

**Scheme of Instruction & Examination**  
**B. E. - Computer Science and Engineering**  
**CSE Semester - IV**

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/D	Contact Hours/week	CIE	SEE	
<b>Theory Courses</b>									
1	3HS404HS	Optimization & Problem Solving Techniques	3	0	0	3	40	60	3
2	3PC404CS	Data Mining	3	1	0	4	40	60	4
3	3PC405CS	Operating Systems	3	0	0	3	40	60	3
4	3PC406CS	Computer Networks	3	0	0	3	40	60	3
5	3HS403HS	Human Values Professional Ethics	2	0	0	2	40	60	2
<b>Practical/ Laboratory Courses</b>									
6	3PC455CS	Operating Systems Lab	0	0	2	2	40	60	1
7	3PC456CS	Computer Networks Lab	0	0	2	2	40	60	1
8	3PC457CS	Java Programming Lab	0	0	2*2	4	40	60	2
9	3PW458CS	Skill Development Course- II	0	0	2	2	40	60	1
<b>Total Credits</b>						<b>25</b>	<b>360</b>	<b>540</b>	<b>20</b>

Course Code	Course Title				Core/Elective		
3HS404HS	OPTIMIZATION & PROBLEM SOLVING TECHNIQUES				Core		
Prerequisite L	Contact Hours per Week				CIE	SEE	Credits
	T	D	P				
ATD	3	-	-	-	40	60	3

### **COURSE OBJECTIVES:**

1. Prepare the students to have the knowledge of Linear Programming Problem in operations.
2. Study Economic Interpretation, Post optimal of sensitivity analysis
3. Use variables for formulating complex mathematical models in management science, industrial engineering and transportation models.
4. Make students understand the concept replacement models.
5. Prepare the students to understand the theory of Game in operations research

### **COURSE OUTCOMES :**

**After the completion of course the students will be able to:**

1. Solve Linear Programming Problems by various methods
2. Finding relationship between primal and dual solution, Economic Interpretation Research.
3. Understand the mathematical tools that are needed to solve optimization problems like Transportation models
4. Understand the Assignment models, replacement models with change in money value considering with time and without time.
5. Understand the theory of Game in operations research at the end students would able to explain applications of Game theory in decision making for conflict.

### **UNIT - I**

**Introduction :** Definition and scope of operations Research.

**Linear Programming :** Introduction, Formulation of Linear programming problem, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

## UNIT-II

**Duality** : Definition, Relationship between primal and dual solution, Economic Interpretation, Post optimal of sensitivity analysis, Dual simplex method.

## UNIT -III

**Transportation Models** : Finding an initial feasible Solution-North West corner method, least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods, special cases in Transportation Problems-Unbalanced Transportation problem.

## UNIT - IV

**Assignment Problems** : Hungarian Method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

**Replacement models** : Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly- Individual replacement policy, Group replacement policy.

## UNIT - V

**Game Theory** : Introduction, 2 person zero sum games, Maximin – Minimax principle of Dominance, Solution for mixed strategy problems, Graphical method for  $2 \times n$  and  $m \times 2$  games.

**Sequencing Models** : Introduction, General assumptions, processing  $n$  jobs through 2 machines, rocessing 'n' jobs through  $m$  machines, Processing 2 jobs through  $m$  machines.

## TEXT BOOKS

1. Hamdy,A.Taha,“Operations Research-AnIntroduction”, Sixth Edition, Prentice Hall of India Pvt. Ltd., 1997
2. S.D.Sharma, Operations Research, Kedarnath, Ramnath& Co., Meerut, 2009.
3. J.B.Gupta, “Utilization of Electric Powerand Electric Traction” S.K.Kataria & Sons.
3. Publications, 2010 Hrvey M.Wagner, Principles of Operations Research, Second Edition, Prentice Hall of India Ltd.,1980.
4. V.K.Kapoor, Operations Research, S.Chand Publishers, New Delhi, 2004.
5. R.Paneer Selvam, Operations Research, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.

Course Code	Course Title					Core/Elective	
3PC404CS	DATA MINING					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	1	-	-	40	60	4

### **COURSE OBJECTIVES :**

1. Introduce the basic concepts of Data Warehouse and Data Mining.
2. Introduce current trends in data mining.
3. Identify data mining problems and implement the data warehouse.
4. Write association rules for a given data pattern.
5. Choose between classification and clustering solution.

