user to select stationary products and display the price of
Product after selection from the list.

10. Create GUI to demonstrate typical Editable Table which describing Employee for a software company.

11. Create GUI to demonstrate swing components using student registration form.

12. Create a Remote Object for simple arithmetic operators. Use AWT/SWING to create user interface.

13. Write an RMI application using call back mechanism

14. Develop Servlet Question-Answer Application using Http Servlet Request and Http Servlet Request
interfaces.

15. Develop Servlet application to accept HTNO of a student from client and display the memorandum of
marks from the serverDatabase.

16. Develop a Hibernate application to Store Feedback of Web site Visitors in MySQL

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Professor & Head
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College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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ARTS & SCIENCE COLLEGE FOR WOMEN
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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Semester II

Subject Code: MCS 451	
No. of credits	**5**
Instructional hours	**5+ 1 T* hrs/w**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 + 70)**

Paper- I: Linear Algebra

Course Objectives:

1. To introduce the notions of diagonalizability of a linear operator.
2. To study relation between projections and invariance of subspaces.
3. To deduce the cyclic decomposition for a finite dimensional vector space.
4. To understand the rational canonical form, Jordan canonical forms of matrices.
5. To determine the nature of quadratic forms and real symmetric, skew-symmetric matrices with the aid
   Of bilincar forms.

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

1. Characterize the linear operators which are diagonalizable.
2. Express linear operator as a sum of diagonalizable and nilpotent linear operators.
3. Write similarity classes of matrices with the aid of rational canonical form and Jordan canonical forms.
4. Determine those matrices which are diagonalizable and these matrices which possess block diagonal
   Representation.

Unit-I

Elementary Canonical forms Introduction, Characteristic Values, Annihilating Polynomials, Invariant Subspaces, Simultaneous Triangulation and Simultaneous Diagonalization **(Ch6, Sec 6.1 - 6.5).**

Dr. M.A. SRINIVAS
Professor & Head
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College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

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M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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Unit-II

Direct sum Decomposition, Invariant Direct sums, The Primary Decomposition Theorem (Ch6, Sec6.6 - 6.8).The Rational and Jordan Forms: Cyclic Subspaces and Annihilators **(Ch7, Sec 7.1)**

Unit-III

Cyclic Decompositions and the Rational Form, the Jordan Form, Computation of Invariant Factors, Semi Simple Operators **(Ch7, Sec 7.2 - 7.5)**

Unit-IV

Bilinear Forms: Bilinear Forms, Symmetric Bilinear Forms, Skew - Symmetric Bilinear Forms, Groups Pre-serving Bilinear Forms **(Ch10, Sec 10.1 - 10.4)**

Text Book:

[1] Linear Algebra by Kenneth Hoffman and Ray Kunze (2e) PHI

References:

[1] Advanced Linear Algebra by Steven Roman (3e)
[2] Linear Algebra by David C Lay
[3] Linear Algebra by Kuldeep Singh

Dr. M.A. Sh[illegible]VAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University,
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Semester II

Subject Code: MCS 452	
No. of credits	**5**
Instructional hours	**5+ 1 T* hrs/w**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 + 70)**

Paper-II Complex Analysis

Course Objectives:

1. Understand and Analyze Analytic Functions and Mappings in the Complex Plane Develop a foundational understanding of complex functions, including limits, continuity, differentiability, the Cauchy-Riemann equations, and mappings (e.g., exponential mappings), with the ability to identify and work with analytic and harmonic functions.
2. Apply Integral Theorems and Series Expansions in Complex Analysis. Gain proficiency in evaluating contour integrals, understanding Cauchy's Theorems (Cauchy-Goursat and Cauchy Integral Formula), and applying series representations such as Taylor and Laurent series for complex functions.
3. Identify Singularities and Evaluate Residues for Complex Integrals. Analyze isolated singular points and compute residues, including those at infinity. Apply residue theory and techniques such as Jordan's Lemma and indented paths to evaluate improper integrals, particularly those relevant in Fourier analysis.
4. Utilize Conformal and Linear Fractional Mappings for Function Visualization. Explore and apply advanced mapping techniques such as linear fractional transformations and conformal mappings to visualize and transform regions in the complex plane, including applications of Rouche's Theorem and the Argument Principle.

