

**O. P. JINDAL UNIVERSITY**  
O. P. Jindal Knowledge Park, Punjipathra, Raigarh-496109



# O. P. Jindal University

Raigarh-Chhattisgarh



*Scheme and Syllabus*  
*of*  
B.Tech

School of Engineering  
Session- 2025-29

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**PROGRAM OUTCOMES (POS):** At graduation, students will be able to: (From AY: 24-25)  
(refer next page for WK1 – WK9 (Knowledge and Attitude Profile))

PO-1	<b>Engineering Knowledge:</b> Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO-2	<b>Problem Analysis:</b> Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO-3	<b>Design/Development of Solutions:</b> Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

### **Knowledge and Attitude Profile (WK)**

**WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

**WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

**WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

**WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

**WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

**WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

**WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

**WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

**WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

**PROGRAM SPECIFIC OUTCOMES** - At graduation, students will be able to provide:

**PSO1: Applying Mechanical Engineering to Global Challenges**

Develop an attitude to meet global challenges and apply the knowledge of mechanical engineering to solve problems related to thermal, design, manufacturing, and interdisciplinary fields.

**PSO2: Technology-Driven Solutions for Industry & Society**

Demonstrate knowledge and skill for solving social, real industrial problems using modern software and hardware tools.

**PSO3: Utilizing Mechanical Engineering for Emerging Technologies**

Utilizing the knowledge of Mechanical Engineering to work effectively in cutting edge technologies such as Robotics, Artificial Intelligence, Mechatronics, and Automation.

Curriculum and Credit Framework for Undergraduate Programme (CCFUP)									
Semester	MAJOR		MINOR	AEC	SEC	Internship/ Apprentice- ship/Project/ Community outreach	VAC	MDC	Total Credits
	DSC	DSE							
<b>I</b>	16			2	2		2		22
<b>II</b>	13			2	2		2	3	22

*\* Students on exit shall be Awarded Undergraduate Certificate (in the Field of Study/ Discipline) after securing the requisite 44 credits in Semesters I and II and complete one vocational course of 4 credits during the summer*

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**AEC:** Ability Enhancement Course

**SEC:** Skill Enhancement Course

**VAC:** Value addition Course

**MDC:** Multidisciplinary Course

**Level of courses:** There will be 5 level of courses on the basis of learning outcome and difficulty levels distributed across semesters in ascending order.

Level-1 (0-99), Level-2 (100-199), Level-3 (200-299), Level-4 (300-399), Level-5 (400-499) courses shall be pre-requisite, introductory, intermediate, higher level, and advanced courses respectively.

DEGREE	MAJOR		MINOR	AEC	SEC	INTERNSHIP/ PROJECT	VAC	MDC	TOTAL CREDIT
	CORE	ELECTIVE							
Honors	106	12	24	8	9	8	6	9	182
Honors with Research	94	12	24	8	9	20	6	9	182

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**Course Structure for B. Tech Program (1<sup>st</sup> & 2<sup>nd</sup> Semester)-2025-29 batch**  
**(School of Engineering, Common to all departments)**

Year	FIRST SEMESTER (NHEQF Level: 4.5)											
	Sem	Course Code	Course Category	Name of the Course	Hours per week			Scheme of Examination and Marks			Credits : L+ T+ (P/2)	
					L	T	P	PRE		ESE		Total
								MID	TA			
First Year	1 <sup>st</sup>	MAT24-B-MJ111	MAJOR	Engineering Mathematics-I	3	0	0	15	15	70	100	3
		PHY24-B-MJ111	MAJOR	Applied Physics	2	0	0	7.5	7.5	35	50	2
		EE24-B-MJ101	MAJOR	Basic Electrical and Electronics	3	0	0	15	15	70	100	3
		ME24-B-MJ101	MAJOR	Engineering Graphics	2	0	2	15	15	70	100	3
		MME24-B-MJ101	MAJOR	Introduction to Engineering Materials	3	0	0	15	15	70	100	3
			AEC	Choose from the Pool	2	0	0	7.5	7.5	35	50	2
			SEC	Choose from the Pool	2	0	0	7.5	7.5	35	50	
					0	0	4	-	15	35	50	
			VAC	Choose from the Pool	2	0	0	7.5	7.5	35	50	2
		EE24-B-MJ102	MAJOR	Basic Electrical and Electronics Lab	0	0	2	-	15	35	50	1
		ME24-B-MJ102	MAJOR	Innovation and Skill Development	0	0	2	-	15	35	50	1
											22	

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## Course Structure for B. Tech Program (1<sup>st</sup> & 2<sup>nd</sup> Semester)-2025-29 batch (School of Engineering, Common to all departments)

Year	SECOND SEMESTER (NHEQF Level: 4.5)											
First Year	SEM	Course Code	Course Category	Name of the Course	Hours per week			Scheme of Examination and Marks				Credits: L+ T+ (P/2)
					L	T	P	PRE		ESE	Total	
								MID	TA			
		MAT24-B-MJ112	MAJOR	Engineering Mathematics-II	3	0	0	15	15	70	100	3
		CHE24-B-MJ111	MAJOR	Applied Chemistry	2	0	0	7.5	7.5	35	50	2
		ME24-B-MJ103	MAJOR	Fundamentals of Mechanics	3	0	0	15	15	70	100	3
		CSE24-B-MJ101	MAJOR	Python Programming	3	0	0	15	15	70	100	3
			AEC	Choose from the pool	2	0	0	7.5	7.5	35	50	2
	II <sup>nd</sup>		SEC	Choose from the pool	2	0	0	7.5	7.5	35	50	2
					0	0	4	-	15	35		
			VAC	Choose from the pool	2	0	0	7.5	7.5	35	50	2
			MDC	Choose from the pool	3	0	0	15	15	70	100	3
		ME24-B-MJ104	MAJOR	Mechanics Lab	0	0	2	-	15	35	50	1
		CHE24-B-MJ112	MAJOR	Applied Science Lab	0	0	2	-	15	35	50	1
												22

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**Exit option to qualify for Undergraduate Certificate (after completion of 1<sup>st</sup> year)**

1. An exit option is available for students those who have earned the total 44 credits at the End of Second Semester.
2. Student who wants to avail the exit option after first year have to earn additional 4 credits from the list of courses shown below.
3. These courses student have to complete within summer vacation after 1st Year.
4. After fulfillment as mentioned in 1 to 3 above, Students can earn U.G Certificate and same will be issued by the University.

**List of Exit Courses (Choose Any *TWO* Skill-based Courses)**

S. N.	Courses Code	Name of the Courses	L	T	P	Credit	Scheme of Examination and Marks			
							PRE		ESE	Total
							MID	TA		
1	CE24-B-EC101	Computer-Aided Drawing with AutoCAD	0	0	4	2	-	15	35	50
2	CSE24-B-EC101	Basic Computer Skills	0	0	4	2	-	15	35	50
3	CSE24-B-EC102	Computer Hardware Skills	0	0	4	2	-	15	35	50
4	EE24-B-EC101	Electrical Wiring & Testing	0	0	4	2	-	15	35	50
5	ME24-B-EC101	Advanced Mechanical Workshop	0	0	4	2	-	15	35	50







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<b>Program:</b>	B. Tech.	<b>Semester:</b>	After 1 <sup>st</sup> Year
<b>Name of the Course:</b>	Advanced Mechanical Workshop	<b>Course Code:</b>	ME24-B-EC101
<b>Credits:</b>	2	<b>No of Hours:</b>	4 hrs. / week
<b>Max Marks:</b>	50		

**Course Descriptions:**

This course provides hands-on training and practical exposure to basic manufacturing processes and advanced mechanical workshop practices essential for mechanical and production engineering students. The course is designed to familiarize students with the operation of hand tools, machines, and manufacturing techniques used in fitting, carpentry, welding, foundry, and machining shops. Students will perform a series of structured practical tasks to understand the material properties, working principles, and safety procedures of various fabrication and machining processes. The course aims to build foundational technical skills and promote confidence in handling real-world engineering problems related to fabrication, assembly, and component production.

**Course Outcomes:**

After Completion of the course, Students will be able to:

CO Number	Course Outcome
CO1	Create wooden components and joints (like mortise and tenon) and develop simple wooden products using carpentry tools.
CO2	Create wooden components and joints (like mortise and tenon) and develop simple wooden products using carpentry tools.
CO3	Perform basic welding operations including butt-joint, lap-joint, and fabrication of components using arc welding and spot-welding techniques.
CO4	Apply the foundry process by preparing molds using patterns and casting non-ferrous metals and complex shapes.
CO5	Operate basic machine tools like lathe, shaper, and milling machines to produce parts with eccentric, dovetail, and pocketing operations.

**Experiments to be performed (Minimum Ten experiments)**

**Fitting Shop**

1. Making a V- groove job using fitting tools.
2. Making a step cutting job using fitting tools.
3. Making a male-female joint using fitting tools.

**Carpentry Shop**

1. Making a two-piece pattern using carpentry tool.
2. Making a mortise and tenon joint using carpentry tools.
3. Making a laptop stand using carpentry tools (Combined job).

**Welding Shop**

1. Making a Butt-Joint using virtual welding 2.0.
2. Making a Lap-joint using spot welding.
3. Fabricating a steel chair using electric arc welding (Combined Job).

**Foundry Shop**

1. Preparing a mold using a two-piece pattern.
2. Casting of a non-ferrous metals using two-piece pattern.
3. Casting of a sculpture using metal pattern (Combined job).

**Machine Shop**

1. Preparing an eccentric job on a lathe machine.
2. Performing dovetail cutting operation on a shaper machine.
3. Performing circular pocketing operation on a milling machine.

**List of Tools/Equipment/Machines Required:**

1. Fitting tools.
2. Carpentry tools
3. Welding machines (MMAW/Virtual 2.0/Spot) and equipment.
4. Muffle furnace.
5. Lathe Machine.
6. Shaper Machine.
7. Milling Machine.

**CO, PO, & PSO Correlation**

CO Number	Program Outcome											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	1	2	1	1	2	2	1	2	3	2	-
CO2	3	2	3	1	2	1	1	2	2	1	2	3	2	-
CO3	3	2	3	2	3	2	1	2	2	2	2	3	3	-
CO4	3	2	3	3	3	2	2	2	2	2	2	3	3	-
CO5	3	3	3	3	3	2	2	2	2	2	2	3	3	-

Note: 1: Low 2: Moderate 3: High



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Academic Semester VII

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P)/2
			L	T	P	PRE**		ESE*	Total Marks	(L+T+P)
						Mid Sem	TA			
CSE	SOE-B-CSE-22-701	Industry Internship	--	--	20	--	125	125	250	10
CSE	SOE-B-CSE-22-702(X)	Professional Elective IV	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-703(X)	Professional Elective V	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-704(X)	Professional Elective lab IV	0	0	2	0	30	20	50	1
CSE	SOE-B-CSE-22-705(X)	Professional Elective lab V	0							

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### Professional Elective - IV

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-702(1)	Unix and Shell Programming
2	SOE-B-CSE-22-702(2)	NoSQL Database
3	SOE-B-CSE-22-702(3)	Deep Learning Techniques

### Professional Elective - IV Lab

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-704(1)	Unix and Shell Programming Lab
2	SOE-B-CSE-22-704(2)	NoSQL Database Lab
3	SOE-B-CSE-22-704(3)	Deep Learning Techniques Lab

### Professional Elective - V

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-703(1)	Web Analytics
2	SOE-B-CSE-22-703(2)	Natural Language Processing
3	SOE-B-CSE-22-703(3)	Image Processing and Applications

### Professional Elective - V Lab

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-705(1)	Web Analytics Lab
2	SOE-B-CSE-22-705(2)	Natural Language Processing Lab
3	SOE-B-CSE-22-705(3)	Image Processing and Applications Lab

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Unix and Shell Programming	Course Code:	SOE-B-CSE-22 - 702(1)
Credits	: 3	No of Hours	: 3 Hrs. / Week
Max Marks	: 100		

### Course Description:

This course introduces students to the Unix operating system and the powerful world of shell programming. It covers essential Unix concepts, commands, file systems, and utilities. Students learn how to automate tasks using shell scripts, manage processes, handle file permissions, and work with advanced text processing tools like sed, awk, and regular expressions. Through hands-on practice, students develop the skills to write efficient shell programs for real-world applications and system administration tasks.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Navigate Unix/Linux systems efficiently.
CO2	Write and debug shell scripts to automate routine tasks.
CO3	Use Unix utilities to manipulate and process text files.
CO4	Understand and manage user and file permissions.
CO5	Apply scripting techniques to solve practical computing problems.

### Syllabus:

#### Unit I: Introduction To Unix:

Architecture of Unix, Features of Unix , Unix Commands – PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip UNIX UTILITIES: Introduction to unix file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin. Text processing utilities and backup utilities , detailed commands to be covered are tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio.

#### Unit II: Introduction To Shells:

Unix Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, - Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization. FILTERS: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

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### Unit III: Grep:

Operation, grep Family, Searching for File Content. SED: Scripts, Operation, Addresses, commands, Applications, grep and sed. AWK: Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands in awk, Applications, awk and grep, sed and awk.

### Unit IV: Interactive Korn Shell:

Korn Shell Features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, Options, Startup Scripts, Command History, Command Execution Process. KORN SHELL PROGRAMMING: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

### Unit V : Interactive C Shell:

C shell features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, On-Off Variables, Startup and Shutdown Scripts, Command History, Command Execution Scripts. C SHELL PROGRAMMING: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples. FILE MANAGEMENT: File Structures, System Calls for File Management system, INODES, Structure of Regular File, Directories, Conversions of a Path, name to an INODE, Super Block, INODE Assignment to a New File create, open, close, read, write, lseek, link, symlink unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

### Text Books:

- Unix and shell Programming, Behrouz A. Forouzan, Richard F. Gilberg, Thomson
- Your Unix the ultimate guide, Sumitabha Das, TMH. 2nd Edition.

### Reference Books:

- Unix for programmers and users, 3rd edition, Graham Glass, King Ables, Pearson education.
- Unix programming environment, Kernighan and Pike, PHI. / Pearson Education
- The Complete Reference Unix, Rosen, Host, Klee, Farber, Rosinski, Second Edition, TMH.
- Unix Shell programming, Yashwanth Kanitkar, 1st Edition, BPB Publisher

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: NoSQL Database	Course Code:	SOE-B-CSE-22 -702( 2)
Credits	: 3	No of Hours :	3 Hrs. / Week
Max Marks	: 100		

### Course Description:

This course provides an in-depth study of NoSQL databases, focusing on their need, design, types, and applications in big data systems. Students will understand the key differences from relational databases, the importance of the CAP theorem, and how to model and manage data using various NoSQL paradigms including key-value, document, column-family, and graph databases. The course will emphasize both theoretical foundations and practical hands-on experience using modern NoSQL tools.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Understand the evolution and characteristics of NoSQL databases and differentiate them from traditional RDBMS.
CO2	Categorize various types of NoSQL databases and identify appropriate use cases.
CO3	Design and implement key-value and document-oriented data models using tools like Redis and MongoDB.
CO4	Apply and manage column-family and graph databases such as Cassandra and Neo4j for real-time applications.
CO5	Evaluate performance, consistency, and scalability trade-offs in distributed NoSQL systems.

### Syllabus:

#### Unit 1: Introduction to NoSQL

Introduction to NoSQL – Characteristics – Comparison with RDBMS – CAP Theorem – ACID vs BASE – Polyglot persistence – Overview of structured, semi-structured, and unstructured data – Applications of NoSQL in Big Data and Real-Time Web.

#### Unit 2: Key -Value Stores

Key-value model – Architecture and storage structure – Data modeling techniques – Features and limitations – Tools: Redis, Riak – CRUD operations – Real-world use cases.

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### Unit 3: Document -Oriented Databases

Document structure: JSON, BSON – Data modeling and nesting – Indexing, querying and aggregation – Schema design practices – MongoDB architecture – CRUD operations – Replication and Sharding.

### Unit 4: Column -Family Databases

Concept of wide-column stores – Data organization – Partitioning and clustering – Schema modeling – Consistency and availability – Cassandra and HBase overview – Query mechanism – CAP in practice.

### Unit 5: Graph Databases

Graph models – Nodes, relationships, properties – Graph traversal algorithms – Cypher query language – Indexes and constraints – Neo4j features and case studies – Applications in social networks and recommendation systems.

### Text Books:

- “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence” , Pramod J. Sadalage and Martin Fowler, Addison-Wesley, 2012.
- “Making Sense of NoSQL: A Guide for Managers and the Rest of Us” , Dan McCreary and Ann Kelly, Manning Publications, 2013.

### Reference Books:

- “Professional NoSQL”, Shashank Tiwari, Wrox Press, 2011.
- “NoSQL For Dummies” ,Adam Fowler, Wiley, 2015.
- “MongoDB Applied Design Patterns” ,Rick Copeland, O'Reilly Media, 2013..

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Programme	: B. Tech.	Semester	: VII
Name of the Course:	Deep Learning Techniques	Course Code:	SOE-B-CSE-22 -702( 3)
Credits	: 3	No of Hours	: 3 Hrs./week
Max Marks	: 100		

### Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

### Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Gain the knowledge about neural networks.
CO2	Introduce the basic concepts and techniques of deep learning.
CO3	Apply optimization techniques in in real life applications.
CO4	Develop the skills in deep learning for solving practical problems. To be familiar with a set of well-known deep neural network, convolutional neural network, filters optimization techniques.
CO5	Apply RNN and LSTM for sentiment analysis

### Syllabus:

#### UNIT -I: Basics of Neural Networks

Biological Neuron, idea of computational units, McCulloch–Pitts unit and thresholding logic, linear perceptron, perceptron learning algorithm, linear separability, convergence theorem for perceptron learning algorithm, limitations of single-layer perceptron, introduction to activation functions (Sigmoid, Tanh, ReLU), bias term and its significance.

#### UNIT -II: Feedforward Networks and Deep Neural Networks

Multilayer perceptron, gradient descent, backpropagation, empirical risk minimization, regularization, autoencoders, difficulty of training deep neural networks, greedy layer-wise training, role of initialization and activation in deep networks, batch vs stochastic gradient descent, mini-batch gradient descent, variants of autoencoders (denoising, sparse, variational - brief introduction).

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### UNIT -III: Optimization in Deep Neural Networks

Newer optimization methods for neural networks (Adagrad, Adadelta, RMSProp, Adam, Nesterov Accelerated Gradient), second-order methods for training, saddle point problem in neural networks, regularization methods (dropout, drop connect, batch normalization), learning rate schedules (step decay, cosine annealing, warm restarts), gradient clipping in deep networks, early stopping as regularization.

### UNIT -IV: Recurrent Neural Networks

Backpropagation through time, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), bidirectional LSTMs, bidirectional RNNs, applications of RNNs (language modeling, sequence prediction), attention mechanism (brief introduction), comparison of LSTM and GRU architectures.

### UNIT -V: Convolutional Neural Networks

Convolution in n-dimensions, convolutional layers, pooling strategies, visualization of filters, padding and stride, parameter calculation in CNNs, overview of modern CNN architectures (LeNet, AlexNet, VGG, ResNet - brief), transfer learning and pre-trained CNN models (basic concept).

### Text Books:

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

### Reference Books:

- Raúl Rojas, “Neural Networks: A Systematic Introduction”, 1996.
- Christopher Bishop, “Pattern Recognition and Machine Learning”, 2007.

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Programme	:	B.Tech.	Semester	:	VII
Name of the Course	:	Unix and Shell Programming Lab	Course Code:	:	SOE-B-CSE-22 - 704(1)
Credits	:	1	No of Hours	:	2 Hrs/Week
Max Marks	:	50			

### Course Descriptions:

This lab course provides hands-on experience with the Unix operating system and shell programming. Students will practice fundamental Unix commands, explore the file system, manage processes, and develop shell scripts to automate tasks. The lab emphasizes problem-solving skills, scripting for system administration, and the use of Unix utilities for text processing and data management. Through a series of structured experiments and mini-projects, students gain practical proficiency in Unix environments.

### Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Efficiently use Unix/Linux commands for system navigation and management.
CO2	Develop shell scripts for automating a variety of tasks.
CO3	Perform text processing and data manipulation using Unix utilities.

The following Concepts/Experiments will be covered in the lab:

- Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.
  - Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.
- Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
  - Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
- Write a shell script to list all of the directory files in a directory.
  - Write a shell script to find factorial of a given integer.
- Write an awk script to count the number of lines in a file that do not contain vowels.
  - Write an awk script to find the number of characters, words and lines in a file.

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5.
  - a) Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files.
  - b) Write a c program that makes a copy of a file using standard I/O and system calls.
6.
  - a) Implement in C the following Unix commands using System calls o cat , ls, mv
  - b) Write a C program to emulate the Unix ls -l command.
7. Write a program that takes one or more file/directory names as command line input and reports the following information on the file.
  - a) File type.
  - b) Number of links.
  - c) Time of last access.
  - d) Read, Write and Execute permissions.
8.
  - a) Write a C program to list for every file in a directory, its inode number and file name.
  - b) Write a C program that demonstrates redirection of standard output to a file. Ex: ls > f1.
9.
  - a) Write a C program to create a child process and allow the parent to display “parent” and the child to display “child” on the screen.
  - b) Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex:- ls -l | sort
10.
  - a) Write a C program to create a Zombie process.
  - b) Write a C program that illustrates how an orphan is created.
11.
  - a) Write C programs that illustrate communication between two unrelated processes using named pipe.
  - b) Write a C program (sender.c) to create a message queue with read and write permissions to write 3 messages to it with different priority numbers.
  - c) Write a C program (receiver.c) that receives the messages (from the above message queue as specified in (21)) and displays them.
12.
  - a) Write a shell script to accept three numbers and display the largest.
  - b) Write a shell script to find the number of files in a directory.
  - c) Write a shell script to display first ten positive numbers using until loop.
13.
  - a) Write a shell script to check if a particular user has logged in or not. If not, continue the loop till he/she logs in. Once the required user logs in, display a message.
  - b) Write a shell script to accept the name, grade, and basic salary from the user. Write the details into a file called employee, separating the fields with a colon (,) continue the process till the user wants.
14.
  - a) Write a shell script to check whether a file is existing or not.
  - b) Write a shell script to find the mode of a file in a directory.
  - c) Write a shell script which will accept different numbers and find their sum.
15.
  - a) Write a menu driven program to display a menu of options and depending upon the user’s choice execute the associated command.
  - b) Write a shell script to calculate the total salary payable to all the employees from the employee file. The salary should be taken from the 8th field of the employee file.
16.
  - a) Write a shell script to copy the source file to the target file.
  - b) Write a shell script to print the first 10 odd numbers using the while loop.

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c) Write a shell script to reverse the digits of a given number.