### **COURSE OUTCOMES :**

**After the completion of course the students will be able to:**

1. Understand the principles of Data Warehousing and Data Mining.
2. Implementing data warehouse architecture and its applications.
3. Organize and prepare the data needed for data mining using preprocessing techniques.
4. Implement the appropriate data mining methods like classification, association and clustering on a given data set.
5. Understanding the importance of data mining application and using the most appropriate approach for the realistic strategy.

## **UNIT - I**

### **Data Warehousing & Modeling :**

**Basic Concepts : Data Warehousing :** A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

## **UNIT - II**

**Data warehouse implementation& Data mining :** Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing

of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.  
Introduction: What is data mining, Challenges, Data Mining Tasks.

**Data:** Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.

### **UNIT - III**

**Association Analysis:** Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

### **UNIT- IV**

**Classification and Prediction :** Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

### **UNIT - V**

**Cluster Analysis :** Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

### **TEXT BOOKS**

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

### **REFERENCE BOOKS**

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

Course Code	Course Title					Core/Elective	
3PC405CS	OPERATING SYSTEMS					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

### **COURSE OBJECTIVES :**

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the mechanisms involved in memory management in contemporary OS.
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection.
5. To know the components and management aspects of concurrency management.

### **COURSE OUTCOMES :**

**After the completion of course the students will be able to:**

1. Describe the concepts of OS structure and Process synchronization.
2. Evaluate and design different process scheduling algorithms.
3. Identify the rationale behind various memory management techniques along with issues and challenges of main memory and virtual memory.
4. Compare different file allocation methods and decide appropriate file allocation strategies.
5. Describe the mechanisms available in OS to control access to resources and provide system security.

### **UNIT-I**

**Introduction :** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

### **UNIT-II**

**Processes :** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

**Thread :** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

**Process Scheduling :** Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multi processor scheduling.

### **UNIT-III**

**Process Synchronization: Inter-process Communication :** Critical Section, Race Conditions, Mutual Exclusion, Peterson's Solution, classical problems of synchronization : The Bounded buffer problem, Producer\Consumer Problem, reader's & writer problem, Dining philosopher's problem. Semaphores, Event Counters, Monitors, Message Passing,

**Deadlocks :** Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling: Deadlocks : Deadlock prevention, Deadlock Avoidance : Banker's algorithm, Deadlock detection and Recovery.

### **UNIT-IV**

**Memory Management :** Basic concept, Logical and Physical address map, Memory allocation : Contiguous Memory allocation, fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, structure of pagetable, Protection and sharing, Disadvantages of paging.

**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms, Trashing

### **UNIT-V**

**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software : Goals of Interrupt handlers, Device drivers, Device independent I/O software,

**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency and performance.

**Secondary-Storage Structure :** Disk structure, Disk scheduling algorithms, Disk Management, RAID structure.

## **TEXT BOOKS**

1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts Essentials, 9th Edition, Wiley Asia Student Edition, 2017.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India, 2016.
3. Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.

## **REFERENCE BOOKS**

1. Maurice Bach, Design of the Unix Operating Systems, 8th Edition, Prentice-Hall of India, 2009.
2. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates.

Course Code	Course Title					Core/Elective	
3PC406CS	COMPUTER NETWORKS					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

### **COURSE OBJECTIVES:**

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the Network security and Internet applications.
4. To understand the performance of data link layer protocols for error and flow control.
5. To understand various routing protocols and network security.

### **COURSE OUTCOMES :**

**After the completion of course the students will be able to:**

1. Understand and explain the concept of Data Communication and networks, layered architecture and their applications.
2. Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
3. Interpret the network layer, routing protocols and analyse how to assign the IP addresses for the given network.
4. Examine the Transport layer services and protocols.
5. Comprehend the functionality of application layer.

## **UNIT-I**

**Introduction to Data communication :** Representation of data communication, flow of networks, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP, Transmission media

**Techniques for Bandwidth utilization:** Multiplexing –Frequency division, time division and wave division, Asynchronous and synchronous transmission.

## **UNIT - II**

**Data Link Layer:** Framing, Error Detection and Correction: Fundamentals, Block coding, Hamming Distance, CRC.

**Flow Control and Error Control Protocols :** Stop and Wait, go back - N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, HDLC.