Course Outcomes:

1. Demonstrate understanding of complex functions and their analytic properties Students will be able to analyze functions of a complex variable, apply the Cauchy-Riemann equations, and determine the conditions for differentiability and analyticity in various regions of the complex plane.
2. Evaluate contour integrals and apply major theorems in complex integration. Students will gain the ability to compute contour integrals, understand and apply the Cauchy-Goursat

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Hyderabad-500 085.

Dr. N. KISHAN
M.Sc. Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

Theorem and Cauchy Integral Formula, and use these results to derive key properties of analytic functions.

3. Classify singularities and compute residues to evaluate complex integrals. Students will be able to identify isolated singular points, compute residues at poles and infinity, and apply the Residue Theorem to evaluate improper and definite integrals, including those arising in Fourier analysis.
4. Apply conformal mappings and transformation techniques in complex analysis. Students will develop the skill to use linear fractional transformations, conformal mappings, and principles such as Rouche's Theorem and the Argument Principle to study function behavior and perform geometric transformations in the complex plane

Unit-1

Regions in the Complex Plane Analytic Functions: Functions of a Complex Variable Mappings Mappings by the Exponential Function Limits-Theorems on limits Limits Involving the Point at Infinity Continuity - Derivatives - Differentiation Formulas-Cauchy -Riemann Equations Sufficient Conditions for Differentiability Polar Coordinates Analytic Functions Examples Harmonic Functions Uniquely Determined Analytic Functions - Reflection Principle.

Unit-II

Integrals: Derivatives of Functions w(t) - Definite Integrals of Functions w(t) - Contours - Contour Integrals - Some Examples- Examples with Branch Cuts - Upper Bounds for Moduli of Contour Integrals - Antiderivatives - Proof of The Theorem - Cauchy-Goursat Theorem -Proof of the Theorem - Simply Connected Domains - Multiply Connected Domains - Cauchy Integral Formula - An Extension of the Cauchy Integral Formula - Some Consequences of the Extension - Liouville's Theorem and Fundamental Theorem of Algebra - Maximum Modulus Principle - Series: Convergence of Sequences - Convergence of Series - Taylor Series - Proof of Taylor's Theorem - Examples - Laurent Series - Proof of Laurent's Theorem - Examples

Unit-III

Residues and Poles: Isolated Singular Points Residues Cauchy's Residue Theorem Residue at Infinity The Three Types of Isolated Singular Points - Residues at Poles Examples Zeros of Analytic Functions- Behaviour of Analytic Functions near Isolated Singular Points - Applications of Residues: Evaluations of Improper Integrals- Examples -Improper Integrals From Fourier Analysis Jordan's Lemma Indented Paths Definite Integrals Involving Sines and Cosines -

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
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Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
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Unit-IV

Argument Principle Rouche's Theorem- Examples Mappings by Elementary Functions: Linear Transformations- The transformation w 1/2- Mappings by 1/2 - Linear Fractional Transformations An Implicit Form Mapping of The Upper Half Plane Transformation w = sinz- Mappings by z^2- Conformal Mapping: Preservation of Angle -Scale Factors.

Text Book:

[1] Complex Variables with applications by James Ward Brown, Ruel V Churchill.

References:

[1] Complex Analysis by Dennis G.Zill.
[2] Complex Variables by Stevan G. Krantz.
[3] Complex Variables with Applications by S.Ponnusamy, Herb Silverman.
[4] Complex Analysis by Joseph Bak, Donald J. Newman.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

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ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Semester II

Subject Code: MCS 453	
No. of credits	**5**
Instructional hours	**5+ 1 T* hrs/w**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 + 70)**

Paper - III: Discrete Mathematics

Course Objectives:

1. Understand the foundational principles of logic, proofs, and Boolean algebra essential for mathematical reasoning.
2. Apply combinatorial techniques and counting principles to solve complex enumeration problems.
3. Analyze and solve recurrence relations using generating functions and characteristic roots.
4. Explore graph theory concepts including connectivity, traversal algorithms, and shortest path problems.
5. Develop algorithmic thinking through the study of trees, spanning trees, and optimization techniques like Prim's and Kruskal's algorithms.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Demonstrate proficiency in propositional and predicate logic, including constructing valid arguments and applying inference rules.
2. Solve combinatorial problems using permutations, combinations, and the principle of inclusion-exclusion.
3. Formulate and solve recurrence relations using various methods including generating functions and substitution.
4. Apply graph theory to model real-world problems and implement algorithms for graph traversal and shortest path determination.
5. Utilize tree structures and spanning tree algorithms to optimize network design and data organization.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
Tel: 040-27098811.04027070471 (Direct).Fax:04027073346
Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Unit-I

Mathematical Logic: propositional logic, propositional equivalences, predicates & quantifiers, rule of inference, direct proofs, proof by contraposition, proof by contradiction. Boolean algebra: Boolean functions and its representation, logic gates, minimizations of circuits by using Boolean identities and K - map.