Text Books :

- Unix Shell programming, Yashwanth Kanitkar, 1st Edition, BPB Publisher
- Unix for programmers and users, 3rd edition, Graham Glass, King Ables, Pearson education.
- Unix programming environment, Kernighan and Pike, PHI. / Pearson Education
- The Complete Reference Unix, Rosen, Host, Klee, Farber, Rosinski, Second Edition, TMH

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Programme	:	B.Tech.	Semester	:	VII
Name of the Course	:	NoSQL Database Lab	Course Code:	:	SOE-B-CSE-22-704(2)
Credits	:	1	No of Hours	:	2 Hrs. / Week
Max Marks	:	50			

### Course Descriptions:

The objectives of this lab course are to provide hands-on experience in working with NoSQL databases, understanding their architecture, and applying key concepts such as document-based, column-oriented, graph, and key-value stores. The emphasis will be on practical implementation, querying, and optimization techniques used in NoSQL database systems

### Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Understand the fundamental concepts of NoSQL databases and their use cases.
CO2	Implement basic CRUD operations in different types of NoSQL databases.
CO3	Perform indexing and optimization techniques to enhance query performance.

The following Concepts/Experiments will be covered in the lab:

- Introduction to NoSQL databases: Key concepts and architecture
- CRUD operations in MongoDB (Document-based database)
- Querying and indexing in MongoDB.
- Working with Cassandra (Column-oriented database)
- Query execution and data modelling in Cassandra.
- Redis as a key-value store: Implementation and operations.
- Introduction to Neo4j (Graph database) and Cypher queries.
- Comparison of NoSQL databases with relational databases.
- Performance benchmarking and optimization techniques.
- Mini-project: Implementing a real-world NoSQL database solution.

### Text Books :

- "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" – Pramod J. Sadalage & Martin Fowler
- "MongoDB: The Definitive Guide" – Kristina Chodorow
- "Cassandra: The Definitive Guide" – Jeff Carpenter & Eben Hewitt
- "Graph Databases" – Ian Robinson, Jim Webber, & Emil Eifrem

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Programme	:	B.Tech.	Semester	:	VII
Name of the Course:		Deep Learning Techniques Lab	Course Code:		SOE-B-CSE-22 -704( 3)
Credits	:	1	No of Hours	:	2 Hrs. / Week
Max Marks	:	50			

### Course Descriptions:

This laboratory course provides hands-on experience in designing, implementing, and evaluating deep learning models. Students will learn to utilize popular deep learning frameworks and libraries to tackle real-world problems in areas such as image recognition, natural language processing, and time series analysis. Through practical exercises and projects, students will gain a deep understanding of the fundamental concepts and techniques in deep learning, including neural network architectures, training methodologies, optimization algorithms, and regularization techniques. Emphasis will be placed on developing practical skills in data preprocessing, model development, hyperparameter tuning, and performance evaluation. Students will also learn to interpret results and critically analyze the strengths and limitations of different deep learning approaches.

### Course Outcomes:

At the end of the course, students should be able to:

CO Number	Course Outcome
CO1	Implement and experiment with fundamental deep learning models
CO2	Apply data preprocessing techniques for deep learning tasks
CO3	Evaluate and compare the performance of deep learning models

### Following concepts will be covered in the lab

- Implementing a Simple Neural Network (MLP) from Scratch
- Image Classification using Convolutional Neural Networks (CNNs)
- Training a Deep Neural Network for Regression Tasks
- Building a Convolutional Autoencoder for Image Denoising
- Transfer Learning with Pretrained CNN Models (VGG, ResNet, etc.)
- Implementing Recurrent Neural Networks (RNN) for Text Generation
- Training Long Short-Term Memory (LSTM) Networks for Time Series Prediction
- Building a Generative Adversarial Network (GAN) for Image Generation
- Hyperparameter Tuning in Neural Networks
- Implementing Dropout and Batch Normalization to Prevent Overfitting

### Software Requirements:

- Python.

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### Text Books:

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

### Reference Books:

- Raúl Rojas, “Neural Networks: A Systematic Introduction”, 1996.
- Christopher Bishop , “Pattern Recognition and Machine Learning”, 2007.

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Web Analytics	Course Code:	SOE-B-CSE-22 - 703(1)
Credits	: 3	No of Hours :	3 Hrs. / Week
Max Marks	: 100		

### Course Description:

This course introduces students to the principles, tools, and techniques of web analytics. With the exponential growth of digital platforms, understanding how users interact with websites is essential for making informed business and marketing decisions. The course covers the setup and usage of popular analytics tools like Google Analytics, measurement of website traffic, user behavior, and conversion performance. Students will learn how to interpret analytical data, create meaningful reports, and apply optimization strategies to improve user experience and business outcomes. The course also includes advanced tracking techniques and real-world applications in digital marketing, e-commerce, and content optimization.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Explain the significance of web analytics in digital marketing and e-commerce ecosystems.
CO2	Configure and utilize web analytics platforms (such as Google Analytics) for data collection and reporting.
CO3	Evaluate website traffic patterns, user behavior, and conversion processes.
CO4	Develop data-driven strategies to enhance website performance and user experience.
CO5	Apply web analytics techniques to real-world business scenarios across various industries.

### Syllabus:

#### Unit I: Introduction to Web Analytics

Introduction to Web Analytics ,Need and Importance of Web Analytics ,Web Metrics: Visits, Page Views, Unique Visitors, Bounce Rate, Conversion Rate ,Types of Web Analytics: Off-site and On-site ,Introduction to Google Analytics

#### Unit II: Data Collection and Tools

Web Data Collection Mechanisms (Cookies, Log Files, Web Beacons) ,Tagging and Tracking Codes ,Setting up Google Analytics Account ,Analytics Dashboard Overview ,Data Segmentation and Filtering.

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### Unit III: Key Performance Indicators and Reporting

Defining and Measuring KPIs ,Traffic Sources and Channels ,Behavior Analysis: Site Content, Landing Pages, Exit Pages ,Goal Setup and Funnel Visualization ,Custom Reports and Dashboards.

### Unit IV: Campaign and Conversion Analysis

Tracking Marketing Campaigns (UTM parameters) ,Social Media and Email Campaign Tracking ,A/B Testing and Multivariate Testing ,Conversion Optimization Techniques ,Attribution Models.

### Unit V : Advanced Topics and Case Studies

Mobile and App Analytics ,E-commerce Analytics ,Real-Time Analytics and Dashboards ,Ethical Considerations and Privacy in Web Analytics ,Case Studies of Web Analytics in Different domains.

### Text Books:

- Avinash Kaushik, *Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity*, Wiley India.

### Reference Books:

- Justin Cutroni, *Google Analytics*, O'Reilly Media.
- Brian Clifton, *Advanced Web Metrics with Google Analytics*, Wiley.
- Marshall Sponder, *Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics*, McGraw-Hill.
- Eric T. Peterson, *Web Analytics Demystified: A Marketer's Guide to Understanding How Your Web Site Affects Your Business*, Celilo Group Media.

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Natural Language Processing	Course Code	: SOE-B-CSE-22 -703(2)
Credits	: 3	No of Hours	: 3 Hrs/Week
Max Marks	: 100		

### Course Description:

The course will provide foundational knowledge of natural language processing. The course will cover basic concepts of language design, grammars, syntax, semantics, and the designing of NLP systems.

### Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Tag a given text with basic Language features
CO2	Design an innovative application using NLP components
CO3	Implement a rule-based system to tackle morphology/syntax of a language
CO4	Design a tag set to be used for statistical processing for real-time applications
CO5	Compare and contrast the use of different statistical approaches for different types of NLP applications.

### Syllabus :

#### Unit -I: Introduction

Origins and challenges of NLP, The evaluation of NLP applications, Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

#### Unit -II: Word level analysis

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models. Corpora and their construction: representativeness

#### Unit -III: Syntactic Analysis

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing –

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Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

### Unit -IV: Semantics and pragmatics

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods. Computational Phonetics and Speech Processing

### Unit -V: Discourse analysis and lexical resources

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus

### Text Books:

- Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, 2014.
- Steven Bird, Ewan Klein, Edward Loper, “Natural Language Processing with Python”, 1st Edition, O\_Reilly Media, 2009

### Reference Books:

- Breck Baldwin, “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015
- Richard M Reese, “Natural Language Processing with Java”, O\_Reilly Media, 2015
- Nitin Indurkha, Fred J. Damerau, “Handbook of Natural Language Processing”, 2nd Edition, Chapman and Hall/CRC Press, 2010.
- Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Image Processing and Applications	Course Code:	SOE-B-CSE-22 -703( 3)
Credits	: 3	No of Hours:	3 Hrs/Week
Max Marks	: 100		

### Course Description:

The objective of this course to equip the students with the techniques & tools for digital image processing, & image analysis in the form of image segmentation, image enhancement, image filters, image transforms, Fourier transforms & fast Fourier transforms, edge detection, image segmentation & colour imaging.

### Course Outcomes:

Upon successful completion of this course, the student will be able to:

CO Number	Course Outcome
CO1	Describe the theory and algorithms that are widely used in digital image processing
CO2	Apply a proper image enhancement technique for given a set of noisy images
CO3	Compare different image segmentation and compression techniques
CO4	Formulate solutions using morphological concepts
CO5	Develop any application using different image processing techniques

### Syllabus:

#### Unit 1: Digital Image Fundamental

Introduction – Steps in Digital Image Processing, Components, Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, Introduction to computational imaging, Basics of multi-resolution imaging, Concept of image metadata, Introduction to different color spaces (e.g., HSV, YCbCr)

#### Unit 2: Image Enhancement

Spatial Domain, Gray level transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Homomorphic filtering, Guided filtering, Detail enhancement techniques, Introduction to deep learning-based image enhancement (brief overview), Frequency Domain, Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters, Ideal, Butterworth and Gaussian filters, Wavelet transform for image enhancement, Directional filtering in the frequency domain, Short-Time Fourier Transform (STFT) for image analysis (brief introduction).

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### Unit 3: Image Restoration

Noise models, Mean filters, Order Statistics, Adaptive filters, Band reject, Band pass, Notch – Optimum notch filtering, Inverse Filtering, Constrained Least Square Filtering, Wiener filtering, Non-local means denoising, Block-matching and 3D filtering (BM3D) (brief introduction), Deep learning for image denoising (brief overview), Restoration in the presence of motion blur.

### Unit 4 : Image Segmentation & Representation

Segmentation – Detection of Discontinuities, Edge Linking and Boundary detection, Region based segmentation, Graph cuts for image segmentation, Active contour models (snakes) (brief introduction), Introduction to semantic segmentation using deep learning (brief overview), Representation – Boundary descriptors, Simple Descriptors, Shape numbers, Regional descriptors, Simple and Topological Descriptors, Scale-invariant feature transform (SIFT) (brief introduction), Histogram of Oriented Gradients (HOG) (brief introduction), Introduction to feature learning using convolutional neural networks (brief overview), Introduction to Image Processing Toolbox, Practice of Image Processing Toolbox, and Case studies–Various Image Processing Techniques, Using the toolbox for advanced segmentation and feature extraction tasks, Case studies involving deep learning-based image processing techniques alongside traditional methods.

### Unit 5 : Image applications

Medical imaging such as MRI and CT scan enhancement, tumor detection, and biomedical edge detection, remote sensing for land use classification, change detection, and vegetation indexing, and industrial applications like defect detection, barcode/QR recognition, and machine vision. It also explores document image analysis through OCR, skew correction, and signature verification, face and object recognition using OpenCV and feature descriptors like SIFT and ORB, security and surveillance through motion detection, background subtraction, and number plate recognition, and applications in augmented reality and gaming including marker-based AR, real-time filters, and gesture recognition.

### Text Books:

- Digital Image Processing. Gonzales R. C. & Woods R. E. 3rd Ed., Pearson Education.2010.
- Fundamentals of Digital Image Processing. Jain A. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing. Jayaraman S., Esaki R. S., Kumar T. V., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.
- Digital Image Processing Using MATLAB. Gonzalez R. C., Woods R. E., Eddins S. L., 3rd Ed. Tata McGraw Hill Pvt. Ltd, 2011.

### Reference Books:

- Digital Image Processing and analysis, Chanda B., Majumder D. D. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing and Pattern Recognition, Pakhira M. K., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.

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Programme	:	B.Tech.	Semester	:	VII
Name of the Course	:	Web Analytics Lab	Course Code:	:	SOE-B-CSE-22 -705(1)
Credits	:	1	No of Hours	:	2 Hrs. / Week
Max Marks	:	50			

### Course Descriptions:

This lab component provides hands-on experience in configuring, using, and interpreting web analytics tools. Students will work with platforms such as Google Analytics to analyze website performance, user behavior, and conversion effectiveness. Through practical exercises and mini-projects, they will apply analytical insights to optimize digital strategies and improve site performance.

### Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Set up and configure web analytics accounts and dashboards.
CO2	Implement tracking codes and goals on a sample website.
CO3	Analyze and interpret web traffic, user behavior, and conversion data.

The following Concepts/Experiments will be covered in the lab:

1. Introduction to Web Analytics Tools
  - Creating a Google Analytics account
  - Exploring dashboard and reports interface
2. Tracking Website Traffic
  - Implementing Google Analytics tracking code on a sample website
  - Analyzing real-time and audience overview reports
3. Setting Up Goals and Events
  - Creating goals for lead capture and form submissions
  - Tracking button clicks and external link clicks using event tracking
4. Traffic Source Analysis
  - Interpreting acquisition reports: Organic, Referral, Direct, Paid
  - Campaign tagging using UTM parameters
5. User Behavior Analysis
  - Studying behavior flow and site content performance
  - Analyzing bounce rate, average session duration, and pageviews
6. Conversion Funnel Setup
  - Creating a multi-step goal funnel (e.g., product checkout)
  - Identifying drop-off points in the conversion process
7. Heatmap and Session Recording Tools

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- Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd edition, Gatesmark Publishing, 2009.
- Wilhelm Burger and Mark J. Burge, Digital Image Processing: An Algorithmic Introduction Using Java (Texts in Computer Science), 1st edition, Springer, 2008.
- John C. Russ and F. Brent Neal, Introductory Digital Image Processing with MATLAB Imaging Toolboxes, 1st edition, CRC Press, 2008.

### Reference Books:

- Richard Szeliski, Computer Vision: Algorithms and Applications, 2nd edition, Springer, 2022.
- Milan Sonka, Vaclav Hlavac, and Roger Boyle, Image Processing, Analysis, and Machine Vision, 4th edition, Cengage Learning, 2014.
- Al Bovik (Editor), Handbook of Image and Video Processing, 2nd edition, Academic Press, 2005.
- John C. Russ, The Image Processing Handbook, 7th edition, CRC Press, 2016.
- Mark Nixon and Alberto S. Aguado, Feature Extraction and Image Processing for Computer Vision, 4th edition, Academic Press, 2019.

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Professional Development	Course Code:	HUM -B-SOE701
Credits	: 1	No of Hours	: 1 Hrs. / Week
Max Marks	: 50		

### Course Description:

This course will focus on concepts of 'Campus to Corporate' to bridge the industry-academia gap and make the students industry ready. The module will enhance the employability skills of the candidates by incorporating the required skill sets i.e. self-development, Wheel of life, Self-esteem, VUCA Coping skills, Emotional intelligence, stress management, growth mind-set etc. Students will also be taught methods on becoming a better version of themselves and assertive communicators. This will enable them to perform better during campus recruitment processes and enable them to crack the job interviews and group discussion organized by renowned corporate giants.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Achieving high level of awareness through wheel of life, emotional intelligence, self-esteem and personal resilience.
CO2	Understanding and analysing self and devising a strategy for self-growth and development.
CO3	Adapting a positive mind-set conducive for growth through optimism and constructive thinking.
CO4	Demonstrating employability skills before hiring managers through public speaking, group discussion, resume building, occupational research and personal interview.
CO5	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.

### Syllabus:

#### Unit -I Personal Development :

- Continuous Self development
- Wheel of life
- Conflict management
- Self esteem
- VUCA coping skills
- Emotional intelligence

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- Motivation and attitude
- Stress management
- Personal resilience

### Unit -II: Professional Development :

- Team building & leadership
- Self-Discovery
- SWOT analysis
- Leap to success
- Fostering positive communication
- Transactional analysis

### Unit -III: Career Development :

- Making business phone calls
- Public speaking
- Extempore speech
- Resume Building/ Cover Letter
- Occupational Research
- Group discussion (GD) and Personal Interviews Concept & Practice

### Unit -IV: Entrepreneurship Development :

- Personal finance and budget management
- Planning and strategy skills
- Problem solving
- Decision making
- Personal branding and impression management
- Executive/Officers like qualities
- Crossroads- A case study based presentation

### Text Books:

- Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education
- Tracy, Brian, Time Management (2018), Manjul Publishing House
- Hill, Napoleon, Think and grow rich (2014), Amazing Reads
- Scott, S.J., SMART goals made simple (2014), Createspace Independent Pub
- Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan
- Burne, Eric, Games People Play (2010), Penguin UK

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## Academic Semester VIII

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P) /2
			L	T	P	PRE**		ESE*	Total Marks	
						Mid Sem	TA			
CSE	SOE-B-CSE-22-801	Major Project	–	–	20	--	125	125	250	10
CSE	SOE-B-CSE-22-802(X)	Professional Elective VI	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-803(X)	Professional Elective VII	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-804	Distributed Computing	3	0	0	30	20	50	100	3
CSE	HUM-B-SOE801	Professional Development-II	0	0	2	0	15	10	25	1
CSE	SOE-B-CSE-22-805(X)	Professional Elective lab VI	0	0	2	0	30	20	50	1
		<b>Total</b>	<b>9</b>	<b>0</b>	<b>24</b>	<b>90</b>	<b>230</b>	<b>305</b>	<b>625</b>	<b>21</b>

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## Professional Elective - VI

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-802(1)	Full Stack Web Development
2	SOE-B-CSE-22-802(2)	Software Testing Methodologies
3	SOE-B-CSE-22-802(3)	BI and Analytics

## Professional Elective – VI Lab

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-805(1)	Full Stack Web Development Lab
2	SOE-B-CSE-22-805(2)	Software Testing Methodologies Lab
3	SOE-B-CSE-22-805(3)	BI and Analytics Lab

## Professional Elective – VII

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-803(1)	Augmented and Virtual Reality
2	SOE-B-CSE-22-803(2)	Wireless Sensor Network
3	SOE-B-CSE-22-803(3)	Software Project Management
4	SOE-B-CSE-22-803(4)	Human computer Interaction

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VII</b>
<b>Name of the Course</b>	<b>: Distributed Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-804</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces the fundamental concepts, principles, and techniques of distributed computing. It focuses on the design and implementation of distributed systems where components located on networked computers communicate and coordinate their actions by passing messages. Key topics include communication models, synchronization, consistency, fault tolerance, distributed file systems, and distributed algorithms. Through theoretical study and practical assignments, students will learn how to build scalable, reliable, and efficient distributed applications.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand models of distributed computing
CO2	Analyze algorithms for coordination, communication and synchronization in distributed systems
CO3	Analyze distributed shared memory models
CO4	Design and Implement distributed file systems
CO5	Design distributed algorithms for handling deadlocks

## Syllabus:

### Unit 1:

Introduction to DS, Message Passing, Leader Election, Distributed Models, Causality and Logical Time

### Unit 2:

Logical Time, Global State & Snapshot and Distributed Mutual Exclusion-Non-Token and Quorum based approaches

### Unit 3:

Distributed Mutual Exclusion-Token based approaches, Consensus & Agreement, Check pointing & Rollback Recovery

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## **Unit 4:**

Deadlock Detection, DSM and Distributed MST, Termination Detection, Message Ordering & Group Communication, Fault Tolerance and Self-Stabilization Distributed Randomized Algorithms, DHT and P2P Computing

## **Unit 5:**

Case Studies: GFS, HDFS, Map Reduce and Spark, Case Studies: Sensor Networks, Authentication & Security in DS

## **Text Books:**

- Ajay D. Kshemakalyani, Mukesh Singhal, "Distributed Computing", Cambridge University Press, 2008
- Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems - Principles and Paradigms", PHI, 2004

## **Reference Books:**

- Pradeep K. Sinha Distributed Operating Systems: Concepts and Design Publisher: PHI Learning
- Gerard Tel Introduction to Distributed Algorithms Publisher: Cambridge University Press
- M. L. Liu Distributed Computing: Principles and Applications Publisher: Pearson Education
- Randy Chow and Theodore Johnson Distributed Operating Systems and Algorithms Publisher: Addison-Wesley

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VIII</b>
<b>Name of the Course</b>	<b>: Full Stack Web Development</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-802(1)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course is designed to equip students with in-demand skills required for full-stack web development using the MERN (MongoDB, Express.js, React.js, and Node.js) stack. It covers both frontend and backend development, client-server interaction, database handling, RESTful API design, deployment, and version control. Through hands-on projects and industry-oriented practices, students will gain comprehensive expertise in building scalable and responsive web applications.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Develop responsive front-end web applications using HTML, CSS, JavaScript, and React.js.
CO2	Implement dynamic user interactions using React components, hooks, and routing.
CO3	Build robust backend systems with Node.js and Express.js, and create RESTful APIs.
CO4	Manage data with MongoDB and Mongoose, including authentication and security features.
CO5	Deploy and maintain full-stack applications using modern tools and CI/CD workflows.

## Syllabus:

### Unit 01: Front-End Fundamentals with HTML, CSS, and JavaScript

Introduction to Web Development and HTML5 , Styling with CSS (Flexbox, Grid, Media Queries) ,Bootstrap and Responsive Design Techniques ,JavaScript Basics: Variables, Data Types, Control Flow ,DOM Manipulation and Event Handling ,Git and GitHub: Version Control Essentials

### Unit 02: React.js and Component-Based Development

Introduction to React and JSX, React Components, Props, and State, Hooks: useState, useEffect, and Custom Hooks, React Router and Client-Side Routing, Context API and Lifecycle Methods, Building Reusable and Dynamic UI Components.

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## **Unit 03: Backend Development with Node.js and Express.js**

Node.js Basics and Event-Driven Architecture ,Express.js Framework and Middleware ,RESTful API Development and CRUD Operations ,Asynchronous Programming: Callbacks, Promises, Async/Await , Authentication and Authorization (JWT) , Error Handling and Security Best Practices.

## **Unit 04: Database with MongoDB and Mongoose**

Introduction to NoSQL and MongoDB, Creating Schemas and Models with Mongoose, CRUD Operations in MongoDB, Indexing, Aggregation, and Data Relationships, Authentication, Authorization, and Access Control, Backup, Data Migration, and Performance Optimization

## **Unit 05: State Management, Integration & Deployment**

State Management with Redux: Actions, Reducers, Store, Integration of Redux with React Applications, Testing REST APIs and Debugging, Project Work: MERN Stack Food Delivery App, Deployment with Netlify, Vercel, and Render, CI/CD Basics and Environment Configuration

### **Text Books:**

- “Learning React: Modern Patterns for Developing React Apps” by Alex Banks and Eve Porcello – O'Reilly.
- “Node.js, MongoDB and Angular Web Development” by Brad Dayley – Addison-Wesley.
- “Full-Stack React, TypeScript, and Node” by David Choi – Packt Publishing.