**Multiple Access Protocols :** ALOHA, CSMA, CSMA/CD, CSMA/CA.

## **UNIT - III**

**Network Layer :** Switching Techniques (Circuit and Packet) concept, Network layer Services, Sub-netting concepts.

**Routing algorithms:** Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.

## **UNIT - IV**

**Internet Networking :** Tunnelling, Fragmentation, Congestion Control (Leaky Bucket and Token Bucket Algorithm), Internet control protocols: ARP, RARP and DHCP

**The Network Layer in Internet :** IPV4, IPV6, IP Addressing, NAT.

## **UNIT - V**

**Transport Layer :** Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, QoS improving techniques.

Application Layer: Domain Name System, SNMP, SMTP, HTTP, Bluetooth

## **TEXT BOOKS**

1. Andrew S Tanenbaum, "Computer Networks," 5/e, Pearson Education, 2011.
2. Behrouz A. Forouzan, "Data Communication and Networking," 4/e, TMH, 2008.
3. William Stallings, "Data and Computer Communications," 8/e, PHI, 2004.

## **REFERENCE BOOKS**

1. Douglas E Comer, "Computer Networks and Internet", Pearson Education Asia, 2000.
2. Prakash C. Gupta, "Data Communications and Computer Networks", PHI learning, 2013.

Course Code	Course Title					Core/Elective	
3PC455 CS	OPERATING SYSTEMS LAB					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

### **COURSE OBJECTIVES:**

1. To Learn various system calls in Linux
2. To Learn different types of CPU scheduling algorithms.
3. To Demonstrate the usage of semaphores for solving synchronization problem
4. To Understand memory management techniques and different types of fragmentation.
5. To Learn various disk scheduling algorithms.

### **COURSE OUTCOMES:**

**After the completion of course the students will be able to:**

1. Use different system calls for writing application programs.
2. Evaluate the performance of different types of CPU scheduling algorithms.
3. Implement producer-consumer problem, reader-writer's problem, Dining philosopher's problem.
4. Simulate Banker's algorithm for deadlock avoidance.
5. Implement paging replacement and disk scheduling techniques.

### **List of Programs(preferred programming language is C)**

**Perform a case study by installing and exploring various types of operating systems on a physical or logical (virtual) machine**

1. Write C programs to implement UNIX system calls and file management system calls.
2. Write C programs to demonstrate various process related concepts.
3. Write C programs to demonstrate various thread related concepts.
4. Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin.

5. Write C programs to simulate Intra & Inter-Process Communication (IPC) techniques: Pipes, Messages Queues, Shared Memory.
6. Write C programs to simulate solutions to Classical Process Synchronization Problems: Dining Philosophers, Producer-Consumer, Readers-Writers.
7. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
8. Write C programs to simulate Page Replacement Algorithms: FIFO, LRU.
9. Write C programs to simulate implementation of Disk Scheduling Algorithms: FCFS, SSTF.
10. Shell programming: creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).

Course Code	Course Title					Core/Elective	
3PC456CS	COMPUTER NETWORKS LAB					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

### **COURSE OBJECTIVES :**

1. Learn to communicate between two desktops
2. Learn to implement different protocols
3. Be familiar with socket programming
4. Be familiar with various routing algorithms
5. Be familiar with different simulation tools
6. Use simulation tools to analyze performance of various network protocols

### **COURSE OUTCOMES :**

**After the completion of course the students will be able to:**

1. Demonstrate a broad knowledge of the area of computer networking and its terminology
2. Understand to configure intermediary network devices
3. Program using sockets
4. Use simulation tools to analyze the performance of various network protocols
5. Implement and analyze various routing algorithms.

### **List of Programs**

1. Running and using services/commands like tcpdump, netstat, ifconfig, nslookup, FTP, TELNET and trace route. Capture ping and trace route PDUs using network protocol analyzer and examine
2. Implement the data link layer framing methods such as character-stuffing and bit stuffing
3. Implement on a dataset of characters using CRC polynomials CRC 12 and CRC 16
4. Initial Configuration of router and switch (using real devices or simulators)
5. Design and implement the following experiments using packet tracer software
  - I. Simulation of network topologies
  - II. Configuration of network using different routing protocols.
6. Do the following using NS2/NS3/NetSim or any other equivalent tool.
  - I. Simulation of Congestion Control Algorithms.
  - II. Simulation of Routing Algorithms.
7. Socket programming using UDP and TCP (e.g simple DNS, date & time client/server, echo client/server, iterative & concurrent servers).
8. Programming using RPC.

Course Code	Course Title				Core/Elective		
3PC458 CS	JAVA PROGRAMMING LAB				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	4	40	60	2

### **COURSE OBJECTIVES :**

1. To implement various java concepts.
2. To write java programs to solve mathematics, science and engineering problems.
3. To identify compile time and runtime errors, syntax and logical errors
4. To import the essentials of java class library and user defined packages.
5. To develop skills in internet programming using applets and swings.