Unit-II

Basic Structures: Sets representations, set operations, functions, sequences and summations. Division algorithm, modular arithmetic, solving congruence's, applications of congruence's. Recursion: Proofs by mathematical induction, recursive definitions, structural induction, generalized induction, recursive algorithms.

Unit-III

Counting: Basic counting principle, include combinations, Binomial coefficient and identities, generalized permutations and combinations, Binomial coefficient and identities, generalized permutations and combinations. Recurrence Relations: introduction, solving linear recurrence relations, generating functions, principle of inclusion - exclusion, applications of inclusion - exclusion. Relations: relations and their properties, representing relations, closures of related partial orderings. Ions, equivalence relation

Unit-IV

Graphs: Graphs definitions, graph terminology, types of graphs, representing graphs, graph isomorphism, connectivity of graphs, Euler and Hamilton paths and circuits, Dijkstras algorithm to and shortest path, planar graphs Euler's formula and its applications, graph coloring and its applications Trees: Trees definitions properties of trees, applications of trees BST, Ha_man Coding, tree traversals: pre - order, in - order, post - order, prefix, infix, postfix notations, spanning tress DFS, BFS, Prim's, Kruskals algorithms.

Text Book:

[1]Discrete Mathematics and its Applications (7e) by Kenneth H. Rosen.

References:

[1] Discrete and Combinatorial Mathematics by Ralph P. Grimaldi
[2] Discrete Mathematics for Computer Scientists by Stein, Drysdale, Bogart.
[3] Mathematical Analysis Vol - I by D J H Garling.[4] Discrete Mathematics for Computer Scientists and Mathematicians by Joe L. Mott, Abraham Kandel, Theoder P. Baker.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc. Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
Tel: 040-27098811.04027070471 (Direct).Fax:04027073346
Email: amsascw1968@gmail.com, ascwams@yahoo.co.in, Website: amsascw.org

Semester II

Subject Code: MCS 454	
No. of credits	**4**
Instructional hours	**4 hrs/wk**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**3 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 +70)**

Paper-IV: Computer Networks

Course Objectives: The Course aims to
1. Make understand the Computer Network Types, different Communication Protocols.
2. Understand different Networking Devices.
3. Impart Knowledge on Socket Programming.
4. Gain knowledge on the functions of different layers in OSI/TCP models.

Course Outcomes: After successful completion of this course, students will be able to
1. Describe basic computer network technology.
2. Explain different types of networks, OSI and TCP/IP reference models.
3. Identify the design issues, perform error detection and correction.
4. Understand the router architecture, IP and routing algorithms.
5. Analyze the various protocols used in respective layers of OSI reference model.
6. Understand the transport layer services, TCP and UDP protocols.
7. Understand the principles of the application layer protocols HTTP, FTP, SMTP and DNS.

Unit I

Computer Networks Fundamentals: Overview, Network Hardware, Network Software, Reference models{OSI Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Model, Example Net-works, Network Standardization. **Physical Layer**: Guided Transmission Media, Wireless Transmission, Multiplexing, Switching. **Data Link Layer**: Design Issues, Error Detection and Correction, Data Link Layer Protocols, Sliding Window Protocol

Unit II

Multiple Access Sublayer: ALOHA, CSMA, Collision Free Protocols, Ethernet, Wireless LAN-802.11, Data Link Layer Switching{Repeaters, Hubs, Bridges, Switches, Routers, Gateways.**Network Layer**: Design Issues, Routing Algorithms { Shortest path, Flooding, Distance Vector Routing, Link state Routing, Hierarchical, Broadcast Routing, Multi cast Routing; Congestion Control Algorithms.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
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Unit III

Internetworking: Tunneling, Internetwork Routing, Fragmentation, IPv4 Vs IPv6Protocol, IP Addresses,CIDR,Internet Control Protocols{IMCP, ARP, RARP, DHCP.**Transport Layer**: Services provided to the upper layers, Transport Protocols, Overview of Congestion Control.