### **Reference Books:**

- “Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node” by Vasanth Subramanian – Apress.
- “Eloquent JavaScript” by Marijn Haverbeke – No Starch Press.
- Online Documentation & Tutorials: React.js, Node.js, Express.js, MongoDB official docs.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Software Testing Methodologies</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-802(2)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course introduces the fundamental principles and methodologies used in software testing to ensure the quality, reliability, and performance of software applications. It provides a systematic approach to testing by covering various functional and structural testing techniques, test planning, test case design, defect management, and software quality assurance. Students will learn about both manual and automated testing strategies and gain hands-on experience with widely used testing tools like Selenium and JUnit. The course also covers advanced testing techniques and integration with modern development practices such as agile and continuous integration. It prepares students to design effective test plans, detect and manage software defects, and contribute meaningfully to the software development lifecycle.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the role and importance of software testing in the software development lifecycle and differentiate between various testing methodologies.
CO2	Apply black-box and white-box testing techniques to design effective and comprehensive test cases.
CO3	Demonstrate the ability to conduct integration, system, and performance testing, and understand their application in real-world scenarios.
CO4	Develop and manage test plans, test cases, and defect tracking reports using standard templates and tools.

## Syllabus:

### Unit 1: Introduction to Software Testing

Importance of software testing, Software Development Life Cycle (SDLC) vs. Software Testing Life Cycle (STLC), Verification vs. Validation, Types of Testing: Manual, Automation, Static, Dynamic, Software testing principles and myths

### Unit 2: Functional Testing Techniques

Black-box testing techniques: Boundary Value Analysis (BVA), Equivalence Class Partitioning, Decision Table Testing, Cause-Effect Graphing, Requirement-based testing and positive/negative testing.

### **Unit 3: Structural (White-box) Testing Techniques**

Control flow testing, Statement coverage, Branch coverage, Condition coverage, Path coverage, Loop testing, Basis path testing, Cyclomatic complexity.

### **Unit 4: Integration and System Testing**

Top-down and bottom-up integration, Big Bang Integration, Drivers and stubs, System testing types: Performance Testing, Load Testing, Stress Testing, Security Testing, Compatibility Testing.

### **Unit 5: Test Planning and Management**

Test plan: objectives, scope, strategy, deliverables, Test case design: templates and management, Test metrics and measurements, Defect lifecycle and management, Bug tracking systems (e.g., JIRA, Bugzilla)

### **Text Books:**

- Software Testing Techniques – Boris Beizer
- Software Testing: Principles and Practices – Naresh Chauhan

### **Reference Books:**

- Foundations of Software Testing – Dorothy Graham, Erik van Veenendaal
- Online references and tool documentation (Selenium, JUnit, etc.)

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<b>Programme :</b>	<b>B. Tech.</b>	<b>Semester :</b>	<b>VIII</b>
<b>Name of the Course:</b>	<b>BI and Analytics</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-802(3)</b>
<b>Credits :</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs./week</b>
<b>Max Marks :</b>	<b>100</b>		

## Course Descriptions:

This course gives the fundamental description about Business Intelligence and technique for gathering, storing, analyzing, sharing and providing access to data, to help University Enterprise or any other organization to make a better decision

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Learn concept, process, and practice of the data science and how methodologies are applied to visualize information from raw data.
CO2	Learn BI involving predictive and statistical approach.
CO3	Implement BI techniques by using various tools and Create data visualization.
CO4	Implement and apply machine learning algorithms.
CO5	Select appropriate algorithms for solving a particular group of real-world problems.

## Syllabus:

### UNIT-I: An Overview of Business Intelligence, Analytics, and Decision Support

Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.

### UNIT-II: Performance Dashboard:

Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

### UNIT-III: Neural Networks and Sentiment Analysis

Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process., Sentiment Analysis, Speech Analytics.

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## **UNIT-IV: Model-Based Decision Making**

Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spread sheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons.

## **UNIT-V: Automated Decision Systems and Expert Systems**

Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

### **Text Books:**

- Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, Pearson.
- Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang, David King, “Business Intelligence and Analytics: System for Decision Support”, 10th Edition, Pearson Global Edition, 2013

### **Reference Books:**

- Hans-Georg Kemper and Henning Baars “Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT”.
- David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Augmented and Virtual Reality</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-803(1)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

The objective of this course is to provide a foundation to the fast growing field of AR and make the students aware of the various AR devices.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe how AR systems work and list the applications of AR.
CO2	Understand and analyses the hardware requirement of AR.
CO3	Use computer vision concepts for AR and describe AR techniques
CO4	Analyze and understand the working of various state of the art AR devices
CO5	Acquire knowledge of mixed reality

## Syllabus:

### Unit I: Introduction to Augmented Reality:

What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

### Unit II: Augmented Reality Hardware:

Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception, Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

### Unit III: Computer Vision for Augmented Reality & A.R. Software

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components

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for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

### **Unit IV: AR Techniques- Marker based & Markerless tracking:**

Marker-based approach- Introduction to marker-based tracking, types of markers, marker camera pose and identification, visual tracking, mathematical representation of matrix multiplication Marker types- Template markers, 2D barcode markers, imperceptible markers. Marker-less approach- Localization based augmentation, real world examples Tracking methods- Visual tracking, feature based tracking, hybrid tracking, and initialization and recovery

### **Unit V: AR Devices & Components & Introduction to Mixed reality:**

AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems, Introduction to mixed reality, Applications of mixed reality, Input and Output in Mixed reality, Computer Vision and Mixed Reality, simultaneous localization and mapping (SLAM), variants of SLAM

### **Text Books:**

- Allan Fowler-AR Game Developmentll, 1st Edition, A press Publications, 2018, ISBN 978-1484236178 2.
- Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition

### **Reference Books:**

- Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
- Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

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<b>Programme :</b>	<b>B.Tech.</b>	<b>Semester :</b>	<b>VIII</b>
<b>Name of the Course :</b>	<b>Wireless Sensor Network</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-803(2)</b>
<b>Credits :</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs/Week</b>
<b>Max Marks :</b>	<b>100</b>		

## **Course Description:**

The goal of this course is to introduce the students to wireless network protocols and architecture. This course covers the various aspects of wireless networking such as: fundamentals of cellular communication, mobile radio propagation, multiple access techniques, mobile ad-hoc networks and routing in wireless and mobile networks. With the increased availability of low-cost micro-electromechanical system (MEMS) devices, several applications of networked sensors and actuators have gathered interest in recent times. Such networks are called Wireless Sensor Networks (WSNs) and they need special algorithms and software owing to the resource-constrained nature of the devices that constitute them. This course starts with a brief introduction of WSNs. It then introduces the concepts of localization and time synchronization and methods to perform them in WSNs. After examining the issues in medium access control, routing, transport and application layers in WSNs, the most important algorithms for WSNs in each of these layers are discussed. Finally, WSN middleware and operating systems are introduced with examples.

## **Course Outcomes:**

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe the overview of wireless sensor networks and enabling technologies for wireless sensor networks (L2)
CO2	Analyze Network Architectures and sensor node hardware/software platforms
CO3	Comprehend network architecture principles and design goals, service interfaces, and gateway concepts in sensor networks.
CO4	Evaluate the performance and characteristics of Medium Access Control (MAC) protocols in wireless sensor networks.
CO5	Understand the physical layer and network layer protocols, including routing strategies, signal propagation, and encoding techniques.

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### **Syllabus:**

#### **Unit-I: Overview Of Wireless Sensor Networks**

Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.

#### **Unit-II: Architectures**

Network Architecture-Sensor Networks - Scenarios-Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals ,Gateway Concepts, Operating Systems and Execution Environments-Introduction To Tiny OS and nes C-Internet to WSN Communication

#### **Unit-III: Networking Sensors**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment to fMAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.

#### **Unit-IV: Infrastructure Establishment**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control

#### **Unit-V: Sensor Network Platforms And Tools:**

Sensor Node Hardware-Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming

#### **Text Books:**

- Wireless communication & networking by Mark & Zuang, PHI.
- Wireless Communications and networks, William Stallings, PHI.

#### **Reference Books:**

- Wireless network performance handbook, by Smith, McGraw-Hill.
- Principles of wireless networks, by Pahlavan, PHI.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Software Project Management</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-803(3)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course will enable students to understand the fundamental principles of software project management with a good knowledge of responsibilities of project manager. Also, to be familiar with the different methods and techniques used for project management.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Apply project management concepts and techniques to an IT project.
CO2	Apply Key project management system techniques like PERT, CRM.
CO3	Explain project management in terms of the software development process.
CO4	Use of Project Management Tools and Techniques
CO5	Apply project management concepts through working in a group as team leader.

## Syllabus:

### Unit-I: Introduction to software project management

Definition and importance of software project management, Software vs. conventional projects, Project life cycle, Roles of a software project manager, Project success and failure factor

### Unit-II: Software Development Team

Three Vital Aspects of Software Project Management - The Team - Meaning of Leadership - Communicating in Harmony - Personality traits - Project Organizations. Project Planning: Top-Down and Bottom-Up Planning - Types of Activity - Project Duration: Schedule Monitoring Tools - Gantt Chart, PERT Chart, Critical Path.

### Unit-III: Software Coding

Programming principles and coding guidelines - method of incrementally developing code - managing the evolving code Testing - Unit testing and Code Inspection - Testing concepts and testing process - Design of Test case and Test plan - Black-box testing - White box testing.

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## **Unit-IV: Project Management Tools and Techniques**

Tools for scheduling (MS Project, OpenProject), Version control and collaboration tools (Git, Jira), Project communication and documentation tools, Case studies and practical applications.

## **Unit-V: Software Project Management Framework**

Methods to estimate project time and cost, Resource Management, Identification, Analysis, mitigation, and monitoring of Project Risks - Ensuring Project quality and quality management, Configuration Management, Change management, CMMI, different levels and need of accreditation.

### **Text Books:**

- Software Engineering, A Precise Approach: Pankaj Jalote, Wiley India-2010.
- Software Project Management: Saikat Dutt /S. Chandramouli, Pearson-Second Edition.

### **Reference Books:**

- Software Engineering: Ian Sommerville, Pearson, Ninth Edition.
- Software Engineering a practitioner's approach – Roger S Pressman, Seventh Edition.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: Final</b>
<b>Name of the Course</b>	<b>: Human-Computer Interaction</b>	<b>Course Code:</b>	<b>SOE-B-CSE-21-F03(1)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs/Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces students to the core theories and practices of Human-Computer Interaction (HCI). As an interdisciplinary domain, HCI blends cognitive psychology, neurocognitive engineering, human factors, computer science, and design thinking. Students will gain theoretical knowledge and practical experience regarding human perception, cognition, and learning in the context of interactive systems, enabling them to design, implement, and evaluate effective user interfaces.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the physiological, perceptual, and cognitive components of human learning and memory.
CO2	Acquire theoretical and practical skills in designing and implementing user interfaces.
CO3	Analyze interaction problems from technical, cognitive, and functional perspectives.
CO4	Develop awareness of general HCI challenges when designing information and interactive systems.
CO5	Explore multimodal interfaces, including visual, auditory, and tactile displays for information presentation.

## Syllabus:

### Unit I: Introduction to HCI

Definition, History and Evolution, Relationship to Ergonomics and Human Factors, Key Challenges and Themes in HCI, Human vs. Computer: Philosophy of Mind, Brain vs. Circuit Models, Human Memory Systems: Sensory Buffers (iconic, echoic, haptic), Working Memory, Long-Term Memory, Memory and HCI: Enhancing Recall and Recognition, Reasoning, Logic Structures, and Impact on Interface Design

### Unit II: Sensation, Perception, and Cognition

User as an Information Processing System, Basics of Human Sensation, Perception, and Cognition, Psychophysics, Problem Solving, Reasoning Models, Human Error and Interface

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Design Challenges, Understanding User Needs and Thought Processes, Evaluation Techniques: Expert Analysis (Cognitive Walkthroughs, Heuristic Evaluation), User Participation Methods (Observation, Query Techniques, Physiological Recording), Empirical and Experimental Research Methods in HCI: Hypothesis Testing, Sampling, Experimental Designs.

### **Unit III: Vision and Audition**

Visual Displays: Sensation, Perception, and Cognitive Aspects, Visual Illusions, Design Guidelines (Typography, Color, Iconography, Layout Principles), Auditory Interfaces: Hearing Physiology, Perception, Text-to-Speech (TTS) and Speech Recognition Systems, Designing Effective Auditory Displays: Verbal vs. 3D Spatial Sound

### **Unit IV: Brain-Computer Interfaces (BCI) and Haptics**

Introduction to BCIs and Brain Plasticity, Neu ergonomics and Neurocognitive Engineering, Applications: Medical (Neuro-prosthetics) and Commercial BCIs, Sensory Substitution Devices: Design and Theories, Touch Interfaces and Haptic Technology: Cutaneous, Kinesthetic, and Haptic Subsystems, Mechanoreceptors and Exploratory Procedures in Haptic Design, Force-feedback, Vibrotactile, and Cutaneous Device Applications

### **Unit V: Virtual and Augmented Reality (VR/AR)**

Virtual Reality (VR): Technologies, Benefits, and Challenges, Augmented Reality (AR): Concepts and Applications, Ubiquitous Computing and Ambient Intelligence, Wearable Devices and Miniaturized Platforms, Use Cases and Emerging Trends (e.g., Spatial Computing, Context-Aware Systems)

### **Text Books:**

- Shneiderman, Plaisant, Cohen, and Jacobs, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th Edition, Addison Wesley.
- Dix, Finlay, Abowd, and Beale, Human-Computer Interaction, 3rd Edition, Pearson Education.
- Wickens, Lee, Liu, and Gordon-Becker, Introduction to Human Factors Engineering, 2nd Edition, Pearson.

### **Reference Books:**

- Rajendra Kumar, Human-Computer Interaction, Laxmi Publications, 2nd Edition.
- Tan, D.S., & Nijholt, A., Brain-Computer Interfaces: Applying Our Minds to Human-Computer Interaction.
- K. Meena & R. Sivakumar, Human-Computer Interaction, PHI Learning.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Full Stack Web Development Lab</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-805(1)</b>
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab course complements the theory of Full Stack Web Development using the MERN stack. It provides hands-on experience in developing modern, scalable web applications. Students will work on real-world problems, covering frontend design using React.js, backend services with Node.js and Express.js, and database management with MongoDB. The course emphasizes project-based learning to build a complete MERN application with deployment.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Build responsive front-end interfaces using HTML, CSS, and JavaScript.
CO2	Create dynamic web applications using React.js and state management tools.
CO3	Design and implement RESTful APIs and integrate them with MongoDB.

## The following Concepts/Experiments will be covered in the lab:

- **Experiment 1:** Create a personal portfolio website using HTML5, CSS3, and Bootstrap  
*Focus: Frontend structure, styling, and responsive layout*
- **Experiment 2:** Build an interactive to-do list using JavaScript  
*Focus: DOM manipulation, events, and local storage*
- **Experiment 3:** Develop a basic React application with functional components  
*Focus: JSX, component props, and conditional rendering*
- **Experiment 4:** Implement React Hooks (useState, useEffect) in a task tracker  
*Focus: State management and side effects*
- **Experiment 5:** Create a multi-page React application using React Router  
*Focus: Routing, navigation, and component structure*
- **Experiment 6:** Develop a RESTful API with Node.js and Express.js  
*Focus: Routing, middleware, and CRUD operations*
- **Experiment 7:** Connect MongoDB with Node.js using Mongoose  
*Focus: Schema design, database connection, and CRUD*

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- **Experiment 8:** Implement JWT-based authentication for a MERN app  
*Focus: Login, protected routes, token storage*
- **Experiment 9:** Integrate Redux in a React application for state management  
*Focus: Actions, reducers, store configuration*
- **Experiment 10:** Deploy a MERN stack application on cloud platforms  
*Focus: Build optimization, hosting, CI/CD basics*

### Text Books:

- “Full-Stack React Projects” by Shama Hoque – Packt Publishing
- “Learning React” by Alex Banks & Eve Porcello – O’Reilly
- “Node.js, MongoDB, and Angular Web Development” by Brad Dayley – Addison-Wesley

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VIII</b>
<b>Name of the Course</b>	<b>: Software Testing Methodologies Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-805(2)</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours</b>	<b>: 2 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Description:

This laboratory course is designed to provide hands-on experience with key software testing techniques and tools used in industry. Students will learn to design, write, and execute test cases using both manual and automated testing approaches. The lab emphasizes black-box and white-box testing methods, test case documentation, integration testing, and the use of industry-standard tools such as JUnit for unit testing, Selenium WebDriver for automation, and Bugzilla/JIRA for defect tracking. By engaging in practical testing scenarios, students will gain the technical skills needed to ensure software quality, reliability, and performance in real-world development environments.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Design and implement test cases using black-box and white-box testing techniques.
CO2	Perform manual testing on software applications and identify bugs or anomalies.
CO3	Use JUnit to develop and execute unit test cases for Java-based applications.
CO4	Automate web-based application testing using Selenium WebDriver.
CO5	Report and manage software defects using bug tracking tools like Bugzilla or JIRA.

## Lab Experiments:

- **Study of Software Testing Life Cycle (STLC)**
  - Understand phases: Requirement Analysis, Test Planning, Test Case Design, Test Execution, Defect Logging, and Closure.
- **Write Test Cases for a Simple Application**
  - Test case design using BVA (Boundary Value Analysis)
  - Equivalence Class Partitioning
- **Decision Table and State Transition Testing**
  - Generate test cases from decision tables
  - Create and test a state transition diagram
- **White-box Testing**

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- Code walkthrough and dry run
- Control flow testing using statement, branch, and path coverage
- **Integration Testing using Stubs and Drivers**
  - Top-down and bottom-up integration

### **Text Books:**

- Software Testing Techniques – Boris Beizer
- Software Testing: Principles and Practices – Naresh Chauhan

### **Reference Books:**

- Foundations of Software Testing – Dorothy Graham, Erik van Veenendaal
- Online references and tool documentation (Selenium, JUnit, etc.)

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<b>Programme</b>	<b>:</b>	<b>B. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course:</b>	<b>BI and Analytics Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-805(3)</b>		
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Description:

This course is about the implementation of basic machine learning algorithms. Students will learn to create machine learning models.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Understand the implementation procedures for the machine learning algorithms
CO2	Construct machine learning models based on the attributes of applications and datasets
CO3	Understand different metrics for evaluation of machine learning models

## The following concepts will be covered in the lab:

- Executive dashboard design for a given business analytics scenario using Tableau Public.
- Generate visual analytics for a given business tasks and data using Tableau Public.
- Enhancing customer experience with predictive analytics and data mining by taking suitable business scenario (Use Weka/RapidMiner/Spark/R/Microsoft power BI).
- Cluster analysis using k-means algorithm for a given customer data set (use Python/R/any other tool).
- Identify frequent item sets using the Apriori algorithm for a given transaction data set (use Python/R/any other tool).
- Use a dataset of customer product reviews (e.g., Amazon reviews) to classify the sentiment of each review as positive, negative, or neutral using a pre-trained machine learning model (e.g., Naïve Bayes). Evaluate the accuracy of your sentiment classifier. (use Python/R/any other tool).
- Use text mining techniques to analyse a collection of news articles. Identify the most frequent terms and
- perform topic modelling using Latent Dirichlet Allocation (LDA) to find hidden topics within the articles. (use Python/R/any other tool).
- Given a dataset representing a social network (e.g., Twitter follower data), create a graph and perform Social Network Analysis (SNA) to find the most influential users using centrality measures like degree, closeness, and between centrality. (use Python/R/any other tool).

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## **Text Books:**

- David Poole, Alan Mackworth, Randy Goebel, “Computational Intelligence: a logical approach”, Oxford University Press.
- R. O. Duda, P. E. Hart and D.G. Stork, “Pattern Classification”, John Wiley, 2001.
- G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem-solving”, Fourth Edition, Pearson Education.
- Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective, Morgan Kaufmann (Elsevier), 2016.
- Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence - Computational Frameworks, Practices, and Applications, CRC Press, 2023.
- Ira J. Haimowitz, DATA ANALYTICS FOR BUSINESS - Lessons for Sales, Marketing, and Strategy, Routledge (Taylor & Francis), 2023.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VIII</b>
<b>Name of the Course</b>	<b>: Professional Development</b>	<b>Course Code:</b>	<b>HUM-B-SOE801</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>1 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Description:

In this course, students will be taught to apply design thinking, interpersonal skills, empathy, group decision making, problem solving, business development engineering, professional networking, work-life balance etc., Since they would be venturing into the corporate world. Special emphasis will also be given to maintaining professional work space, earning recognition and handling difficult interpersonal relations.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Achieving high level of awareness through empathy, work-life balance and interpersonal skills
CO2	Understanding and applying design thinking and professional work ethics & networking for self-growth and professional development.
CO3	Organizing and conducting academic and professional events
CO4	Demonstrating employability skills before hiring managers through public speaking, group discussion, resume building, occupational research and personal interview.
CO5	Applying industry readiness strategies to survive in VUCA world.

## Syllabus:

### Unit-I Idea Building:

- Ideathon
- Design Thinking & Budgeting
- Group Decision Making and Problem Solving
- Selling Yourself.

### Unit-II: Managing Client/Customer Relations:

- Organizing meetings
- Professional Events
- Handling Difficult Clients/Customers
- Networking Professionally
- Business Development Engineering

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### **Unit-III: Professional Work Ethics:**

- Work life Balance
- Empathy
- Maintaining Professional Workspace
- Earning Recognition
- Handling Difficult interpersonal situations

### **Unit-IV: Industry Readiness:**

- Video Resumes
- Mock GD
- Mock PI
- Campus Recruitment Test (Non Tech)
- Cross Roads Case Study Based Team Presentation.