### **COURSE OUTCOMES :**

**After the completion of course the students will be able to:**

1. To understand the use of OOPs concepts.
2. Develop Java program using packages, inheritance and interface.
3. Develop java programs to implement error handling techniques using exception handling.
4. Develop graphical user interface using AWT.
5. Demonstrate event handling mechanism.

### **List of Programs**

1. Implement the concept of classes and objects.
2. Implement Arrays to a given application.
3. Use String and String Tokenizer classes and develop a java programs.
4. Develop a java programs Using interfaces and packages.
5. Develop Java Programs using inheritance.
6. Develop Java programs using Method overloading and method overriding.
7. Develop java programs using Exception handling (using try, catch, throw, throws and finally).
8. Develop java programs using Multithreading (using Thread class and Runnable interface, synchronization).
9. Develop java programs using collections (using list, set, Map and generics).
10. CASE STUDY: Develop a program to calculate SGPA & CGPA of a student and display the progress report.

**INPUT :**

INPUT		
ROLLNO	NAME	HOW MANY SEMESTERS? Semester wise : Subject Code, Subject Name And Marks

**OUTPUT:**

Progress report of <NAME>

Roll No:

Program(BE/ME)

Branch:

College Code and Name:

Year of joining:

Semester-I Grades	Semester-II Grades	Semester-III Grades
Subject 1:	Subject 1:	Subject 1:
Subject 2:	Subject 2:	Subject 2:
Subject 3:	Subject 3:	Subject 3:
....	....	....
SGPA:	SGPA:	SGPA:
CGPA:	CGPA:	CGPA:

Note: The above experiments can be implemented using any IDE.

## **SKILL DEVELOPMENT COURSE-II**

<b>Semester IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>Subject code – 3PW458CS</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **Guidelines for Evaluation of Skill Development**

1. Continuous Evaluation method is adopted for skill development courses of all semesters and 40 marks are allocated for CIE.  
At the end of each module, the student is evaluated by allocating marks as given under.  
Observation- 10 marks  
Continuous Performance and Execution -20 marks  
Viva-Voce—10marks  
Average of marks obtained in all experiments is considered as the marks obtained in CIE
2. The Semester End Examination shall be conducted with an external examiner and the internal examiner for 60 marks. The external examiner shall be appointed by the Principal from the panel of examiners recommended by Controller of Evaluation and Board of Studies.  
Quiz/ Skill Test/Assignment/ Mini Project– 40 marks.  
Viva-voce-20 marks.

Course Code	Course Title					Core/Elective	
3PW458CS	CISCOCCNA MODULE I					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

### **COURSE OBJECTIVES:**

1. Explain the advances in modern network technologies, configure IP address, passwords etc.
2. Explain how network protocols enable devices to access local and remote network resources.
3. Explain how routers use network layer protocols and services to enable end-to-end connectivity.
4. Implement IPv4 and IPv6 addressing scheme.
5. Configure a switch port to be assigned to a VLAN based on requirements.

### **COURSE OUTCOMES:**

**After the completion of course the students will be able to:**

1. Build simple LANs, perform basic configurations for routers and switches,
2. Implement IPv4 and IPv6 addressing schemes.
3. Implement VLANs and trunking in a switched network.
4. Implement DHCPv4 to operate across multiple LANs and explain how WLANs enable network connectivity.
5. Develop critical thinking and problem-solving skills using real equipment and Cisco Packet Tracer.

### **MODULE -I:**

**Networking today:** Network Affect our Lives, Network Components, Network topologies, Types of Networks.

**Basic Switch and End Device Configuration :** IOS Access, Command Structure, basic device configuration, Ports and addresses, configuring IP address, protocols and models.

**MODULE - II :**

**Physical Layer :** Introduction to cables, Number Systems.

**Data Link Layer :** Topologies, Data Link frame.

**Ethernet Switching :** Ethernet Frame, MAC Address Table.

**MODULE - III:**

**Network layer :** IPv4 and IPv6 packet , addressing of IPv4 and IPv6.

**Address Resolution:** MAC & IP, ARP, IPv6 Neighbour Discovery.

**MODULE - IV:**

**ICMP, Transport layer :** TCP & UDP

**Application Layer :** Web and email protocols, IP Addressing Services.

**MODULE - V:**

**Network Security Fundamentals:** Network Attacks, Device Security.

**REFERENCES :**

CCNA ROUTING & SWITCHING BY CISCO PRESS.

# **V SEMESTER**