Unit-IV

The Internet Transport Protocols: Introduction to UDP&RPC, Real Time Transport Protocols, The Inter-net Transport Protocols{TCP, TCP Service Model, TCP protocol, TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modeling TCP Connection Management, TCP Sliding Window,TCPTime Management, TCP Congestion Control. **Application Layer**: DNS, TELNET, E-Mail, FTP, HTTP, SSH, Overview of WWW.

Text Book: Computer AndrewS.Tanenbaum, David J Wetherall,Networks(5e)

References:

[1] S S Shinde, Computer Network.
[2] William Stallings, Data and Computer Communications.
[3] Behrouz A. Forouzan,Data Communication and Networking.
[4] James F Kurose, Keith W Ross, Computer Networking { A Top-Down Approach.
[5] Behrouz A Forouzan, Firouz Mosharraf, Computer Networks A Top-Down Approach

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Kukatpally, Hyderabad-500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
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Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Semester II

Subject Code: MCS 484	
No. of credits	**1**
Instructional hours	**2 hrs/wk**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**25 marks**
Max.marks	**25**

Paper-V: Computer Networks Lab

Course Objectives: The Course aims to

1. To understand the working principle of various communication protocols.
2. To analyze the various routing algorithms.
3. To know the concept of data transfer between nodes

Course Outcomes: After successful completion of this course, students will be able to

1. Basic Networking programs to find category of IP address and Analyze various Congestion control mechanisms.
2. Demonstrate the Sockets creation, socket program using TCP & UDP
3. Develop simple applications using TCP & UDP
4. Develop the various Routing protocols

List of Programs:

1. Program to identify the category of the IP address for the given IP address
2. Program to implement sliding window protocol
3. Program for Socket pair system call usage in IPC
4. Program for Socket options using signals
5. Program to implement Echo concurrent Stream Server

Dr. M.A. SRIHIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07

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6. Program to implement Echo concurrent stream client
7. Program to implement Listener and Talker
8. Program to implement TCP time service
9. Program to implement UDP time service
10. Program to implement Ping service
11. Program to implement Route tracing program
12. Program to implement File Transfer Protocol
13. Program to implement any Shortest path routing Algorithm
14. Program to implement Distance Vector Routing Implementation
15. Program to implement ICMP Error Message simulations
16. Program to implement Reverse Address Resolution Protocol

Dr. M.A. SRINIVAS
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Department of Mathematics
College of Engineering
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Semester II

Subject Code: MCS 455	
No. of credits	**4**
Instructional hours	**4 hrs/wk**
Duration of Internal Assessment	**1 hr**
Marks for Internal Assessment	**30 marks**
Duration of Semester Examination	**3 Hrs**
Marks for Semester Examination	**70 marks**
Max.marks	**100(30 +70)**

Paper--VI: Programming in Python

Course objectives: The Course aims to

1. Choose modern computing tools, skills and techniques necessary for innovative software solutions

2. Relate practical skills to provide solutions to industry, society and business.

3. Enumerate the creative ideas with the emerging technologies in real time applications.

4. Interpret complex business scenarios and contemporary issues in emerging technologies.

5. Classify the computing systems through quantitative and qualitative technique.

6. Associate techniques necessary for innovative software solutions.

Course Outcomes: After successful completion of this course, students will be able to

1. Explore Python language fundamentals, including basic syntax, variables, types,

2. Control statements and functions.

4. Apply python functions along with Python data structures - lists, tuples, dictionaries.

3. Illustrate function, Random Numbers and Modules.

5. Apply input/output with files and Illustrate OOPs concepts in python.

6. Illustrate GUI Programming using tkinter Module.

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Unit- I

Introduction to Python Programming: How a Program Works, Using Python, Why Python, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations (Operators. Type conversions, Expressions), More about Data Output, Indentation.Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

Unit- II

Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value -Returning Functions-Generating Random Numbers, Writing Our Own ValueReturning Functions. Modules-Importing module, creating and exploring modules: math module, Numpy module, time module,random module, OS,calendar,sys.,Storing Functions in Modules.

Unit- III

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples. **Strings**: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms. **File and Exceptions**: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions.