### **Text Books:**

- Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education
- Burne, Eric, Games People Play (2010), Penguin UK
- Carnegie, Dale, How to Win Friends and Influence People (2004), RHUK
- Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan
- Steinburg, Scott, Netiquette Essentials (2013), Lulu.com

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## Academic Semester V

Type of Course	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit
			L	P	T	PRE**		ESE*	Total Marks	L+(T+P)/2
						Mid Sem	TA			
CC	SOE-B-CSE-23-501	Analysis & Design of Algorithm	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-502(X)	Department Specific Elective – II	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-503(X)	Department Specific Elective – III	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-504(X)	Department Specific Elective – IV	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-505	Cloud Computing	3	0	0	30	20	50	100	3
SEC	SOE-B-CSE-23-506	Internet Technology – I (HTML, PHP, CSS)	0	4	0	--	30	20	50	2
CC	SOE-B-CSE-23-507	Analysis & Design of Algorithm Lab	0	2	0	--	30	20	50	1
DSE	SOE-B-CSE-23-508(X)	Department Specific Elective – II Lab	0	2	0	--	30	20	50	1
CC	SOE-B-CSE-23-509	Cloud Computing Lab	0	2	0	--	30	20	50	1
GEC	SOE-B-CSE-23-510	Generic Elective – II (MOOC / SWAYAM/Any other online platform)	0	2	0	--	30	20	50	2
AECC	SOE-B-CSE-23-511	Professional Development-I	0	2	0	--	30	20	50	1
		Total	15	14	0	150	280	370	800	23

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<b>Subject Code</b>	<b>Department Specific Elective (DSE) - II</b>
SOE-B-CSE-23-502(1)	Deep Learning
SOE-B-CSE-23-502(2)	Business Intelligence
SOE-B-CSE-23-502(3)	Scripting Language

<b>Subject Code</b>	<b>Department Specific Elective (DSE) - II Lab</b>
SOE-B-CSE-23-508(1)	Deep Learning Lab
SOE-B-CSE-23-508(2)	Business Intelligence Lab
SOE-B-CSE-23-508(3)	Scripting Language Lab

<b>Subject Code</b>	<b>Department Specific Elective (DSE) - III</b>
SOE-B-CSE-23-503(1)	Operation Research
SOE-B-CSE-23-503(2)	Compiler Design
SOE-B-CSE-23-503(3)	Computer Graphics

<b>Subject Code</b>	<b>Department Specific Elective (DSE) - IV</b>
SOE-B-CSE-23-504(1)	Graph Theory
SOE-B-CSE-23-504(2)	Digital Marketing
SOE-B-CSE-23-504(3)	Quantum Computing

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Analysis &amp; Design of Algorithm</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-501</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course aims to provide the fundamentals of algorithm design and analysis, specifically in terms of algorithm design techniques, application of these design techniques for real-world problem solving and analysis of complexity and correctness of algorithms.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Evaluate the correctness and analyze complexity of algorithms.
CO2	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
CO3	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
CO4	Describe the dynamic-programming and backtracking paradigms and explain when an algorithmic design situation calls for them. For given problems of dynamic-programming/ backtracking and develop the dynamic programming/ backtracing algorithms, and analyze them to determine its computational complexity.
CO5	To understand the differences between tractable and intractable problems and introduce P and NP Class.

## Syllabus:

### Unit-I Introduction:

Algorithm, Properties, Representations of Algorithms and Testing Algorithms, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations-Big Oh Notation, Omega Notation, Theta Notation and Little Oh Notation, Mathematical background for algorithm analysis, analysis of selection sort, insertion sort. Solving Recurrence Relations-Substitution Method, Master Method and Recursion Tree Methods. Fibonacci Heap, Binomial Heap.

### Unit-II: Divide and Conquer:

Divide and Conquer Approach: General method, Analysis of Merge sort, Analysis of Quick sort, Analysis of Binary search, Finding minimum and maximum algorithm and analysis, Strassen's matrix multiplication

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## **Unit-III: Greedy Approach:**

Greedy Method: General Method, Applications-0/1 Knapsack Problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees – Kruskal and Prim’s algorithm, Optimal storage on tapes, Single source shortest path problem

## **Unit-IV: Dynamic Programming:**

General Method, Multistage graphs, single source shortest path, all pair shortest path, Assembly-line scheduling, 0/1 knapsack, Travelling salesman problem, Longest common subsequence, Matrix Chain Multiplication, optimal binary search trees.

## **Unit-V: Backtracking:**

General Method, Applications- n – queen’s problem, Sum of subsets problem, Graph Coloring, Hamiltonian Cycle NP-Hard and NP-Complete Problems: Basic Concepts, Non-Deterministic Algorithms, NP-Hard and NP-Complete Classes, Cook’s Theorem

## **Text Books:**

- Ellis Horowitz, Sartaj Sahni and S. Rajasekharan, “Fundamentals of Computer Algorithms”, 2nd Edition, Universities Press.
- T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, “Introduction to Algorithms”, 3rd Edition, PHI.
- P. H. Dave, H.B. Dave, “Design and Analysis of Algorithms”, 2nd edition, Pearson Education.

## **Reference Text Books:**

- M. T. Goodrich and R. Tomassia, “Algorithm Design: Foundations, Analysis and Internet examples”, John Wiley and sons.
- S. Sridhar, “Design and Analysis of Algorithms”, Oxford Univ. Press.
- Aho, Ullman and Hopcroft, “Design and Analysis of algorithms”, Pearson Education.
- R. Neapolitan and K. Imipour, “Foundations of Algorithms”, 4th edition, Jones and Bartlett Student edition.

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<b>Programme</b>	<b>: B. Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course:</b>	<b>Deep Learning</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-502(1)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs./week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Gain the knowledge about neural networks.
CO2	Introduce the basic concepts and techniques of deep learning.
CO3	Apply optimization techniques in in real life applications.
CO4	Develop the skills in deep learning for solving practical problems. To be familiar with a set of well-known deep neural network, convolutional neural network, filters optimization techniques.
CO5	Apply RNN and LSTM for sentiment analysis

## Syllabus:

### UNIT-I: Basics of Neural Networks

Biological Neuron, idea of computational units, McCulloch–Pitts unit and thresholding logic, linear perceptron, perceptron learning algorithm, linear separability, convergence theorem for perceptron learning algorithm, limitations of single-layer perceptron, introduction to activation functions (Sigmoid, Tanh, ReLU), bias term and its significance.

### UNIT-II: Feedforward Networks and Deep Neural Networks

Multilayer perceptron, gradient descent, backpropagation, empirical risk minimization, regularization, autoencoders, difficulty of training deep neural networks, greedy layer-wise training, role of initialization and activation in deep networks, batch vs stochastic gradient

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descent, mini-batch gradient descent, variants of autoencoders (denoising, sparse, variational - brief introduction).

### **UNIT-III: Optimization in Deep Neural Networks**

Newer optimization methods for neural networks (Adagrad, Adadelata, RMSProp, Adam, Nesterov Accelerated Gradient), second-order methods for training, saddle point problem in neural networks, regularization methods (dropout, drop connect, batch normalization), learning rate schedules (step decay, cosine annealing, warm restarts), gradient clipping in deep networks, early stopping as regularization.

### **UNIT-IV: Recurrent Neural Networks**

Backpropagation through time, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), bidirectional LSTMs, bidirectional RNNs, applications of RNNs (language modeling, sequence prediction), attention mechanism (brief introduction), comparison of LSTM and GRU architectures.

### **UNIT-V: Convolutional Neural Networks**

Convolution in n-dimensions, convolutional layers, pooling strategies, visualization of filters, padding and stride, parameter calculation in CNNs, overview of modern CNN architectures (LeNet, AlexNet, VGG, ResNet - brief), transfer learning and pre-trained CNN models (basic concept).

### **Text Books:**

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

### **Reference Books:**

2. Raúl Rojas, “Neural Networks: A Systematic Introduction”, 1996.
3. Christopher Bishop , “Pattern Recognition and Machine Learning”, 2007.

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<b>Programme</b>	<b>: B. Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course:</b>	<b>Business Intelligence</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-502(2)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs./week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Descriptions:

This course gives the fundamental description about Business Intelligence and technique for gathering, storing, analyzing, sharing and providing access to data, to help University Enterprise or any other organization to make a better decision

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Learn concept, process, and practice of the data science and how methodologies are applied to visualize information from raw data.
CO2	Learn BI involving predictive and statistical approach.
CO3	Implement BI techniques by using various tools and Create data visualization.
CO4	Learn Business intelligence applications
CO5	Knowledge Management

## Syllabus:

### Unit-I

Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system

### Unit-II:

Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models Data mining: Definition of data mining, Representation of input data , Data mining process, Analysis methodologies Data preparation: Data validation, Data transformation, Data reduction

### Unit-III:

Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models

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## **Unit-IV:**

Business intelligence applications: Marketing models: Relational marketing, Sales force management, Logistic and production models: Supply chain optimization, Optimization models for logistics planning, Revenue management systems. Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices

## **Unit-V:**

Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems

## **Text Books:**

- Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, Pearson.
- Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang, David King, “Business Intelligence and Analytics: System for Decision Support”, 10th Edition, Pearson Global Edition, 2013

## **Reference Books:**

- Hans-Georg Kemper and Henning Baars “Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT”.
- David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Scripting Language</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-502(3)</b>	
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course introduces students to widely-used scripting languages to automate tasks, process data, and develop lightweight applications. It emphasizes practical programming in Python, JavaScript, and Shell scripting, covering fundamental syntax, regular expressions, file handling, web scripting, APIs, and basic automation. The course prepares students to write efficient scripts for system administration, web development, and data processing tasks.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the syntax, data structures, and control flow of scripting languages like Python and JavaScript
CO2	Perform file I/O operations and regular expression-based text processing
CO3	Use scripting to automate tasks in system administration and web development
CO4	Develop simple web-based applications using JavaScript and APIs
CO5	Integrate scripting with databases and use libraries for common tasks like data parsing and visualization

## Syllabus:

### Unit 1: Introduction to Scripting Languages

Definition and advantages of scripting, Difference between scripting and programming languages, Overview of popular scripting languages (Python, JavaScript, Shell), Use cases in system automation, web development, and data processing

### Unit 2: Python Scripting

Python syntax, variables, data types, operators, Control structures (if, for, while) , Functions, modules, and packages, File handling and exception handling, Regular expressions and JSON parsing.

### Unit 3: JavaScript for Web Scripting

Basics of JavaScript: syntax, variables, operators, functions, DOM manipulation and event handling, Form validation using JavaScript, AJAX and fetch API, ES6+ features (arrow functions, promises, let/const).

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## **Unit 4: Shell Scripting (Bash)**

Shell environment and commands, Writing and executing shell scripts, Conditional statements, loops, and functions in shell, File handling and command-line arguments, Scheduling jobs using corn, process management.

## **Unit 5: Scripting for Automation and Integration**

Using scripting languages for system automation, API calls and data retrieval, working with databases using Python (SQLite/MySQL), Web scraping using Python (BeautifulSoup/Requests), Scripting for data visualization (Matplotlib/Seaborn basics).

### **Text Books:**

- "Learning Python" by Mark Lutz, O'Reilly Media
- "Eloquent JavaScript" by Marijn Haverbeke
- "Classic Shell Scripting" by Arnold Robbins & Nelson Beebe

### **Reference Books:**

- "Python Cookbook" by David Beazley & Brian K. Jones
- "JavaScript: The Good Parts" by Douglas Crockford
- "UNIX and Shell Programming" by Behrouz Forouzan

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Operation Research</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-23-503(1)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

The course enables the students to the nature and scope of various decision making situations within business contexts, understand and apply operation research techniques to industrial applications, To make the student capable of Formulating the various real life decision making problems as Mathematical programming problems. Students to learn the fundamental Techniques of Operations Research and to choose a suitable OR technique to solve problem on hand.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Create mathematical models of the real-life situations and capable of obtaining best solution using Graphical Method and Simplex Method.
CO2	Implement the theory of duality for simplifying the solution procedure for certain LPPs, and solve the special cases of LPP such as Transportation and Assignment problems.
CO3	Gain knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition.
CO4	Apply different techniques to represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project, Probabilities of completing Projects.
CO5	Applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems.

## Syllabus:

### Unit I: Introduction Linear Programming -1 :

OR definition- Classification of Models - Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two-Phase Simplex Method, Big-M Method, Special Cases of LP-Degeneracy, Infeasibility and Multiple Optimal Solutions;.

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## **Unit II: Linear Programming -2:**

Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method, Transportation Problem - Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method; Special Cases - Unbalanced Transportation Problem, Degenerate Problem; Assignment Problem - Formulation; Optimal Solution -Traveling Salesman problem.

## **Unit III: Game Theory & Queuing Theory**

Induction - Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy -Games with Mixed Strategies - 2 X 2 Games - Dominance, Principle- Solution by Graphical Method of  $m \times 2$  &  $2 \times n$  games.

**Queuing Theory:** Introduction -Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length;

## **Unit IV: PERT & CPM:**

Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float- CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration- PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time.

## **Unit V: Dynamic Programming:**

Introduction - Bellman's Principle of Optimality - Applications of Dynamic Programming- Capital Budgeting Problem - Shortest Path Problem - Solution of Linear Programming Problem by DP.

## **Text Books:**

- Introduction to Operations Research, H.A.Taha, PHI, 10th edition, 2013.
- Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, Preetam Basu, Gerald J. Lieberman, TMH.

## **Reference Books:**

- Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
- Operations Research, Wagner, PHI Publications.
- Operation Research, J.K.Sharma, MacMillan,

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Compiler Design</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-</b>	<b>503(2)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

The aim of this course is to learn how to design and implement a compiler and also to study the underlying theories. The main emphasis is for the imperative languages. This study explains the principles, techniques and tools required in developing compilers in a systematic way; To gain an understanding on different theoretical and systems concepts from computer science coming together in building a compiler.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Design and implement of a prototype compiler.
CO2	Define a grammar for a language and validation.
CO3	Generate Three address code of a grammar.
CO4	Learn about storage allocation.
CO5	Apply various optimization techniques to produce efficient code.

## Syllabus:

### Unit I: Introduction To Compilers:

Language Processor, Definition of Compiler, Analysis-Synthesis Model, Phases of Compiler, The Science of Building Compilers, Applications of Language Processors, Basic Understanding of Interpreter and Assembler, Difference between Interpreter and Compiler, Compilation of Source Code Into Target Language, Cousins of Compiler, Types of Compiler.

### Unit II: Lexical Analysis

The Role of the lexical Analyzer, Specifications of tokens, Recognition of Tokens, Input Buffering, Elementary Scanner Design and its Implementation (Lex), Design of Lexical Analyzer Generator, Optimization of DFA.

### Unit III: Syntax Analysis

Understanding Parser and CFG(Context Free Grammars), Top Down and Bottom Up Parsing Algorithms, Top-Down Parsing- Recursive Descent Parser, Predictive LL(l) parsing, Bottom Up Parsing- Shift Reduce Parser, LR Parsers, Simple LR Parsing (SLR), LR(k) Parser, LALR Parser, Comparison of LR Parsers.

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## **Unit IV: Runtime Environment**

Storage organization, activation tree, activation record, allocation strategies, Parameter passing, symbol table, dynamic storage allocation.

## **Unit V: Code Optimization & Code Generation:**

Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Global data flow analysis, Loop invariant computations. Issues in the design of Code generator, register allocation, the target machine and a simple code generator.

## **Text Books:**

- Compiler-Principles, Techniques and Tools by Alfred V.Aho, Ravi Sethi and J. D. Ullman, Addison Wesley.
- Principles of Compiler Design, Alfred V. Aho and J.D.Ullman, Narosa Publication.

## **Reference Books:**

- Compiler Design in C by A.C. Holub, Prentice Hall of India.
- Compiler Construction (Theory and Practice) by A.Barret William and R.M.Bates (Galgotia Publication)
- Compiler Design, Kakde, Compiler Design, Galgotia Publication.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Computer Graphics</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-503(3)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## **Course Description:**

The objectives of this course are to equip students with the fundamental knowledge and basic technical competence in the field of computer graphics, emphasize on implementation aspect of Computer Graphics Algorithms and advance areas like Image Processing. Topics covered include graphics systems and input devices; geometric representations and 2D/3D transformations; viewing and projections; illumination and color models; animation; rendering and implementation; visible surface detection.

## **Course Outcomes:**

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matrix, Fundamental circuit matrix and rank of Circuit matrix. Cut – set matrix. AUnit IV:  
Runtime Environment

### **Unit IV: Coloring and Dominating sets:**

Definition of Chromatic number. Chromatic Partitioning. Chromatic Polynomial. Finding Chromatic polynomial by Decomposition Theorem and by Multiplication Theorem (without Proofs). Dominating set. Minimal Dominating set. Domination number. Independent dominating set. Finding minimal dominating sets. Some applications of domination theory.

### **Unit V: Graph Theoretic Algorithms and its applications**

Computer representation of a graph. Algorithm on spanning trees: Kruskal's and Prim's Algorithm. Shortest path algorithms: Shortest path from a specified vertex to another specified vertex by Dijkstra's algorithm, Shortest path between all pairs of vertices. Warshall's algorithm

### **Text Books:**

- Graph Theory with applications to engineering and computer Science by Narasingh Deo, Edition, Prentice hall of India Private Limited, 2009. ISBN: 9788120301450.
- Discrete and Combinatorial Mathematics, Ralph P. Grimaldi., 5th Edition , Pearson, 2006, ISBN: 9788177584240.

### **Reference Books:**

- Graph Theory, Modeling, Applications and Algorithms, Geir Agnarsson and Raymond Green law, 1st Edition, Pearson Education, Inc, New Delhi 2009.
- A First Look at Graph Theory, John Clark and Holton D.A, Allied Publishers, 2001.
- Introduction to Graph Theory, Douglas B West, Prentice hall of India Private Limited, New Delhi

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Digital Marketing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-504(2)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The objective of this course is to provide students with in-depth knowledge of digital marketing concepts, tools, and techniques. It focuses on enhancing practical skills through strategic use of social media, SEO, SEM, email marketing, content marketing, and web analytics. The course aims to prepare students to implement and evaluate digital marketing campaigns and understand their impact on consumer behavior and business growth.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the fundamental concepts and evolution of digital marketing.
CO2	Demonstrate knowledge of digital tools such as SEO, SEM, email marketing, and content marketing.
CO3	Analyze and develop digital marketing strategies for branding and promotion.
CO4	Use social media platforms and tools to design and manage campaigns.
CO5	Apply analytics and performance metrics to evaluate digital marketing effectiveness.

## Syllabus:

### Unit 1: Introduction to Digital Marketing

Definition and importance of digital marketing, Traditional vs. Digital marketing, Digital marketing platforms and channels, Current trends and future of digital marketing, Consumer behavior in the digital age, Buying journey, and digital touchpoints.

### Unit 2: Search Engine Optimization (SEO) and Search Engine Marketing (SEM)

Basics of search engines, SEO techniques (on-page, off-page, technical), Keyword research, Google Search Console, Search Engine Marketing with Google Ads, PPC campaigns, Bidding strategies, Ad Rank, Quality Score.

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## **Unit 3: Social Media and Content Marketing**

Role of social media in marketing, Strategies for Facebook, Instagram, LinkedIn, Twitter, YouTube, Social media content planning and scheduling tools, Influencer marketing, Blogging and video content, Storytelling for brands.

## **Unit 4: Email Marketing and Affiliate Marketing**

Email campaign creation, A/B testing, Deliverability, Personalization, Email automation tools, Compliance and ethics (CAN-SPAM Act, GDPR), Introduction to affiliate marketing, How affiliate networks work, Tracking and commission models.

## **Unit 5: Web Analytics and Performance Measurement**

Introduction to web analytics, Google Analytics dashboard, Key performance indicators (KPIs), Conversion tracking, UTM parameters, Reporting, Dashboards, ROI in digital marketing, Optimization of campaigns through data insights.

### **Text Books:**

- Ryan, D. (2016). Understanding Digital Marketing. Kogan Page.
- Chaffey, D., & Ellis-Chadwick, F. (2019). Digital Marketing. Pearson Education.
- Kotler, P., Kartajaya, H., & Setiawan, I. (2021). Marketing 5.0. Wiley.

### **Reference Books:**

- Kingsnorth, S. (2022). Digital Marketing Strategy: An Integrated Approach to Online Marketing. Kogan Page.
- Tuten, T. L., & Solomon, M. R. (2017). Social Media Marketing. Sage Publications.
- Cutroni, J. (2010). Google Analytics. O'Reilly Media.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Quantum Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-</b>	<b>504(3)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

A fundamental of quantum computing focused primarily on foundations, theory, and rigor, rather than specific hardware implementations or heuristic applications. We will begin with the axioms of quantum mechanics and the most common formulation of quantum computation based on quantum circuits. We will then develop the core primitives in the quantum algorithms toolkit (such as quantum Fourier transforms, phase estimation, and Trotterization/quantum simulation) and establish some elementary complexity-theoretic results (including some oracle separations, and various lower and upper bounds), as well as work through the crown jewel of quantum algorithms to date—Shor's factoring algorithm. Along the way, we will see some of the more curious aspects of quantum information facilitated by quantum entanglement (such as Grover search, quantum teleportation, super dense coding, and Bell violations).

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe quantum mechanics concepts and quantum computer systems
CO2	Explain and apply linear algebra operations in quantum computing
CO3	Relate the role of quantum technology in secure computing
CO4	Test and use modern tools for industry 4.0
CO5	Able to independently analyze and find solutions in quantum computing.

## Syllabus:

### Unit-I:

Basics: Basic quantum mechanics, Classical v/s Quantum systems, Quantum supremacy, Quantum computer architectures, Quantum applications, Complex Numbers, Linear Algebra – vector and matrix operations.

Qubit & Quantum States: Quantum bits, Bloch sphere representation of a qubit, multiple qubits, Vector Spaces. Linear Combination of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchy-schwarz and triangle

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### Unit-II:

Quantum Gates: Single Qubit gates, Multiple Qubit gates, Tensor Products and Density Operator: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.

### Unit-III:

Quantum Algorithms: Classical computation on quantum computers, Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Grover search, Quantum error correcting code, Quantum parallelism, Simon's periodicity algorithm, Application of entanglement, teleportation, superdense coding.

### Unit-IV:

Quantum Cryptography : Introduction to quantum cryptography and quantum information theory, Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekert 91

Quantum Technology: Quantum measurement, Cloning theorem, Scalability in real quantum systems, Quantum Computing Implementations: Quantum programming languages, Probabilistic and Quantum computations, Quantum annealing (e.g., D-Wave systems), Superconducting qubits (e.g., IBM Q), Ion trap quantum computers (e.g., Honeywell)

### Unit-V:

Quantum Application : Healthcare, transportation, finance, security, Quantum warfare and Post quantum cryptography, Drug Discovery and Material Science, Machine Learning and Artificial Intelligence, Supply Chain Management and Logistics, Climate Modeling and Environmental Analysis, Machine Vision and Imaging, Genomics and Personalized Medicine.

### Text Books:

- Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, 2008
- Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008
- Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010

### Reference Books:

- Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995
- Explorations in Quantum Computing, C. P. Williams and S. H. Clearwater, Springer, New York, 2018.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Cloud Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-505</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course aims to understand the basics of cloud computing and its working. The concept of virtualization in cloud computing will be explained, and the types of virtualization and hypervisor will be covered. In all, the difference services and deployment models will be covered, and the trust over cloud computing and security challenges will be discussed with range of different service platform like Google, AWS, Microsoft Azure etc.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the basic concept of the cloud computing
CO2	Understand the concept of virtualization, hypervisor and implementation of virtual machines
CO3	Gain the knowledge of the Cloud Delivery Models like IaaS, PaaS and SaaS with reference to Services.
CO4	Understanding of Cloud Computing Reference Architecture with reference to relationships between various functional units and Security issues
CO5	Understanding of Cloud Service Platforms

## Syllabus:

### Unit-I: Introduction:

Cloud Computing, Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS. Cloud Architecture: Public, Private, Hybrid, and Community Cloud.

### Unit-II: Virtualization:

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Type of Hypervisor, Understanding Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management.

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### Unit-III: Cloud Services:

Software as a Service (SaaS): Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms. Infrastructure as a Services (IaaS): Introduction, Background & Related Work. Virtual Machines Provisioning and Manageability. Platform as a service (PaaS): Integration of Private and Public Cloud, Technologies and Tools for Cloud Computing, Resource Provisioning services.

### Unit-IV: Cloud Deployment Models:

**Private Cloud:** Illustration of Private Cloud, Advantages of Private Cloud, Limitations of Private Cloud, Service Management, Journey into Private Cloud, Planning and Strategy. Standardization, Virtualization, Automation, Cloud, Case study – VMware.

**Public Cloud:** Illustration of Public Cloud, Why Public Cloud, Advantages of Public Cloud, Limitations of Public Cloud, Low degree of security and control, Lack of control on infrastructure, configuration, Network latency and accessibility concerns, Highest long term cost, Public v/s Private.

**Hybrid Cloud:** Why Hybrid Cloud, Illustration of Hybrid Cloud, Advantages of Hybrid Cloud, Challenges of Hybrid Cloud, Develop and manage hybrid workloads, developing applications for hybrid cloud, develop applications using PaaS, Managing hybrid workloads.

### Unit-V: Cloud Service Providers & Platforms:

Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP), Cloud services comparison (compute, storage, networking), Cloud pricing models and billing

### Text Books:

- Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
- John W. itinghouse james F.Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press.

### Reference Books:

- Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
- Cloud Security: A Comprehensive Guide to secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Internet Technology – I (HTML, PHP, CSS) Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-506</b>	
<b>Credits</b>	<b>:</b>	<b>2</b>	<b>No of Hours</b>	<b>:</b>	<b>4 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This course introduces the fundamentals of web development using HTML, CSS, and PHP. It covers front-end development using HTML and CSS to design responsive and user-friendly websites, and back-end development using PHP to handle server-side scripting and database interaction. Students will learn to build complete dynamic web applications integrating both frontend and backend technologies.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Understand and apply the foundational structure of HTML and CSS to create responsive and visually appealing web pages.
CO2	Develop server-side scripts using PHP and perform form handling along with integration of backend databases like MySQL.
CO3	Design, build, and deploy dynamic web applications by integrating both frontend and backend components effectively.

## Unit 1: HTML Fundamentals

Introduction to Web Technologies , Structure of HTML Documents ,HTML Elements: Headings, Paragraphs, Lists, Links, Images, Tables ,Forms and Input Types ,Semantic HTML5 Tags.

## Unit 2: CSS for Styling and Layout

Introduction to CSS: Syntax, Selectors, and Properties ,Inline, Internal, and External CSS,Box Model, Margins, Padding, Borders ,Positioning, Flexbox, and Grid Layouts ,Responsive Design: Media Queries and Mobile-first Design

## Unit 3: Introduction to PHP

PHP Syntax and Variables ,Data Types, Operators, and Expressions, Control Structures:Conditionals and Loops ,Functions in PHP,Form Handling with PHP (GET and POST methods).

### **Unit 4: PHP and MySQL Integration**

Introduction to MySQL and phpMyAdmin, Connecting PHP with MySQL, Performing CRUD Operations (Create, Read, Update, Delete), Validating and Sanitizing User Inputs, Session Management and Cookies.

### **Unit 5: Building and Deploying Dynamic Web Applications**

File Upload Handling in PHP, Email Sending with PHP, Building a Mini Project (e.g., Student Registration System / Online Feedback System) Hosting Web Applications (using XAMPP or live server), Version Control Introduction (Git Basics).

### **The following Concepts/Experiments will be covered in the lab:**

#### **1. Create a Basic Webpage using HTML**

- Objective: Design a static webpage using headings, paragraphs, lists, and images.

#### **2. Design a Student Registration Form using HTML**

- Objective: Implement form elements like text fields, radio buttons, dropdowns, and submit buttons.

#### **3. Style a Webpage using CSS**

- Objective: Use selectors, colors, font styles, borders, padding, and margin.

#### **4. Create a Responsive Layout using CSS Flexbox/Grid**

- Objective: Design a responsive page layout compatible with multiple devices.

#### **5. Form Handling using PHP (GET and POST methods)**

- Objective: Create a form and process user input using PHP scripts.

#### **6. Create a Login and Registration Page using PHP and MySQL**

- Objective: Store and retrieve user data from a database securely.

#### **7. CRUD Operations with PHP and MySQL**

- Objective: Create a system for adding, viewing, editing, and deleting records (e.g., student data).

#### **8. Session and Cookie Management in PHP**

- Objective: Track user login sessions and demonstrate cookie creation and access.

#### **9. File Upload Handling using PHP**

- Objective: Allow users to upload files (PDF/Image) and store them on the server.

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### 10. Mini Project: Feedback Collection System

- Objective: Build a complete feedback system using HTML, CSS, PHP, and MySQL.

#### **Text Books:**

- "HTML and CSS: Design and Build Websites" by Jon Duckett
- "Learning PHP, MySQL & JavaScript" by Robin Nixon

#### **Reference Books:**

- "PHP and MySQL Web Development" by Luke Welling and Laura Thomson
- "Web Development with HTML, CSS, JavaScript and jQuery" by Jon Duckett
- "Head First PHP & MySQL" by Lynn Beighley and Michael Morrison

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Analysis &amp; Design of Algorithm Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-507</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The objectives of this course are to equip students with the fundamental knowledge and basic technical competence in the field of computer graphics, emphasize on implementation aspect of Computer Graphics Algorithms and advance areas like Image Processing.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Analyze algorithm to solve problems by iterative approach.
CO2	Analyze algorithm to solve problems by divide and conquer approach.
CO3	Implement algorithm to solve problems by Greedy Approach, Dynamic programming, backtracking, branch, and bound approach.

## The following concepts will be covered in the lab:

- Provide algorithms and programs to implement the following searching procedures.
  - Linear search
  - Binary search
- Implementation of Sorting algorithm like Quick sort, Heap Sort, Merge sort etc. and computation of 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 non graph sheet. The elements can be read from a file or can be generated using the random number generator.
- Implementation of divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
- Implementation of 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
- Implementation of Dijkstra's algorithm to find shortest paths from a given vertex in a weighted connected graph.
- Implementation of finding Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.

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- Implementation of Prim's algorithm to find Minimum Cost Spanning Tree of a given connected undirected graph.
- Implementation of All-Pairs Shortest Paths problem using Floyd's algorithm.
- Implementation of Travelling Sales Person problem using

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## **Text Books:**

- David Poole, Alan Mackworth, Randy Goebel, “Computational Intelligence: a logical approach”, Oxford University Press.
- R. O. Duda, P. E. Hart and D.G. Stork, “Pattern Classification”, John Wiley, 2001.
- G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem-solving”, Fourth Edition, Pearson Education.
- Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective, Morgan Kaufmann (Elsevier), 2016.
- Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence - Computational Frameworks, Practices, and Applications, CRC Press, 2023.
- Ira J. Haimowitz, DATA ANALYTICS FOR BUSINESS - Lessons for Sales, Marketing, and Strategy, Routledge (Taylor & Francis), 2023.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Scripting Language Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-508(3)</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab is designed to provide hands-on practice in popular scripting languages such as Python, JavaScript, and Shell Scripting. Students will develop the ability to write small, practical programs to automate tasks, manipulate data, and perform essential scripting operations useful in web development, system operations, and data handling.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Develop programs using basic scripting constructs such as loops, conditionals, functions, and modules.
CO2	Demonstrate the ability to manipulate files, perform regular expression matching, and automate routine tasks.
CO3	Apply scripting techniques in real-world scenarios such as web interaction, data parsing, and system utilities.

## The following Concepts/Experiments will be covered in the lab:

- **Basic Python Scripting**  
Write a Python program to demonstrate variables, conditional statements, loops, and user-defined functions.
- **File Handling in Python**  
Write a script to read, write, append, and delete data from text files using file handling functions.
- **Regular Expressions**  
Create a Python script that validates email addresses and phone numbers using regular expressions.
- **Web Scraping using Python**  
Write a script using requests and BeautifulSoup to extract data (e.g., news headlines or tables) from a website.

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- **JavaScript Basics and DOM Manipulation**

Create an HTML page with embedded JavaScript to manipulate DOM elements based on user input.

- **Form Validation using JavaScript**

Write a JavaScript program to validate a registration form (e.g., check for empty fields, email format, etc.).

- **AJAX and Fetch API**

Create a web page that uses JavaScript fetch API to get data from a public API and display it dynamically.

- **Shell Scripting Basics**

Write a shell script to perform basic arithmetic operations, and display system information (like disk usage, users).

- **Shell Script for File and Process Handling**

Create a shell script that finds the number of lines in a file, deletes temporary files, or monitors a running process.

- **Database Connection using Python**

Write a Python program to connect to a SQLite/MySQL database, create a table, and perform basic CRUD operations.

## **Text Books:**

- "Learning Python" by Mark Lutz, O'Reilly Media
- "Eloquent JavaScript" by Marijn Haverbeke
- "Classic Shell Scripting" by Arnold Robbins & Nelson Beebe

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course:</b>	<b>Cloud Computing Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-509</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours</b>	<b>: 2 Hrs. / week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Descriptions:

This laboratory course provides hands-on experience with the core concepts and practical applications of cloud computing. Students will explore leading cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) to understand cloud infrastructure, deployment models, and service models. The course emphasizes practical exposure to virtualization, cloud storage, serverless computing, cloud databases, identity management, and deployment of scalable web applications.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	The students will learn to provision virtual machines, implement storage solutions, configure auto-scaling and load balancing, and deploy applications using platform services.
CO2	Introduces modern DevOps tools and practices, including containerization.
CO3	Students will be equipped with the technical skills needed to develop and manage applications in a cloud environment.

## The following Experiments will be covered in the lab:

### 1. Introduction to Cloud Platforms

- Overview and setup of AWS Free Tier / Azure Student Account / GCP
- Navigating the cloud console

### 2. Launching and Configuring Virtual Machines

- Create and configure EC2 instances (AWS) or Virtual Machines (Azure)
- Connect via SSH and install packages

### 3. Working with Object Storage

- Create and use an S3 bucket (AWS) / Blob Storage (Azure)
- Upload, retrieve, and manage files

### 4. Creating and Deploying a Website

- Host a static website on AWS S3 / Azure Blob Storage
- Deploy a dynamic web app using AWS Elastic Beanstalk / Azure App Service

### 5. Load Balancing and Auto Scaling

- Set up a Load Balancer in AWS
- Configure auto-scaling groups based on CPU utilization

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### 6. Cloud Database Services

- Create and access Amazon RDS / Azure SQL Database
- Connect with an application

### 7. Serverless Computing

- Create a simple AWS Lambda function
- Trigger using API Gateway or S3 event

### 8. Identity and Access Management (IAM)

- Create IAM users and roles
- Assign policies and test access controls

### 9. Virtualization with VirtualBox/Docker

- Install and configure VirtualBox/Docker
- Create and run containers

### 10. CI/CD in the Cloud (Optional Advanced Lab)

- Set up a basic pipeline using AWS CodePipeline or GitHub Actions
- Automate deployment of a simple app

### Text Books:

- Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
- John W. itinghouse james F.Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press.

### Reference Books:

- Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
- Cloud Security: A Comprehensive Guide to secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley

### Tools & Platforms:

- AWS Educate / Free Tier
- Microsoft Azure for Students
- Google Cloud Platform (GCP) Free Tier
- Docker, VirtualBox
- GitHub, Jenkins (optional)

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Professional Development</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-511</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>1 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Description:

In this course, students will be taught to develop and become team player for creativity and innovation in the organization they work in. Students will be taught methods to develop cordial relation using “Johari Window”, which will help them in managing change in their organizations. Since they would be entering the world of work, special emphasis will also be given to manners, etiquettes, negotiation, stress and conflict management. Finally, students will be rigorously prepared for facing various selection tools like – GD, PI and resume preparation.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Communicating effectively in a variety of public and interpersonal settings
CO2	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of change
CO3	Analysing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships
CO4	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust
CO5	Handling difficult situations with grace, style, and professionalism

## Syllabus:

### Unit-I Intrapersonal Skills:

- Creativity and Innovation
- Understanding self and others (Johari window)
- Stress Management
- Managing Change for competitive success
- Handling feedback and criticism

### Unit-II: Interpersonal Skills:

- Conflict management
- Development of cordial interpersonal relations at all levels
- Negotiation
- Importance of working in teams in modern organisations

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- Manners, etiquette and net etiquette

### **Unit-III: Interview Techniques:**

- Job Seeking
- Group discussion (GD)
- Personal Interview

### **Text Books:**

- Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education
- Burne, Eric, Games People Play (2010), Penguin UK
- Carnegie, Dale, How to Win Friends and Influence People (2004), RHUK
- Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan
- Steinburg, Scott, Netiquette Essentials (2013), Lulu.com

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## Academic Semester VI

Type of Course	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit
			L	P	T	PRE**		ESE*	Total Marks	L+(T+P)/2
						Mid Sem	TA			
CC	SOE-B-CSE-23-601	Computer Network	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-602	Software Engineering	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-603(X)	Department Specific Elective – V	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-604	Cryptography and Information Security	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-605	Distributed Computing	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-606	Computer Network Lab	0	2	0	--	30	20	50	1
CC	SOE-B-CSE-23-607	Software Engineering Lab	0	2	0	--	30	20	50	1
DSE	SOE-B-CSE-23-608(X)	Department Specific Elective – V Lab	0	2	0	--	30	20	50	1
CC	SOE-B-CSE-23-609	Cryptography and Information Security Lab	0	2	0	--	30	20	50	1
SEC	SOE-B-CSE-23-610	Internet Technology – II (Node JS, Express JS, TypeScript, MongoDB)	0	2	0	--	30	20	50	1
Value Added	SOE-B-CSE-23-611	Value Added Course through (MOOC / SWAYAM/Any other online platform))	0	4	0	--	30	20	50	2
AECC	SOE-B-CSE-23-612	Professional Development-II	0	2	0	--	30	20	50	1
		Total	15	16	0	150	310	390	850	23

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>: Software Engineering</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-602</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course offers lectures, tutorials, case studies, laboratory, and online interaction to provide a foundation in software engineering concepts. It includes representing information with the traditional and modern approaches in software engineering including knowledge of CASE tools. This course further explains concepts of software development process, agile, scrum and DevOps development process, software project management, software requirement and design engineering, development, quality assurance, automated testing, operational support and software maintenance.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To learn and understand the Concepts of Software Engineering
CO2	To Learn and understand Software Development Life Cycle
CO3	To apply the project management and analysis principles to software project development.
CO4	To apply the design & testing principles to software project development.
CO5	Evaluate software quality using industry standards and metrics, and apply maintenance and evolution strategies for software systems.

## Syllabus:

### Unit 1: Introduction Software Engineering and Process Models

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths, Types of software, Attributes of good software. Generic view of process: Software engineering- A layered technology, a process framework, Process patterns, process assessment. Process models: The waterfall model, Incremental process models, Evolutionary process models, Spiral development, The Unified process, Agility and Agile Process model, Extreme programming, Rapid application development (RAD), Software prototyping, Other process models of Agile Development and Tools

### **Unit 2: Software Project Management and Requirement Analysis.**

Software Project Management: Responsibilities of a Software Project Manager, Project planning, Metrics for Project Size Estimation: Function Point Analysis, LOC Estimation, Project Estimation Techniques, COCOMO, Project scheduling, Staffing, Risk Management

System and software requirements: Types of software requirements, Functional and non-functional requirements, Domain requirements, User requirements. Requirement Gathering: Viewpoints, Interviewing, Scenarios, Use-cases, Process modeling with physical and logical DFDs: Entity Relationship Diagram, Data Dictionary, Requirement validation. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. Software requirement Specification (SRS), Structure and contents, SRS format.

### **Unit 3: Software Design**

Design Engineering: Design process and Design quality, Design concepts, the design model. Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural Design. Object-Oriented Design: Objects and object classes, An Object-Oriented design process, Design evolution. Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps.

### **Unit 4: Software Implementation and Testing**

Programming languages and development tool: Selecting languages and tools, Good programming practices, Coding Standards. Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Verification and validation, Black-box and White-box testing, Inspections. Levels of testing: Unit testing, Integration Testing, Interface testing, System testing, Alpha and beta testing, Regression testing. Design of test cases.

### **Unit 5: Software Quality and Maintenance**

Software Reliability, Software Quality, Quality management activities: Software Measurement, Metrics for software quality, Product and process quality. Standards: ISO9000, Capability Maturity Model (CMM), Six Sigma. Characteristics of Software Maintenance, Characteristics of Software Evolution, Software Reverse Engineering, Software Maintenance Process Models, Estimation of Maintenance Cost.

### **Text Books:**

- Pearson Edu, “Software Engineering by Ian SomMerville”, 9th edition, 2010
- Roger P, “Software Engineering – A Practitioner’s Approach”, seventh edition, Pressman, 2010.
- The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, 2nd Edition, 2005.

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## **Reference Books:**

- Agile Product Management with Scrum: Creating Products that Customers Love by Roman Pichler, Addison-Wesley Professional, 2010.
- The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations by Gene Kim, Jez Humble, Patrick Debois, John Willis, 2016.

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<b>Programme</b>	<b>:</b>	<b>B. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>Soft Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-603(1)</b>		
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

A unified and unique mathematical treatment of various soft computing techniques for constructing intelligent systems, in modelling, optimization and control. The course covers the theory and applications of neural networks, fuzzy logic, evolutionary strategies and genetic algorithms in developing intelligent systems with examples and practical applications.

## Course Outcomes:

At the end of this courses, the student will be able to: -

CO Number	Course Outcome
CO1	Recognize the feasibility of applying a soft computing methodology for a particular problem.
CO2	Recognize Develop intelligent machines to provide solutions to real world problems, which are not modelled or too difficult to model mathematically.
CO3	Exploit the tolerance for Approximation, Uncertainty, Imprecision and Partial Truth in order to achieve close resemblance with human like decision making.

## Syllabus:

### UNIT-I: Neural Networks-1 (Introduction & Architecture)

Neuron, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto- associative and hetro-associative memory.

### UNIT-II: Neural Networks-II (Back Propagation Networks)

Architecture: perception model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient; back propagation algorithm, factors affecting back propagation training, applications.

### UNIT-III: Fuzzy Logic-I (Introduction)

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

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## **UNIT-IV: Fuzzy Logic AI (Fuzzy Membership, Rules)**

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfication & Defuzzification, Fuzzy Controller, Industrial applications.

## **UNIT-5: Genetic Algorithm (GA)**

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators: Crossover, Mutation, Generational Cycle, GA optimization problem, applications.

### **Text Books:**

- “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” by S. Rajsekaran & G.A. Vijayalakshmi Pai, Prentice Hall of India.
- “Artificial Intelligence and Intelligent Systems” by N.P.Padhy, Oxford University Press.

### **Reference Books:**

- Siman Haykin “Neural Networks”, Prentice Hall of India.
- Timothy J. Ross “Fuzzy Logic with Engineering Applications”, Wiley India.
- Kumar Satish “Neural Networks”, Tata Mc Graw Hill.

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<b>Programme</b>	<b>:</b>	<b>B. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>:</b>	<b>Big Data Analytics</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-23-603(2)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## **Course Description:**

The Big Data Analytics course introduces students to the fundamental concepts of Big Data, including its types, challenges, and technologies. It covers data processing with Hadoop and Spark, along with analytics techniques such as descriptive, diagnostic, and predictive analytics. Students will also learn to visualize data using tools like Tableau and PowerBI. The course explores real-world applications of Big Data across industries like healthcare, IoT, and social media.

## **Course Outcomes:**

After Completion of the course Students will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To learn basic concept of Big Data and its characteristics.
CO2	To understand data processing using Hadoop and Spark.
CO3	To understand the role and architecture of YARN and MapReduce in the Hadoop ecosystem
CO4	To learn basic statistical methods and analytics techniques on large datasets
CO5	To understand and apply Big Data technologies to solve problems in various sectors

## **Syllabus:**

### **UNIT-I: Introduction to Big Data Analytics**

Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured. Sources of data. Definition and Features of Big Data, Big Data Value, The development of Big Data, Characteristics and Need of Big Data-Challenges of big data. Analytics Tools and Techniques: Hadoop, Spark, and NoSQL in the context of big data analytics.

### **UNIT-II: Data Processing with Hadoop and Spark**

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read. NameNode, Secondary NameNode and DataNode. Hadoop ecosystem components - Schedulers - Fair and Capacity. SPARK: SPARK BASICS, Using the Spark Shell, RDD Data Types and RDD Creation, RDDs (Resilient Distributed Datasets) in Spark, General RDD Operations: Transformations & Actions, RDD Lineage, RDD Persistence

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Overview, Distributed Persistence. HIVE: Hive Shell, Hive Services, Hive Meta store, Comparison with Traditional Databases.

### **UNIT-III: MapReduce and YARN framework**

Introduction to Map Reduce, Processing data with Hadoop using MapReduce, Introduction to YARN, Architecture, Managing Resources and Applications with Hadoop YARN. Big data technologies and Databases: NoSQL: Introduction to NoSQL - Features and Types-Advantages & Disadvantages -Application of NoSQL.

### **UNIT-IV: Data Analytics Techniques**

Data Analytics Overview: Descriptive, diagnostic, predictive, and prescriptive analytics, Basic Data Statistics: Mean, median, mode, variance, correlation. Data Visualization: Techniques for visualizing data using charts (histograms, scatter plots, box plots). Tools for Visualization: Introduction to Tableau or PowerBI for creating interactive dashboards. Exploratory Data Analysis (EDA): Summarizing and visualizing datasets to identify patterns and trends.

### **UNIT-V: Big Data Applications**

Application Evolution, Big Data Analysis Fields - Structured Data Analysis, Text Data Analysis, Web Data Analysis, Multimedia Data Analysis, Network Data Analysis, Mobile Traffic Analysis, Key Applications - Application of Big Data in Enterprises, Application of IoT Based Big Data, Application of Online Social Network Oriented Big Data, Applications of Healthcare and Medical Big Data, Collective Intelligence, Smart Grid.

### **Textbooks:**

- Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd.,2016.
- Mike Frampton, “Mastering Apache Spark”, Packt Publishing, 2015.