Unit- IV

OOPs Concept: Introduction to OOP, Classes and objects, Inheritance Method overloading and method overriding,Abstract method and Abstract class, Interfaces in python,Abstract class VS Interfaces,constructor,instance methods ,class methods, static methods. GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Text Book: Starting Out With Python by Tony Gaddis. (4e)

References:

1. Fundamentals of Python by Kenneth A. Lambert.
2. Foundations for Analytics with Python by Clinton W. Brownley.
3. Beginning Python using Python 2.6 and Python 3 by James Payne.
4. Introduction to Computer Science using Python by Charles Dierach.
5. Practical Programming: An Introduction to Computer Science using Python 3 by Paul Gries.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Nehru Technological University
500 085.

Dr. N. KISHAN
M.Sc, Ph.D
Senior Professor of Mathematics
Department of Mathematics

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
Tel: 040-27098811.04027070471 (Direct).Fax:04027073346
Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

Semester II

Subject Code: MCS 485	
No. of credits	**1**
Instructional hours	**2 hrs/wk**
Duration of Semester Examination	**2 Hrs**
Marks for Semester Examination	**25 marks**
Max.marks	**25**

Paper--VII: Programming in Python Lab

Course Objectives: The Course aims to

1. Provide hands on experience to develop core Programming skills using fundamental concepts.

2. Learn basic syntax and semantics, data structure like list, dictionaries etc.

3. Good knowledge on OOPs concepts and GUI Programming

Course Outcomes: After successful completion of this course, students will be able to

1. Understand the basic concepts scripting and the contributions of scripting language

2. Examine the core data structures like lists, dictionaries, tuples and sets in Python to store, Process and sort the data.

3. Identify the external modules and import specific methods from them

4. Demonstrate proficiency in handling Strings and File Systems.

5. Ability to explore python especially the object oriented concepts, and the built in objects of Python

Demonstrate the GUI application development using tkinter module

List of Programs:

1. Write a program that displays the following information: Your name, Full address, Mobile number, College name, Course subjects.

2. Write a program to find the largest three integers using if-else and conditional operator.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
...rial Nehru Technological University
...ad-500 085

Dr. N. KISHAN
M.Sc. Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.

ANDHRA MAHILA SABHA
ARTS & SCIENCE COLLEGE FOR WOMEN
Autonomous - NAAC Re-Accredited, O.U.Campus, Hyderabad – 500 007
Tel: 040-27098811.04027070471 (Direct).Fax:04027073346
Email: amsascw1968@gmail.com , ascwams@yahoo.co.in, Website: amsascw.org

3. Write a program that asks the user to enter a series of positive numbers (The user should enter negative number to signal the end of the series) and the program should display the numbers in order and their sum.

4. Write a program to find the product and sum of two matrices [A]mxp and [B]pxr using Numpy

5. Write recursive and non-recursive functions for the following:

a. To find GCD of two integers.
b. To find the factorial of positive integer

c. To print Fibonacci Sequence up to given number n

6. Write a program to display two random numbers that are to be added, such as: 247 + 129, the program should allow the student to enter the answer. If the answer is correct, a message of congratulations should be displayed. If the answer is incorrect, a message showing the correct

answer should be displayed.
7. Write a function to demonstrate variable length arguments.

8. WAP to Demonstrate about Fundamental Data types(sequentiël and non-sequential) in Python Programming using type function.

9. Write a program to create file, write the content and display the contents of the file.
10. In a program, write a function that accepts two arguments: a list and a number n. The function displays all of the numbers in the list that are greater than the number n.

11. Write a program with a function that accepts a string as an argument and returns the no. of vowels that the string contains. Another function to return number of consonants.

12. Write a program that opens a specified text file and then displays a list of all the unique words found in the file. (Store each word as an element of a set.)

13. Write a program to analyze the contents of two text files using set operations.

14. Write a program to implement the inheritance and dynamic polymorphism.

15. Write a GUI program that converts Celsius temperatures to Fahrenheit temperatures.

16. Write a GUI program that displays your details when a button is clicked.

Note: Handle the Exceptions raised by File Operations.

Dr. M.A. SRINIVAS
Professor & Head
Department of Mathematics
College of Engineering
Jawaharlal Nehru Technological University
Hyderabad-500 085.

Dr. N. KISHAN
M.Sc. Ph.D
Senior Professor of Mathematics
Department of Mathematics
Osmania University, Hyd-07.