### **Reference Books:**

- Tom White, “Hadoop: The Definitive Guide”, O’Reilly, 4th Edition, 2015.
- Mohammed Guller, “Big Data Analytics with Spark”, Apress, 2015
- Donald Miner, Adam Shook, “Map Reduce Design Pattern”, O’Reilly, 2012

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>Digital Image Processing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-603(3)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours:</b>	<b>3 Hrs/Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The objective of this course to equip the students with the techniques & tools for digital image processing, & image analysis in the form of image segmentation, image enhancement, image filters, image transforms, Fourier transforms & fast Fourier transforms, edge detection, image segmentation & colour imaging.

## Course Outcomes:

Upon successful completion of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe the theory and algorithms that are widely used in digital image processing
CO2	Apply a proper image enhancement technique for given a set of noisy images
CO3	Compare different image segmentation and compression techniques
CO4	Formulate solutions using morphological concepts
CO5	Develop any application using different image processing techniques

## Syllabus:

### Unit 1: Digital Image Fundamental

Introduction – Steps in Digital Image Processing, Components, Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, Introduction to computational imaging, Basics of multi-resolution imaging, Concept of image metadata, Introduction to different color spaces (e.g., HSV, YCbCr)

### Unit 2: Image Enhancement

Spatial Domain, Gray level transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Homomorphic filtering, Guided filtering, Detail enhancement techniques, Introduction to deep learning-based image enhancement (brief overview), Frequency Domain, Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters, Ideal, Butterworth and Gaussian filters, Wavelet transform for image enhancement, Directional filtering in the frequency domain, Short-Time Fourier Transform (STFT) for image analysis (brief introduction).

### Unit 3: Image Restoration

Noise models, Mean filters, Order Statistics, Adaptive filters, Band reject, Band pass, Notch – Optimum notch filtering, Inverse Filtering, Constrained Least Square Filtering, Wiener filtering, Non-local means denoising, Block-matching and 3D filtering (BM3D) (brief introduction), Deep learning for image denoising (brief overview), Restoration in the presence of motion blur.

### Unit 4: Image Compression

Fundamentals – Image Compression models, Error Free Compression, Variable Length Coding – Bit, Plane Coding, Lossless Predictive Coding, Lossy Compression, Lossy Predictive Coding, Wavelet Coding, and Compression Standards – JPEG2000, Image compression using neural networks (brief overview), Fractal image compression (brief introduction), Region of Interest (ROI) based compression, Modern image formats and their compression techniques (e.g., HEIF, AVIF - very brief introduction).

### Unit 5: Image Segmentation & Representation

Segmentation – Detection of Discontinuities, Edge Linking and Boundary detection, Region based segmentation, Graph cuts for image segmentation, Active contour models (snakes) (brief introduction), Introduction to semantic segmentation using deep learning (brief overview), Representation – Boundary descriptors, Simple Descriptors, Shape numbers, Regional descriptors, Simple and Topological Descriptors, Scale-invariant feature transform (SIFT) (brief introduction), Histogram of Oriented Gradients (HOG) (brief introduction), Introduction to feature learning using convolutional neural networks (brief overview), Introduction to Image Processing Toolbox, Practice of Image Processing Toolbox, and Case studies–Various Image Processing Techniques, Using the toolbox for advanced segmentation and feature extraction tasks, Case studies involving deep learning-based image processing techniques alongside traditional methods.

#### Text Books:

- Digital Image Processing. Gonzales R. C. & Woods R. E. 3rd Ed., Pearson Education.2010.
- Fundamentals of Digital Image Processing. Jain A. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing. Jayaraman S., Esaki R. S., Kumar T. V., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.
- Digital Image Processing Using MATLAB. Gonzalez R. C., Woods R. E., Eddins S. L., 3rd Ed. Tata McGraw Hill Pvt. Ltd, 2011.

#### Reference Books:

- Digital Image Processing and analysis, Chanda B., Majumder D. D. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing and Pattern Recognition, Pakhira M. K., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.
- Fundamentals of Digital Image Processing, Annadurai S., Shanmugalakshmi R., 1st Ed. Pearson Education, 2007.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>: Cryptography and Information Security</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-604</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The course covers fundamental aspects of security in a modern networked environment with the focus on system design aspects and cryptography in the specific context of network / internetwork security. It also dwells into basics of cryptographic techniques, algorithms and protocols required to achieve these properties; computational issues in implementing cryptographic protocols and algorithms; and system/application design issues in building secure networked systems.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand basics of Cryptography and Information Security.
CO2	Understand various symmetric key algorithm and apply them on real world data.
CO3	Analyze the different conventional and public key encryption algorithms
CO4	Demonstrate various methods to calculate authentication codes using Message Authenticate Code.
CO5	Categorize viruses and mechanisms used for intrusion detection

## Syllabus:

### Unit <sup>2</sup> I: Introduction

Introduction to security attacks, services and mechanism, Classical encryption techniques, substitution ciphers and transposition ciphers, cryptanalysis, steganography, Modular Arithmetic, Classical encryption techniques: substitution techniques, transposition techniques, steganography, Stream and block ciphers.

### Unit - II: Symmetric Key Cryptography

Introduction to group, field, finite field of the form  $GF(p)$ , modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard (DES), Strength of DES, block cipher modes of operations, Triple DES, Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4.

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## **Unit <sup>2</sup> III: Public Key Cryptography**

Mathematics Of Asymmetric Key Cryptography: Primes, Primality Testing, Factorization, Euler's totient function, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Exponentiation and logarithm, Discrete Logarithmic Problem.

## **Unit <sup>2</sup> IV: Message Authentication And Integrity**

Principles of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elgamel encryption, Message Authentication and Hash Function, Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS.

## **Unit - V: Security Practice And System Security**

Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

### **Text Books:**

- William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
- Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
- C K Shyamala, N Harini, Dr. T.R.Padmabhan Cryptography and Security ,Wiley
- Bruce Schneier, "Applied Cryptography". John Wiley & Sons
- Bernard Menezes," Network Security and Cryptography", Cengage Learning.
- Atul Kahate, "Cryptography and Network Security", McGraw Hill

### **Reference Books:**

- C K Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", 1st Edition, Wiley India
- Forouzan Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Mc Graw Hill
- Mark Stamp, "Information Security, Principles, and Practice", Wiley India.
- WM. Arthur Conklin, Greg White, "Principles of Computer Security", TMH.
- Neal Krawetz, "Introduction to Network Security", CENGAGE Learning.
- Bernard Menezes, "Network Security and Cryptography", CENGAGE Learning.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VII</b>
<b>Name of the Course</b>	<b>: Distributed Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-605</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces the fundamental concepts, principles, and techniques of distributed computing. It focuses on the design and implementation of distributed systems where components located on networked computers communicate and coordinate their actions by passing messages. Key topics include communication models, synchronization, consistency, fault tolerance, distributed file systems, and distributed algorithms. Through theoretical study and practical assignments, students will learn how to build scalable, reliable, and efficient distributed applications.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand models of distributed computing
CO2	Analyze algorithms for coordination, communication and synchronization in distributed systems
CO3	Analyze distributed shared memory models
CO4	Design and Implement distributed file systems
CO5	Design distributed algorithms for handling deadlocks

## Syllabus:

### Unit-1: Distributed Computing

Introduction: Definition, Relation to parallel systems, synchronous vs asynchronous execution, design issues and challenges A Model of Distributed Computations: A Model of distributed executions, Models of communication networks, Global state of distributed system, Models of process communication.

### Unit-2: Logical Time

Logical clocks, scalar time, vector time, Matrix time, virtual time, Physical clock synchronization – NTP, Global state and snapshot recording algorithms: System model, Snapshot algorithms for FIFO channels, Variations of Chandy-Lamport algorithm, Snapshot algorithms for non-FIFO channels, Snapshots in a causal delivery system, Monitoring global state, Necessary and sufficient conditions for consistent global snapshots, Finding consistent global snapshots in a distributed computation.

### **Unit-3: Message ordering and group communication**

Message ordering paradigms, Group communication, Causal order (CO), Total order, Multicast, Propagation trees for multicast, Application-level multicast algorithms, Fault-tolerant group communication, Multicast algorithms at the network layer. Termination detection: System model of a distributed computation, Termination detection using distributed snapshots, weight throwing and spanning-tree-based algorithms, Message-optimal termination detection, and Termination detection in a general distributed computing model, Termination detection in the atomic computation model, Termination detection in a faulty distributed system

### **Unit-4: Distributed mutual exclusion algorithms**

Lamport's algorithm, Ricart-Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms, Maekawa's algorithm, Agarwal-El Abbadi quorum-based algorithm, Token-based algorithms, Suzuki-Kasami's broadcast algorithm, Raymond's tree-based algorithm.

### **Unit-5: Deadlock detection in distributed systems:**

System model, Models of deadlocks, Knapp's classification of distributed deadlock detection algorithms, Mitchell and Merritt's algorithm for the single resource model, Chandy-Misra-Haas algorithm for the AND model, Chandy-Misra-Haas algorithm for the OR model, Check pointing and rollback recovery : Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Koo-Toueg coordinated check pointing algorithm, Juang-Venkatesan algorithm for asynchronous check pointing and recovery, Failure detectors: Unreliable failure detectors, The consensus problem, Atomic broadcast

### **Text Books:**

- Ajay D. Kshemakalyani, Mukesh Singhal, "Distributed Computing", Cambridge University Press, 2008
- Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems - Principles and Paradigms", PHI, 2004

### **Reference Books:**

- Pradeep K. Sinha Distributed Operating Systems: Concepts and Design Publisher: PHI Learning
- Gerard Tel Introduction to Distributed Algorithms Publisher: Cambridge University Press
- M. L. Liu Distributed Computing: Principles and Applications Publisher: Pearson Education
- Randy Chow and Theodore Johnson Distributed Operating Systems and Algorithms Publisher: Addison-Wesley

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<b>Programme :</b>	<b>B.Tech.</b>	<b>Semester :</b>	<b>V</b>
<b>Name of the Course:</b>	<b>Computer Network Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-606</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>2 Hrs. / week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Descriptions:

This lab is designed to Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	The students will be able to develop fundamental communication systems with customize requirement(s).
CO2	The students will be able to design computer network as per the specifications given.
CO3	The students will acquire analytical ability to identify the problems area in the hardware planning of computer network with possible trouble shooting technique.
CO4	The students will be able to diagnose the possible Bugs in the software application and to provide the possible trouble shoot.
CO5	Project planning Network planning, design, selection of hardware components and its configuration.

## The following concepts will be covered in the lab:

- Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
- Study of Network Devices in Detail.
- Study of network IP.
- Connect the computers in Local Area Network.
- Study of basic network command and Network configuration commands.
- Implement the data link layer farming methods such as character count, character stuffing and bit stuffing
- Performing an Initial Switch Configuration
- Performing an Initial Router Configuration
- Configuring and Troubleshooting a Switched Network
- Connecting a Switch

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- Configuring WEP on a Wireless Router

## **Text Books:**

- “Internetworking with TCP/IP, Principles Protocols and Architecture” 5th Edition Vol1 by Duglas E Comer by PHI.
- “TCP/IP Protocol Suit” 4th Edition by Behrouz A Forouzen Tata MGraw Hills.
- “Computer Network - a Systems Approach” by Larry L Petersnand Bruce S Davie 5th Edition by Morgan Kaufmabb Elsevier.
- “Data Networks” 2nd Edition by Dimitri Betsekas Robert Gallager by PHI.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>Software Engineering Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-607</b>		
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab deals with the analysis and design of a software problem. The tool used in a lab is rational rose. this tool is used for an object oriented design of a problem. We draw a UML diagram in a rational rose which deals with the objects and classes in a system. The Unified Modeling Language or UML is a mostly graphical modelling language that is used to express designs. It is a standardized language in which to specify the artefacts and components of a software system. It is important to understand that the UML describes a notation and not a process. It does not put forth a single method or process of design, but rather is a standardized tool that can be used in a design process.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Provide users with a ready-to-use, expressive visual modeling language so they can develop and exchange meaningful models
CO2	Generate a high-level design of the system from the software requirements
CO3	Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

## List of Experiments:

- Development of problem statement.
- Preparation of Software Requirement Specification Document
- Data flow diagram.
- Entity – Relationship Diagram
- Study and usage of any Design phase CASE tool:
  - Class Diagram
  - Sequence Diagram
  - State Chart Diagram
  - Use-Case Diagram
  - Activity Diagram
- Develop test cases for various white box and black box testing techniques.

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## **Sample Projects**

- Passport automation System
- Book Bank
- Online Exam Registration
- Stock Maintenance System
- Online course reservation system
- E-ticketing
- Software Personnel Management System
- Credit Card Processing
- E-book management System.
- Recruitment system

## **Text Books :**

- The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, 2nd Edition, 2005.
- Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
- Software Engineering- Sommerville, 7th edition, Pearson Education.

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<b>Programme</b>	<b>: B. Tech</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course:</b>	<b>Soft Computing Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-608(1)</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours</b>	<b>: 2 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Descriptions:

This course will cover fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA). Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices. In summary, this course will provide exposure to theory as well as practical systems and software used in soft computing.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Explore methods that implements neural network techniques.
CO2	Practice the fuzzy set relations using different operations.
CO3	Design Regression techniques for a set of data points.
CO4	Capture an appropriate classification model for analytical tasks.

## The following concepts will be covered in the lab:

- Introduction to Soft Computing
  - Concept of computing systems.
  - "Soft" computing versus "Hard" computing
  - Characteristics of Soft computing
  - Some applications of Soft computing techniques
  - Solving single-objective optimization problems using Gas
- Program to implement logic gates.
- Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
- Implement svm classification by fuzzy concepts.
- Implementation of Genetic Application
- Implementation of Perceptron Learning Algorithm
- Implementation of Unsupervised Learning Algorithm
- Write a program to implement artificial neural network without back propagation.
- Implement travelling sales person problem (tsp) using genetic algorithms.
- Implement crisp partitions for real-life iris dataset
- Implement linear regression and multi-regression for a set of data points
- Perceptron net for an AND function with bipolar inputs and targets.
- Program for Pattern storage of 10 digits with Discrete Hopfield Network

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## **Text Books:**

- G. A. Vijayalakshami, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran”, PHI.
- E. Goldberg, “Genetic Algorithms: Search and Optimization”.
- Chin Teng Lin, “Neuro-Fuzzy Systems”, C. S. George Lee, PHI.
- Joe choong, “Build\_Neural\_Network\_With\_MS\_Excel\_sample”.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>Big Data Analytics Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-608(2)</b>		
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The Big Data Analytics course introduces students to key tools and technologies such as Python, Hadoop, MongoDB, and Apache Spark for processing and analyzing large datasets. Students will learn to perform data visualization, implement MapReduce programs, and apply NoSQL database operations. The course emphasizes hands-on experience with data storage, manipulation, and analysis using Big Data frameworks.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To Visualize and process data using Python plotting techniques
CO2	To Perform NoSQL operations such as CRUD operations, arrays, and advanced queries using MongoDB.
CO3	To Implement and execute MapReduce programs for data processing

## List of Experiments

- Install, configure and run python, numPy and Pandas.
- Install, configure and run Hadoop and HDFS.
- Visualize data using basic plotting techniques in Python.
- Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB.
- Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB.
- Implement word count / frequency programs using MapReduce.
- Implement a MapReduce program that processes a dataset.
- Implement clustering techniques using SPARK.
- Implement an application that stores big data in MongoDB / Pig using Hadoop / R.

## Text Books :

- Hadoop: The Definitive Guide Tom White, 4th Edition, O'Reilly Media
- Big Data: Principles and Paradigms, Rajendra Akerkar, Wiley-IEEE Press
- Learning Spark: Lightning-Fast Big Data Analysis Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia, O'Reilly Media.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>		<b>Digital Image Processing Lab</b>	<b>Course Code:</b>		<b>SOE-B-CSE-23-608(3)</b>
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This course is an introduction to image processing, image analysis techniques and concepts. Areas include: Imaging sensors and their principles; Image representation and storage, coding and compression techniques, lossy versus lossless; techniques for noise reduction.

## Course Outcomes:

At the end of the course, students should be able to:

CO Number	Course Outcome
CO1	Learn concepts, process and practice DIP methodologies
CO2	Learn image processing in spatial and frequency domain
CO3	Learn image restoration and segmentation

## Following concepts will be covered in the lab

- Implement Low Pass Filters – Gaussian, Butterworth, Ideal
- Implement High Pass Filters – Gaussian, Butterworth, Ideal
- Perform Image Enhancement in Spatial Domain through Gray Level Transformations
- Image Filtering in the Frequency Domain
- Apply Wavelet Transforms for Image Decomposition and Denoising
- Implement Transformation Functions and Histogram Equalization
- Perform Histogram Specification (Matching)
- Implement Image Compression using Transform Coding
- Image Restoration using Inverse and Wiener Filtering
- Implementation of Morphological Operations, Image Segmentation, and Edge Detection

## Textbooks:

- Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, (various editions available), Pearson (or Prentice Hall depending on the edition), (various years depending on the edition).
- Chris Solomon and Toby Breckon, Fundamentals of Digital Image Processing: A Practical Approach with Examples in Matlab, 1st edition, Wiley-Blackwell, 2011.
- Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd edition, Gatesmark Publishing, 2009.
- Wilhelm Burger and Mark J. Burge, Digital Image Processing: An Algorithmic Introduction Using Java (Texts in Computer Science), 1st edition, Springer, 2008.

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- John C. Russ and F. Brent Neal, *Introductory Digital Image Processing with MATLAB Imaging Toolboxes*, 1st edition, CRC Press, 2008.

## **Reference Books:**

- Richard Szeliski, *Computer Vision: Algorithms and Applications*, 2nd edition, Springer, 2022.
- Milan Sonka, Vaclav Hlavac, and Roger Boyle, *Image Processing, Analysis, and Machine Vision*, 4th edition, Cengage Learning, 2014.
- Al Bovik (Editor), *Handbook of Image and Video Processing*, 2nd edition, Academic Press, 2005.
- John C. Russ, *The Image Processing Handbook*, 7th edition, CRC Press, 2016.
- Mark Nixon and Alberto S. Aguado, *Feature Extraction and Image Processing for Computer Vision*, 4th edition, Academic Press, 2019.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course</b>	<b>:</b>	<b>Cryptography and Information Security Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-609</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

To give practical exposure on basic security attacks, encryption algorithms, authentication techniques and digital signature.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Develop code for classical Encryption Techniques to solve the problems.
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3	Apply the different cryptographic operations of public key cryptography

## The following concepts will be covered in the lab:

- Symmetric key cryptography.
- Asymmetric key cryptography.
- Key exchange protocol.
- Authentication algorithms.
- Digital signature standards.

## Text Books:

- William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education.
- Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
- C K Shyamala, N Harini, Dr. T.R.Padmabhan Cryptography and Security ,Wiley
- Bruce Schneier, "Applied Cryptography". John Wiley & Sons
- Bernard Menezes," Network Security and Cryptography", Cengage Learning.
- Atul Kahate, "Cryptography and Network Security", McGraw Hill

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course</b>	<b>:</b>	<b>Internet Technology <sup>2</sup> II Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-610</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab course provides hands-on experience in developing backend applications using Node.js, Express.js, TypeScript, and MongoDB. Students will learn to create RESTful APIs, manage server-side logic, implement middleware, and interact with NoSQL databases to build scalable and secure applications.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Set up and build server-side applications using Node.js, Express.js, and TypeScript
CO2	Develop RESTful APIs and perform CRUD operations with MongoDB using Mongoose
CO3	Implement authentication, validation, and middleware for secure backend development

## The following Concepts/Experiments will be covered in the lab:

- Create a simple Node.js application demonstrating module usage, file system access, and basic server setup.
- Build a basic web server using Express.js with routing and response handling for GET and POST requests.
- Develop a REST API for user data with operations like GET, POST, PUT, DELETE.
- Implement middleware functions for logging, request parsing, and global error handling in Express.js.
- Create a database in MongoDB and connect it using Mongoose to store and retrieve structured data.
- Perform Create, Read, Update, and Delete operations in MongoDB via Express routes.
- Write basic TypeScript programs demonstrating types, interfaces, and classes.
- Convert a Node.js application to TypeScript and use tsconfig.json for configuration.
- Add user authentication in your Express app using JSON Web Tokens (JWT) and bcrypt.
- Implement file upload and serve static HTML/CSS/JS files using Express.js.

## Mini Project: Full-Stack Backend Development

- Title: Student Record Management System / Blogging Platform / E-commerce Backend API

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### **Description:**

Build a full-fledged RESTful API backend using Node.js, Express.js, TypeScript, and MongoDB. The project should include:

- a. User authentication and authorization
- b. CRUD operations on core entities
- c. Middleware usage
- d. API response handling with status codes
- e. MongoDB schema design with Mongoose
- f. Deployment using any cloud platform (optional)

### **Text Books:**

- "Node.js Design Patterns" by Mario Casciaro
- "Learning Node.js Development" by Andrew Mead
- "Pro Express.js" by Azat Mardan

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>: Professional Development</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-612</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>1 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Description:

This course will focus on enhancing employability skills to bridge the industry-academia gap and make the students industry ready. The module will be instrumental in terms of boosting the confidence level of the candidates and incorporating the required skill sets i.e. 21<sup>st</sup> century skills, interview success attributes, resume building, preparing cover letter, professional networking, public speaking, professional dressing, grooming, personal hygiene etc. Students will also be taught methods on acing an interview and various rounds of interviews conducted by esteemed organizations. This will enable them to perform better during campus recruitment processes.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Analyzing expectations of industries , discovering self and developing interview skills to succeed.
CO2	Creating strong professionals network with his skills of team building and leadership for perfect fit in corporate environment
CO3	Understanding ways & means to find suitable job opportunities and would be making suitable resume and cover letter
CO4	Exhibiting good communication skills through public speaking , telephones, E- Mails, online meetings, assertiveness etc.
CO5	Analyzing recruitment processes, document requirements, facing group discussions and interviews with full confidence.

## Syllabus:

### Unit-I Personal Excellence:

- Industry Expectation (21<sup>st</sup> Century skills)
- Interview Success Attributes
- Self-Discovery
- Team Building & Leadership
- Professional Networking
- Grooming for Corporate environment

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## **Unit-II: Professional Preparedness:**

- Job Seeking
- Resume Building
- Cover Letter preparation
- Public Speaking- Tools & Techniques
- Corporate Etiquettes- Telephone, Email, Messenger Apps, Online Meetings
- Expressing opinions assertively- Agreement & Disagreement
- Verbal Ability- Orientation
- Aptitude & Reasoning- Orientation

## **Unit-III: Selection Process Techniques:**

- Recruitment Processes of Various companies
- Company Profile Briefing by students (3 dream Companies)
- Professional Documents Docket- File & Soft Copy
- Group discussion (GD)- Concept and Practices
- Personal Interviews- Concept and Practices
- Activity- Organizing job fair

## **Text Books:**

- Stephen E. Lucas, The Art of Public Speaking, Third Edition, Singapore: McGraw-Hill, 1989
- Sonya Hamlin, how to Talk so People Listen, New York: Throson, 1993
- Jeff Davidson, The Complete Guide to Public Speaking, Manjul Books PVT. Bhopal, 2006
- Turk, Cristopher, Effective Speaking, Second Indian Reprint, Taylor and Francis Group, Delhi, 2010
- P.D. Chaturvedi – Busines Communication (Pearson Education, 3st Edition 2006).
- Rajendra Pal –Business Communication (Sultan chand & Sons Publication)

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## Academic Semester V

Type of Course	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P)/2
			L	P	T	PRE**		ESE*	Total Marks	
						Mid Sem	TA			(L+T+P)
CC	SOE-B-CSE-23-501	Analysis & Design of Algorithm	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-502(X)	Department Specific Elective – II	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-503(X)	Department Specific Elective – III	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-504(X)	Department Specific Elective – IV	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-505	Cloud Computing	3	0	0	30	20	50	100	3
SEC	SOE-B-CSE-23-506	Internet Technology – I (HTML, PHP, CSS)	0	4	0	--	30	20	50	2
CC	SOE-B-CSE-23-507	Analysis & Design of Algorithm Lab	0	2	0	--	30	20	50	1
DSE	SOE-B-CSE-23-508(X)	Department Specific Elective – II Lab	0	2	0	--	30	20	50	1
CC	SOE-B-CSE-23-509	Cloud Computing Lab	0	2	0	--	30	20	50	1
GEC	SOE-B-CSE-23-510	Generic Elective – II (MOOC / SWAYAM/Any other online platform)	0	2	0	--	30	20	50	2
AECC	SOE-B-CSE-23-511	Professional Development-I	0	2	0	--	30	20	50	1
		Total	15	14	0	150	280	370	800	23

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<b>Subject Code</b>	<b>Department Specific Elective (DSE) - II</b>
SOE-B-CSE-23-502(1)	Deep Learning
SOE-B-CSE-23-502(2)	Business Intelligence
SOE-B-CSE-23-502(3)	Scripting Language

<b>Subject Code</b>	<b>Department Specific Elective (DSE) - II Lab</b>
SOE-B-CSE-23-508(1)	Deep Learning Lab
SOE-B-CSE-23-508(2)	Business Intelligence Lab
SOE-B-CSE-23-508(3)	Scripting Language Lab

<b>Subject Code</b>	<b>Department Specific Elective (DSE) - III</b>
SOE-B-CSE-23-503(1)	Operation Research
SOE-B-CSE-23-503(2)	Compiler Design
SOE-B-CSE-23-503(3)	Computer Graphics

<b>Subject Code</b>	<b>Department Specific Elective (DSE) - IV</b>
SOE-B-CSE-23-504(1)	Graph Theory
SOE-B-CSE-23-504(2)	Digital Marketing
SOE-B-CSE-23-504(3)	Quantum Computing

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Analysis &amp; Design of Algorithm</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-501</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course aims to provide the fundamentals of algorithm design and analysis, specifically in terms of algorithm design techniques, application of these design techniques for real-world problem solving and analysis of complexity and correctness of algorithms.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Evaluate the correctness and analyze complexity of algorithms.
CO2	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
CO3	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
CO4	Describe the dynamic-programming and backtracking paradigms and explain when an algorithmic design situation calls for them. For given problems of dynamic-programming/ backtracking and develop the dynamic programming/ backtracing algorithms, and analyze them to determine its computational complexity.
CO5	To understand the differences between tractable and intractable problems and introduce P and NP Class.

## Syllabus:

### Unit-I Introduction:

Algorithm, Properties, Representations of Algorithms and Testing Algorithms, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations-Big Oh Notation, Omega Notation, Theta Notation and Little Oh Notation, Mathematical background for algorithm analysis, analysis of selection sort, insertion sort. Solving Recurrence Relations-Substitution Method, Master Method and Recursion Tree Methods. Fibonacci Heap, Binomial Heap.

### Unit-II: Divide and Conquer:

Divide and Conquer Approach: General method, Analysis of Merge sort, Analysis of Quick sort, Analysis of Binary search, Finding minimum and maximum algorithm and analysis, Strassen's matrix multiplication

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## **Unit-III: Greedy Approach:**

Greedy Method: General Method, Applications-0/1 Knapsack Problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees – Kruskal and Prim’s algorithm, Optimal storage on tapes, Single source shortest path problem

## **Unit-IV: Dynamic Programming:**

General Method, Multistage graphs, single source shortest path, all pair shortest path, Assembly-line scheduling, 0/1 knapsack, Travelling salesman problem, Longest common subsequence, Matrix Chain Multiplication, optimal binary search trees.

## **Unit-V: Backtracking:**

General Method, Applications- n – queen’s problem, Sum of subsets problem, Graph Coloring, Hamiltonian Cycle NP-Hard and NP-Complete Problems: Basic Concepts, Non-Deterministic Algorithms, NP-Hard and NP-Complete Classes, Cook’s Theorem

## **Text Books:**

- Ellis Horowitz, Sartaj Sahni and S. Rajasekharan, “Fundamentals of Computer Algorithms”, 2nd Edition, Universities Press.
- T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, “Introduction to Algorithms”, 3rd Edition, PHI.
- P. H. Dave, H.B. Dave, “Design and Analysis of Algorithms”, 2nd edition, Pearson Education.

## **Reference Text Books:**

- M. T. Goodrich and R. Tomassia, “Algorithm Design: Foundations, Analysis and Internet examples”, John Wiley and sons.
- S. Sridhar, “Design and Analysis of Algorithms”, Oxford Univ. Press.
- Aho, Ullman and Hopcroft, “Design and Analysis of algorithms”, Pearson Education.
- R. Neapolitan and K. Imipour, “Foundations of Algorithms”, 4th edition, Jones and Bartlett Student edition.

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<b>Programme</b>	<b>:</b>	<b>B. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course:</b>	<b>Deep Learning</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-502(1)</b>		
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Gain the knowledge about neural networks.
CO2	Introduce the basic concepts and techniques of deep learning.
CO3	Apply optimization techniques in in real life applications.
CO4	Develop the skills in deep learning for solving practical problems. To be familiar with a set of well-known deep neural network, convolutional neural network, filters optimization techniques.
CO5	Apply RNN and LSTM for sentiment analysis

## Syllabus:

### UNIT-I: Basics of Neural Networks

Biological Neuron, idea of computational units, McCulloch–Pitts unit and thresholding logic, linear perceptron, perceptron learning algorithm, linear separability, convergence theorem for perceptron learning algorithm, limitations of single-layer perceptron, introduction to activation functions (Sigmoid, Tanh, ReLU), bias term and its significance.

### UNIT-II: Feedforward Networks and Deep Neural Networks

Multilayer perceptron, gradient descent, backpropagation, empirical risk minimization, regularization, autoencoders, difficulty of training deep neural networks, greedy layer-wise training, role of initialization and activation in deep networks, batch vs stochastic gradient

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descent, mini-batch gradient descent, variants of autoencoders (denoising, sparse, variational - brief introduction).

### **UNIT-III: Optimization in Deep Neural Networks**

Newer optimization methods for neural networks (Adagrad, Adadelata, RMSProp, Adam, Nesterov Accelerated Gradient), second-order methods for training, saddle point problem in neural networks, regularization methods (dropout, drop connect, batch normalization), learning rate schedules (step decay, cosine annealing, warm restarts), gradient clipping in deep networks, early stopping as regularization.

### **UNIT-IV: Recurrent Neural Networks**

Backpropagation through time, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), bidirectional LSTMs, bidirectional RNNs, applications of RNNs (language modeling, sequence prediction), attention mechanism (brief introduction), comparison of LSTM and GRU architectures.

### **UNIT-V: Convolutional Neural Networks**

Convolution in n-dimensions, convolutional layers, pooling strategies, visualization of filters, padding and stride, parameter calculation in CNNs, overview of modern CNN architectures (LeNet, AlexNet, VGG, ResNet - brief), transfer learning and pre-trained CNN models (basic concept).

### **Text Books:**

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.

### **Reference Books:**

2. Raúl Rojas, "Neural Networks: A Systematic Introduction", 1996.
3. Christopher Bishop , "Pattern Recognition and Machine Learning", 2007.

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<b>Programme</b>	<b>: B. Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course:</b>	<b>Business Intelligence</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-502(2)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs./week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Descriptions:

This course gives the fundamental description about Business Intelligence and technique for gathering, storing, analyzing, sharing and providing access to data, to help University Enterprise or any other organization to make a better decision

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Learn concept, process, and practice of the data science and how methodologies are applied to visualize information from raw data.
CO2	Learn BI involving predictive and statistical approach.
CO3	Implement BI techniques by using various tools and Create data visualization.
CO4	Learn Business intelligence applications
CO5	Knowledge Management

## Syllabus:

### Unit-I

Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system

### Unit-II:

Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models Data mining: Definition of data mining, Representation of input data , Data mining process, Analysis methodologies Data preparation: Data validation, Data transformation, Data reduction

### Unit-III:

Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models

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## **Unit-IV:**

Business intelligence applications: Marketing models: Relational marketing, Sales force management, Logistic and production models: Supply chain optimization, Optimization models for logistics planning, Revenue management systems. Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices

## **Unit-V:**

Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems

## **Text Books:**

- Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, Pearson.
- Ramesh Sharda, Dursun Delen, Efraim Turban, J.E.Aronson, Ting-Peng Liang, David King, “Business Intelligence and Analytics: System for Decision Support”, 10th Edition, Pearson Global Edition, 2013

## **Reference Books:**

- Hans-Georg Kemper and Henning Baars “Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT”.
- David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Scripting Language</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-502(3)</b>	
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course introduces students to widely-used scripting languages to automate tasks, process data, and develop lightweight applications. It emphasizes practical programming in Python, JavaScript, and Shell scripting, covering fundamental syntax, regular expressions, file handling, web scripting, APIs, and basic automation. The course prepares students to write efficient scripts for system administration, web development, and data processing tasks.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the syntax, data structures, and control flow of scripting languages like Python and JavaScript
CO2	Perform file I/O operations and regular expression-based text processing
CO3	Use scripting to automate tasks in system administration and web development
CO4	Develop simple web-based applications using JavaScript and APIs
CO5	Integrate scripting with databases and use libraries for common tasks like data parsing and visualization

## Syllabus:

### Unit 1: Introduction to Scripting Languages

Definition and advantages of scripting, Difference between scripting and programming languages, Overview of popular scripting languages (Python, JavaScript, Shell), Use cases in system automation, web development, and data processing

### Unit 2: Python Scripting

Python syntax, variables, data types, operators, Control structures (if, for, while) , Functions, modules, and packages, File handling and exception handling, Regular expressions and JSON parsing.

### Unit 3: JavaScript for Web Scripting

Basics of JavaScript: syntax, variables, operators, functions, DOM manipulation and event handling, Form validation using JavaScript, AJAX and fetch API, ES6+ features (arrow functions, promises, let/const).

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## **Unit 4: Shell Scripting (Bash)**

Shell environment and commands, Writing and executing shell scripts, Conditional statements, loops, and functions in shell, File handling and command-line arguments, Scheduling jobs using corn, process management.

## **Unit 5: Scripting for Automation and Integration**

Using scripting languages for system automation, API calls and data retrieval, working with databases using Python (SQLite/MySQL), Web scraping using Python (BeautifulSoup/Requests), Scripting for data visualization (Matplotlib/Seaborn basics).

### **Text Books:**

- "Learning Python" by Mark Lutz, O'Reilly Media
- "Eloquent JavaScript" by Marijn Haverbeke
- "Classic Shell Scripting" by Arnold Robbins & Nelson Beebe

### **Reference Books:**

- "Python Cookbook" by David Beazley & Brian K. Jones
- "JavaScript: The Good Parts" by Douglas Crockford
- "UNIX and Shell Programming" by Behrouz Forouzan

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Operation Research</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-23-503(1)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

The course enables the students to the nature and scope of various decision making situations within business contexts, understand and apply operation research techniques to industrial applications, To make the student capable of Formulating the various real life decision making problems as Mathematical programming problems. Students to learn the fundamental Techniques of Operations Research and to choose a suitable OR technique to solve problem on hand.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Create mathematical models of the real-life situations and capable of obtaining best solution using Graphical Method and Simplex Method.
CO2	Implement the theory of duality for simplifying the solution procedure for certain LPPs, and solve the special cases of LPP such as Transportation and Assignment problems.
CO3	Gain knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition.
CO4	Apply different techniques to represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project, Probabilities of completing Projects.
CO5	Applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems.

## Syllabus:

### Unit I: Introduction Linear Programming -1 :

OR definition- Classification of Models - Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two-Phase Simplex Method, Big-M Method, Special Cases of LP-Degeneracy, Infeasibility and Multiple Optimal Solutions;.

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## **Unit II: Linear Programming -2:**

Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method, Transportation Problem - Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method; Special Cases - Unbalanced Transportation Problem, Degenerate Problem; Assignment Problem - Formulation; Optimal Solution -Traveling Salesman problem.

## **Unit III: Game Theory & Queuing Theory**

Induction - Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy -Games with Mixed Strategies - 2 X 2 Games - Dominance, Principle- Solution by Graphical Method of  $m \times 2$  &  $2 \times n$  games.

**Queuing Theory:** Introduction -Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length;

## **Unit IV: PERT & CPM:**

Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float- CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration- PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time.

## **Unit V: Dynamic Programming:**

Introduction - Bellman's Principle of Optimality - Applications of Dynamic Programming- Capital Budgeting Problem - Shortest Path Problem - Solution of Linear Programming Problem by DP.

## **Text Books:**

- Introduction to Operations Research, H.A.Taha, PHI, 6th edition, 2013.
- Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, Preetam Basu, Gerald J. Lieberman, TMH.

## **Reference Books:**

- Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
- Operations Research, Wagner, PHI Publications.
- Operation Research, J.K.Sharma, MacMillan,

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Compiler Design</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-</b>	<b>503(2)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

The aim of this course is to learn how to design and implement a compiler and also to study the underlying theories. The main emphasis is for the imperative languages. This study explains the principles, techniques and tools required in developing compilers in a systematic way; To gain an understanding on different theoretical and systems concepts from computer science coming together in building a compiler.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Design and implement of a prototype compiler.
CO2	Define a grammar for a language and validation.
CO3	Generate Three address code of a grammar.
CO4	Learn about storage allocation.
CO5	Apply various optimization techniques to produce efficient code.

## Syllabus:

### Unit I: Introduction To Compilers:

Language Processor, Definition of Compiler, Analysis-Synthesis Model, Phases of Compiler, The Science of Building Compilers, Applications of Language Processors, Basic Understanding of Interpreter and Assembler, Difference between Interpreter and Compiler, Compilation of Source Code Into Target Language, Cousins of Compiler, Types of Compiler.

### Unit II: Lexical Analysis

The Role of the lexical Analyzer, Specifications of tokens, Recognition of Tokens, Input Buffering, Elementary Scanner Design and its Implementation (Lex), Design of Lexical Analyzer Generator, Optimization of DFA.

### Unit III: Syntax Analysis

Understanding Parser and CFG(Context Free Grammars), Top Down and Bottom Up Parsing Algorithms, Top-Down Parsing- Recursive Descent Parser, Predictive LL(l) parsing, Bottom Up Parsing- Shift Reduce Parser, LR Parsers, Simple LR Parsing (SLR), LR(k) Parser, LALR Parser, Comparison of LR Parsers.

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## **Unit IV: Runtime Environment**

Storage organization, activation tree, activation record, allocation strategies, Parameter passing, symbol table, dynamic storage allocation.

## **Unit V: Code Optimization & Code Generation:**

Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Global data flow analysis, Loop invariant computations. Issues in the design of Code generator, register allocation, the target machine and a simple code generator.

## **Text Books:**

- Compiler-Principles, Techniques and Tools by Alfred V.Aho, Ravi Sethi and J. D. Ullman, Addison Wesley.
- Principles of Compiler Design, Alfred V. Aho and J.D.Ullman, Narosa Publication.

## **Reference Books:**

- Compiler Design in C by A.C. Holub, Prentice Hall of India.
- Compiler Construction (Theory and Practice) by A.Barret William and R.M.Bates (Galgotia Publication)
- Compiler Design, Kakde, Compiler Design, Galgotia Publication.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Computer Graphics</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-503(3)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## **Course Description:**

The objectives of this course are to equip students with the fundamental knowledge and basic technical competence in the field of computer graphics, emphasize on implementation aspect of Computer Graphics Algorithms and advance areas like Image Processing. Topics covered include graphics systems and input devices; geometric representations and 2D/3D transformations; viewing and projections; illumination and color models; animation; rendering and implementation; visible surface detection.

## **Course Outcomes:**

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matrix, Fundamental circuit matrix and rank of Circuit matrix. Cut – set matrix. AUnit IV:  
Runtime Environment

### **Unit IV: Coloring and Dominating sets:**

Definition of Chromatic number. Chromatic Partitioning. Chromatic Polynomial. Finding Chromatic polynomial by Decomposition Theorem and by Multiplication Theorem (without Proofs). Dominating set. Minimal Dominating set. Domination number. Independent dominating set. Finding minimal dominating sets. Some applications of domination theory.

### **Unit V: Graph Theoretic Algorithms and its applications**

Computer representation of a graph. Algorithm on spanning trees: Kruskal's and Prim's Algorithm. Shortest path algorithms: Shortest path from a specified vertex to another specified vertex by Dijkstra's algorithm, Shortest path between all pairs of vertices. Warshall's algorithm

### **Text Books:**

- Graph Theory with applications to engineering and computer Science by Narasingh Deo, Edition, Prentice hall of India Private Limited, 2009. ISBN: 9788120301450.
- Discrete and Combinatorial Mathematics, Ralph P. Grimaldi., 5th Edition , Pearson, 2006, ISBN: 9788177584240.

### **Reference Books:**

- Graph Theory, Modeling, Applications and Algorithms, Geir Agnarsson and Raymond Green law, 1st Edition, Pearson Education, Inc, New Delhi 2009.
- A First Look at Graph Theory, John Clark and Holton D.A, Allied Publishers, 2001.
- Introduction to Graph Theory, Douglas B West, Prentice hall of India Private Limited, New Delhi

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Digital Marketing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-504(2)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The objective of this course is to provide students with in-depth knowledge of digital marketing concepts, tools, and techniques. It focuses on enhancing practical skills through strategic use of social media, SEO, SEM, email marketing, content marketing, and web analytics. The course aims to prepare students to implement and evaluate digital marketing campaigns and understand their impact on consumer behavior and business growth.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the fundamental concepts and evolution of digital marketing.
CO2	Demonstrate knowledge of digital tools such as SEO, SEM, email marketing, and content marketing.
CO3	Analyze and develop digital marketing strategies for branding and promotion.
CO4	Use social media platforms and tools to design and manage campaigns.
CO5	Apply analytics and performance metrics to evaluate digital marketing effectiveness.

## Syllabus:

### Unit 1: Introduction to Digital Marketing

Definition and importance of digital marketing, Traditional vs. Digital marketing, Digital marketing platforms and channels, Current trends and future of digital marketing, Consumer behavior in the digital age, Buying journey, and digital touchpoints.

### Unit 2: Search Engine Optimization (SEO) and Search Engine Marketing (SEM)

Basics of search engines, SEO techniques (on-page, off-page, technical), Keyword research, Google Search Console, Search Engine Marketing with Google Ads, PPC campaigns, Bidding strategies, Ad Rank, Quality Score.

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## **Unit 3: Social Media and Content Marketing**

Role of social media in marketing, Strategies for Facebook, Instagram, LinkedIn, Twitter, YouTube, Social media content planning and scheduling tools, Influencer marketing, Blogging and video content, Storytelling for brands.

## **Unit 4: Email Marketing and Affiliate Marketing**

Email campaign creation, A/B testing, Deliverability, Personalization, Email automation tools, Compliance and ethics (CAN-SPAM Act, GDPR), Introduction to affiliate marketing, How affiliate networks work, Tracking and commission models.

## **Unit 5: Web Analytics and Performance Measurement**

Introduction to web analytics, Google Analytics dashboard, Key performance indicators (KPIs), Conversion tracking, UTM parameters, Reporting, Dashboards, ROI in digital marketing, Optimization of campaigns through data insights.

### **Text Books:**

- Ryan, D. (2016). Understanding Digital Marketing. Kogan Page.
- Chaffey, D., & Ellis-Chadwick, F. (2019). Digital Marketing. Pearson Education.
- Kotler, P., Kartajaya, H., & Setiawan, I. (2021). Marketing 5.0. Wiley.

### **Reference Books:**

- Kingsnorth, S. (2022). Digital Marketing Strategy: An Integrated Approach to Online Marketing. Kogan Page.
- Tuten, T. L., & Solomon, M. R. (2017). Social Media Marketing. Sage Publications.
- Cutroni, J. (2010). Google Analytics. O'Reilly Media.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Quantum Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-</b>	<b>504(3)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

A fundamental of quantum computing focused primarily on foundations, theory, and rigor, rather than specific hardware implementations or heuristic applications. We will begin with the axioms of quantum mechanics and the most common formulation of quantum computation based on quantum circuits. We will then develop the core primitives in the quantum algorithms toolkit (such as quantum Fourier transforms, phase estimation, and Trotterization/quantum simulation) and establish some elementary complexity-theoretic results (including some oracle separations, and various lower and upper bounds), as well as work through the crown jewel of quantum algorithms to date—Shor's factoring algorithm. Along the way, we will see some of the more curious aspects of quantum information facilitated by quantum entanglement (such as Grover search, quantum teleportation, super dense coding, and Bell violations).

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe quantum mechanics concepts and quantum computer systems
CO2	Explain and apply linear algebra operations in quantum computing
CO3	Relate the role of quantum technology in secure computing
CO4	Test and use modern tools for industry 4.0
CO5	Able to independently analyze and find solutions in quantum computing.

## Syllabus:

### Unit-I:

Basics: Basic quantum mechanics, Classical v/s Quantum systems, Quantum supremacy, Quantum computer architectures, Quantum applications, Complex Numbers, Linear Algebra – vector and matrix operations.

Qubit & Quantum States: Quantum bits, Bloch sphere representation of a qubit, multiple qubits, Vector Spaces. Linear Combination of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchy-schwarz and triangle

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### Unit-II:

Quantum Gates: Single Qubit gates, Multiple Qubit gates, Tensor Products and Density Operator: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.

### Unit-III:

Quantum Algorithms: Classical computation on quantum computers, Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Grover search, Quantum error correcting code, Quantum parallelism, Simon's periodicity algorithm, Application of entanglement, teleportation, superdense coding.

### Unit-IV:

Quantum Cryptography : Introduction to quantum cryptography and quantum information theory, Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekert 91

Quantum Technology: Quantum measurement, Cloning theorem, Scalability in real quantum systems, Quantum Computing Implementations: Quantum programming languages, Probabilistic and Quantum computations, Quantum annealing (e.g., D-Wave systems), Superconducting qubits (e.g., IBM Q), Ion trap quantum computers (e.g., Honeywell)

### Unit-V:

Quantum Application : Healthcare, transportation, finance, security, Quantum warfare and Post quantum cryptography, Drug Discovery and Material Science, Machine Learning and Artificial Intelligence, Supply Chain Management and Logistics, Climate Modeling and Environmental Analysis, Machine Vision and Imaging, Genomics and Personalized Medicine.

### Text Books:

- Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, 2008
- Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008
- Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010

### Reference Books:

- Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995
- Explorations in Quantum Computing, C. P. Williams and S. H. Clearwater, Springer, New York, 2018.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Cloud Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-505</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course aims to understand the basics of cloud computing and its working. The concept of virtualization in cloud computing will be explained, and the types of virtualization and hypervisor will be covered. In all, the difference services and deployment models will be covered, and the trust over cloud computing and security challenges will be discussed with range of different service platform like Google, AWS, Microsoft Azure etc.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the basic concept of the cloud computing
CO2	Understand the concept of virtualization, hypervisor and implementation of virtual machines
CO3	Gain the knowledge of the Cloud Delivery Models like IaaS, PaaS and SaaS with reference to Services.
CO4	Understanding of Cloud Computing Reference Architecture with reference to relationships between various functional units and Security issues
CO5	Understanding of Cloud Service Platforms

## Syllabus:

### Unit-I: Introduction:

Cloud Computing, Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS. Cloud Architecture: Public, Private, Hybrid, and Community Cloud.

### Unit-II: Virtualization:

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Type of Hypervisor, Understanding Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management.

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### Unit-III: Cloud Services:

Software as a Service (SaaS): Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms. Infrastructure as a Services (IaaS): Introduction, Background & Related Work. Virtual Machines Provisioning and Manageability. Platform as a service (PaaS): Integration of Private and Public Cloud, Technologies and Tools for Cloud Computing, Resource Provisioning services.

### Unit-IV: Cloud Deployment Models:

**Private Cloud:** Illustration of Private Cloud, Advantages of Private Cloud, Limitations of Private Cloud, Service Management, Journey into Private Cloud, Planning and Strategy. Standardization, Virtualization, Automation, Cloud, Case study – VMware.

**Public Cloud:** Illustration of Public Cloud, Why Public Cloud, Advantages of Public Cloud, Limitations of Public Cloud, Low degree of security and control, Lack of control on infrastructure, configuration, Network latency and accessibility concerns, Highest long term cost, Public v/s Private.

**Hybrid Cloud:** Why Hybrid Cloud, Illustration of Hybrid Cloud, Advantages of Hybrid Cloud, Challenges of Hybrid Cloud, Develop and manage hybrid workloads, developing applications for hybrid cloud, develop applications using PaaS, Managing hybrid workloads.

### Unit-V: Cloud Service Providers & Platforms:

Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP), Cloud services comparison (compute, storage, networking), Cloud pricing models and billing

### Text Books:

- Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
- John W. itinghouse james F.Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press.

### Reference Books:

- Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
- Cloud Security: A Comprehensive Guide to secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Internet Technology – I (HTML, PHP, CSS) Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-506</b>	
<b>Credits</b>	<b>:</b>	<b>2</b>	<b>No of Hours</b>	<b>:</b>	<b>4 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This course introduces the fundamentals of web development using HTML, CSS, and PHP. It covers front-end development using HTML and CSS to design responsive and user-friendly websites, and back-end development using PHP to handle server-side scripting and database interaction. Students will learn to build complete dynamic web applications integrating both frontend and backend technologies.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Understand and apply the foundational structure of HTML and CSS to create responsive and visually appealing web pages.
CO2	Develop server-side scripts using PHP and perform form handling along with integration of backend databases like MySQL.
CO3	Design, build, and deploy dynamic web applications by integrating both frontend and backend components effectively.

## Unit 1: HTML Fundamentals

Introduction to Web Technologies , Structure of HTML Documents ,HTML Elements: Headings, Paragraphs, Lists, Links, Images, Tables ,Forms and Input Types ,Semantic HTML5 Tags.

## Unit 2: CSS for Styling and Layout

Introduction to CSS: Syntax, Selectors, and Properties ,Inline, Internal, and External CSS,Box Model, Margins, Padding, Borders ,Positioning, Flexbox, and Grid Layouts ,Responsive Design: Media Queries and Mobile-first Design

## Unit 3: Introduction to PHP

PHP Syntax and Variables ,Data Types, Operators, and Expressions, Control Structures:Conditionals and Loops ,Functions in PHP,Form Handling with PHP (GET and POST methods).

### **Unit 4: PHP and MySQL Integration**

Introduction to MySQL and phpMyAdmin, Connecting PHP with MySQL, Performing CRUD Operations (Create, Read, Update, Delete), Validating and Sanitizing User Inputs, Session Management and Cookies.

### **Unit 5: Building and Deploying Dynamic Web Applications**

File Upload Handling in PHP, Email Sending with PHP, Building a Mini Project (e.g., Student Registration System / Online Feedback System) Hosting Web Applications (using XAMPP or live server), Version Control Introduction (Git Basics).

### **The following Concepts/Experiments will be covered in the lab:**

#### **1. Create a Basic Webpage using HTML**

- Objective: Design a static webpage using headings, paragraphs, lists, and images.

#### **2. Design a Student Registration Form using HTML**

- Objective: Implement form elements like text fields, radio buttons, dropdowns, and submit buttons.

#### **3. Style a Webpage using CSS**

- Objective: Use selectors, colors, font styles, borders, padding, and margin.

#### **4. Create a Responsive Layout using CSS Flexbox/Grid**

- Objective: Design a responsive page layout compatible with multiple devices.

#### **5. Form Handling using PHP (GET and POST methods)**

- Objective: Create a form and process user input using PHP scripts.

#### **6. Create a Login and Registration Page using PHP and MySQL**

- Objective: Store and retrieve user data from a database securely.

#### **7. CRUD Operations with PHP and MySQL**

- Objective: Create a system for adding, viewing, editing, and deleting records (e.g., student data).

#### **8. Session and Cookie Management in PHP**

- Objective: Track user login sessions and demonstrate cookie creation and access.

#### **9. File Upload Handling using PHP**

- Objective: Allow users to upload files (PDF/Image) and store them on the server.

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### 10. Mini Project: Feedback Collection System

- Objective: Build a complete feedback system using HTML, CSS, PHP, and MySQL.

#### **Text Books:**

- "HTML and CSS: Design and Build Websites" by Jon Duckett
- "Learning PHP, MySQL & JavaScript" by Robin Nixon

#### **Reference Books:**

- "PHP and MySQL Web Development" by Luke Welling and Laura Thomson
- "Web Development with HTML, CSS, JavaScript and jQuery" by Jon Duckett
- "Head First PHP & MySQL" by Lynn Beighley and Michael Morrison

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Analysis &amp; Design of Algorithm Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-507</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The objectives of this course are to equip students with the fundamental knowledge and basic technical competence in the field of computer graphics, emphasize on implementation aspect of Computer Graphics Algorithms and advance areas like Image Processing.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Analyze algorithm to solve problems by iterative approach.
CO2	Analyze algorithm to solve problems by divide and conquer approach.
CO3	Implement algorithm to solve problems by Greedy Approach, Dynamic programming, backtracking, branch, and bound approach.

## The following concepts will be covered in the lab:

- Provide algorithms and programs to implement the following searching procedures.
  - Linear search
  - Binary search
- Implementation of Sorting algorithm like Quick sort, Heap Sort, Merge sort etc. and computation of 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 non graph sheet. The elements can be read from a file or can be generated using the random number generator.
- Implementation of divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
- Implementation of 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
- Implementation of Dijkstra's algorithm to find shortest paths from a given vertex in a weighted connected graph.
- Implementation of finding Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.

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- Implementation of Prim's algorithm to find Minimum Cost Spanning Tree of a given connected undirected graph.
- Implementation of All-Pairs Shortest Paths problem using Floyd's algorithm.
- Implementation of Travelling Sales Person problem using

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## **Text Books:**

- David Poole, Alan Mackworth, Randy Goebel, “Computational Intelligence: a logical approach”, Oxford University Press.
- R. O. Duda, P. E. Hart and D.G. Stork, “Pattern Classification”, John Wiley, 2001.
- G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem-solving”, Fourth Edition, Pearson Education.
- Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective, Morgan Kaufmann (Elsevier), 2016.
- Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence - Computational Frameworks, Practices, and Applications, CRC Press, 2023.
- Ira J. Haimowitz, DATA ANALYTICS FOR BUSINESS - Lessons for Sales, Marketing, and Strategy, Routledge (Taylor & Francis), 2023.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>V</b>
<b>Name of the Course</b>	<b>:</b>	<b>Scripting Language Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-508(3)</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab is designed to provide hands-on practice in popular scripting languages such as Python, JavaScript, and Shell Scripting. Students will develop the ability to write small, practical programs to automate tasks, manipulate data, and perform essential scripting operations useful in web development, system operations, and data handling.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Develop programs using basic scripting constructs such as loops, conditionals, functions, and modules.
CO2	Demonstrate the ability to manipulate files, perform regular expression matching, and automate routine tasks.
CO3	Apply scripting techniques in real-world scenarios such as web interaction, data parsing, and system utilities.

## The following Concepts/Experiments will be covered in the lab:

- **Basic Python Scripting**  
Write a Python program to demonstrate variables, conditional statements, loops, and user-defined functions.
- **File Handling in Python**  
Write a script to read, write, append, and delete data from text files using file handling functions.
- **Regular Expressions**  
Create a Python script that validates email addresses and phone numbers using regular expressions.
- **Web Scraping using Python**  
Write a script using requests and BeautifulSoup to extract data (e.g., news headlines or tables) from a website.

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- **JavaScript Basics and DOM Manipulation**

Create an HTML page with embedded JavaScript to manipulate DOM elements based on user input.

- **Form Validation using JavaScript**

Write a JavaScript program to validate a registration form (e.g., check for empty fields, email format, etc.).

- **AJAX and Fetch API**

Create a web page that uses JavaScript fetch API to get data from a public API and display it dynamically.

- **Shell Scripting Basics**

Write a shell script to perform basic arithmetic operations, and display system information (like disk usage, users).

- **Shell Script for File and Process Handling**

Create a shell script that finds the number of lines in a file, deletes temporary files, or monitors a running process.

- **Database Connection using Python**

Write a Python program to connect to a SQLite/MySQL database, create a table, and perform basic CRUD operations.

## **Text Books:**

- "Learning Python" by Mark Lutz, O'Reilly Media
- "Eloquent JavaScript" by Marijn Haverbeke
- "Classic Shell Scripting" by Arnold Robbins & Nelson Beebe

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course:</b>	<b>Cloud Computing Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-509</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours</b>	<b>: 2 Hrs. / week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Descriptions:

This laboratory course provides hands-on experience with the core concepts and practical applications of cloud computing. Students will explore leading cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) to understand cloud infrastructure, deployment models, and service models. The course emphasizes practical exposure to virtualization, cloud storage, serverless computing, cloud databases, identity management, and deployment of scalable web applications.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	The students will learn to provision virtual machines, implement storage solutions, configure auto-scaling and load balancing, and deploy applications using platform services.
CO2	Introduces modern DevOps tools and practices, including containerization.
CO3	Students will be equipped with the technical skills needed to develop and manage applications in a cloud environment.

## The following Experiments will be covered in the lab:

### 1. Introduction to Cloud Platforms

- Overview and setup of AWS Free Tier / Azure Student Account / GCP
- Navigating the cloud console

### 2. Launching and Configuring Virtual Machines

- Create and configure EC2 instances (AWS) or Virtual Machines (Azure)
- Connect via SSH and install packages

### 3. Working with Object Storage

- Create and use an S3 bucket (AWS) / Blob Storage (Azure)
- Upload, retrieve, and manage files

### 4. Creating and Deploying a Website

- Host a static website on AWS S3 / Azure Blob Storage
- Deploy a dynamic web app using AWS Elastic Beanstalk / Azure App Service

### 5. Load Balancing and Auto Scaling

- Set up a Load Balancer in AWS
- Configure auto-scaling groups based on CPU utilization

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### 6. Cloud Database Services

- Create and access Amazon RDS / Azure SQL Database
- Connect with an application

### 7. Serverless Computing

- Create a simple AWS Lambda function
- Trigger using API Gateway or S3 event

### 8. Identity and Access Management (IAM)

- Create IAM users and roles
- Assign policies and test access controls

### 9. Virtualization with VirtualBox/Docker

- Install and configure VirtualBox/Docker
- Create and run containers

### 10. CI/CD in the Cloud (Optional Advanced Lab)

- Set up a basic pipeline using AWS CodePipeline or GitHub Actions
- Automate deployment of a simple app

### Text Books:

- Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
- John W. itinghouse james F.Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press.

### Reference Books:

- Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
- Cloud Security: A Comprehensive Guide to secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley

### Tools & Platforms:

- AWS Educate / Free Tier
- Microsoft Azure for Students
- Google Cloud Platform (GCP) Free Tier
- Docker, VirtualBox
- GitHub, Jenkins (optional)

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: V</b>
<b>Name of the Course</b>	<b>: Professional Development</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-511</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>1 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Description:

In this course, students will be taught to develop and become team player for creativity and innovation in the organization they work in. Students will be taught methods to develop cordial relation using “Johari Window”, which will help them in managing change in their organizations. Since they would be entering the world of work, special emphasis will also be given to manners, etiquettes, negotiation, stress and conflict management. Finally, students will be rigorously prepared for facing various selection tools like – GD, PI and resume preparation.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Communicating effectively in a variety of public and interpersonal settings
CO2	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of change
CO3	Analysing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships
CO4	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust
CO5	Handling difficult situations with grace, style, and professionalism

## Syllabus:

### Unit-I Intrapersonal Skills:

- Creativity and Innovation
- Understanding self and others (Johari window)
- Stress Management
- Managing Change for competitive success
- Handling feedback and criticism

### Unit-II: Interpersonal Skills:

- Conflict management
- Development of cordial interpersonal relations at all levels
- Negotiation
- Importance of working in teams in modern organisations

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- Manners, etiquette and net etiquette

### **Unit-III: Interview Techniques:**

- Job Seeking
- Group discussion (GD)
- Personal Interview

### **Text Books:**

- Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education
- Burne, Eric, Games People Play (2010), Penguin UK
- Carnegie, Dale, How to Win Friends and Influence People (2004), RHUK
- Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan
- Steinburg, Scott, Netiquette Essentials (2013), Lulu.com

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## Academic Semester VI

Type of Course	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit
			L	P	T	PRE**		ESE*	Total Marks	L+(T+P)/2
						Mid Sem	TA			
CC	SOE-B-CSE-23-601	Computer Network	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-602	Software Engineering	3	0	0	30	20	50	100	3
DSE	SOE-B-CSE-23-603(X)	Department Specific Elective – V	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-604	Cryptography and Information Security	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-605	Distributed Computing	3	0	0	30	20	50	100	3
CC	SOE-B-CSE-23-606	Computer Network Lab	0	2	0	--	30	20	50	1
CC	SOE-B-CSE-23-607	Software Engineering Lab	0	2	0	--	30	20	50	1
DSE	SOE-B-CSE-23-608(X)	Department Specific Elective – V Lab	0	2	0	--	30	20	50	1
CC	SOE-B-CSE-23-609	Cryptography and Information Security Lab	0	2	0	--	30	20	50	1
SEC	SOE-B-CSE-23-610	Internet Technology – II (Node JS, Express JS, TypeScript, MongoDB)	0	2	0	--	30	20	50	1
Value Added	SOE-B-CSE-23-611	Value Added Course through (MOOC / SWAYAM/Any other online platform))	0	4	0	--	30	20	50	2
AECC	SOE-B-CSE-23-612	Professional Development-II	0	2	0	--	30	20	50	1
		<b>Total</b>	<b>15</b>	<b>16</b>	<b>0</b>	<b>150</b>	<b>310</b>	<b>390</b>	<b>850</b>	<b>23</b>

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>: Software Engineering</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-602</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course offers lectures, tutorials, case studies, laboratory, and online interaction to provide a foundation in software engineering concepts. It includes representing information with the traditional and modern approaches in software engineering including knowledge of CASE tools. This course further explains concepts of software development process, agile, scrum and DevOps development process, software project management, software requirement and design engineering, development, quality assurance, automated testing, operational support and software maintenance.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To learn and understand the Concepts of Software Engineering
CO2	To Learn and understand Software Development Life Cycle
CO3	To apply the project management and analysis principles to software project development.
CO4	To apply the design & testing principles to software project development.
CO5	Evaluate software quality using industry standards and metrics, and apply maintenance and evolution strategies for software systems.

## Syllabus:

### Unit 1: Introduction Software Engineering and Process Models

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths, Types of software, Attributes of good software. Generic view of process: Software engineering- A layered technology, a process framework, Process patterns, process assessment. Process models: The waterfall model, Incremental process models, Evolutionary process models, Spiral development, The Unified process, Agility and Agile Process model, Extreme programming, Rapid application development (RAD), Software prototyping, Other process models of Agile Development and Tools

### **Unit 2: Software Project Management and Requirement Analysis.**

Software Project Management: Responsibilities of a Software Project Manager, Project planning, Metrics for Project Size Estimation: Function Point Analysis, LOC Estimation, Project Estimation Techniques, COCOMO, Project scheduling, Staffing, Risk Management

System and software requirements: Types of software requirements, Functional and non-functional requirements, Domain requirements, User requirements. Requirement Gathering: Viewpoints, Interviewing, Scenarios, Use-cases, Process modeling with physical and logical DFDs: Entity Relationship Diagram, Data Dictionary, Requirement validation. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. Software requirement Specification (SRS), Structure and contents, SRS format.

### **Unit 3: Software Design**

Design Engineering: Design process and Design quality, Design concepts, the design model. Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural Design. Object-Oriented Design: Objects and object classes, An Object-Oriented design process, Design evolution. Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps.

### **Unit 4: Software Implementation and Testing**

Programming languages and development tool: Selecting languages and tools, Good programming practices, Coding Standards. Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Verification and validation, Black-box and White-box testing, Inspections. Levels of testing: Unit testing, Integration Testing, Interface testing, System testing, Alpha and beta testing, Regression testing. Design of test cases.

### **Unit 5: Software Quality and Maintenance**

Software Reliability, Software Quality, Quality management activities: Software Measurement, Metrics for software quality, Product and process quality. Standards: ISO9000, Capability Maturity Model (CMM), Six Sigma. Characteristics of Software Maintenance, Characteristics of Software Evolution, Software Reverse Engineering, Software Maintenance Process Models, Estimation of Maintenance Cost.

### **Text Books:**

- Pearson Edu, “Software Engineering by Ian SomMerville”, 9th edition, 2010
- Roger P, “Software Engineering – A Practitioner’s Approach”, seventh edition, Pressman, 2010.
- The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, 2nd Edition, 2005.

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## **Reference Books:**

- Agile Product Management with Scrum: Creating Products that Customers Love by Roman Pichler, Addison-Wesley Professional, 2010.
- The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations by Gene Kim, Jez Humble, Patrick Debois, John Willis, 2016.

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<b>Programme</b>	<b>:</b>	<b>B. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>Soft Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-603(1)</b>		
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

A unified and unique mathematical treatment of various soft computing techniques for constructing intelligent systems, in modelling, optimization and control. The course covers the theory and applications of neural networks, fuzzy logic, evolutionary strategies and genetic algorithms in developing intelligent systems with examples and practical applications.

## Course Outcomes:

At the end of this courses, the student will be able to: -

CO Number	Course Outcome
CO1	Recognize the feasibility of applying a soft computing methodology for a particular problem.
CO2	Recognize Develop intelligent machines to provide solutions to real world problems, which are not modelled or too difficult to model mathematically.
CO3	Exploit the tolerance for Approximation, Uncertainty, Imprecision and Partial Truth in order to achieve close resemblance with human like decision making.

## Syllabus:

### UNIT-I: Neural Networks-1 (Introduction & Architecture)

Neuron, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto- associative and hetro-associative memory.

### UNIT-II: Neural Networks-II (Back Propagation Networks)

Architecture: perception model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient; back propagation algorithm, factors affecting back propagation training, applications.

### UNIT-III: Fuzzy Logic-I (Introduction)

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

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## **UNIT-IV: Fuzzy Logic AI (Fuzzy Membership, Rules)**

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfication & Defuzzification, Fuzzy Controller, Industrial applications.

## **UNIT-5: Genetic Algorithm (GA)**

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators: Crossover, Mutation, Generational Cycle, GA optimization problem, applications.

### **Text Books:**

- “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” by S. Rajsekaran & G.A. Vijayalakshmi Pai, Prentice Hall of India.
- “Artificial Intelligence and Intelligent Systems” by N.P.Padhy, Oxford University Press.

### **Reference Books:**

- Siman Haykin “Neural Networks”, Prentice Hall of India.
- Timothy J. Ross “Fuzzy Logic with Engineering Applications”, Wiley India.
- Kumar Satish “Neural Networks”, Tata Mc Graw Hill.

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<b>Programme</b>	<b>:</b>	<b>B. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>:</b>	<b>Big Data Analytics</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-23-603(2)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

The Big Data Analytics course introduces students to the fundamental concepts of Big Data, including its types, challenges, and technologies. It covers data processing with Hadoop and Spark, along with analytics techniques such as descriptive, diagnostic, and predictive analytics. Students will also learn to visualize data using tools like Tableau and PowerBI. The course explores real-world applications of Big Data across industries like healthcare, IoT, and social media.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	To learn basic concept of Big Data and its characteristics.
CO2	To understand data processing using Hadoop and Spark.
CO3	To understand the role and architecture of YARN and MapReduce in the Hadoop ecosystem
CO4	To learn basic statistical methods and analytics techniques on large datasets
CO5	To understand and apply Big Data technologies to solve problems in various sectors

## Syllabus:

### UNIT-I: Introduction to Big Data Analytics

Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured. Sources of data. Definition and Features of Big Data, Big Data Value, The development of Big Data, Characteristics and Need of Big Data-Challenges of big data. Analytics Tools and Techniques: Hadoop, Spark, and NoSQL in the context of big data analytics.

### UNIT-II: Data Processing with Hadoop and Spark

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read. NameNode, Secondary NameNode and DataNode. Hadoop ecosystem components - Schedulers - Fair and Capacity. SPARK: SPARK BASICS, Using the Spark Shell, RDD Data Types and RDD Creation, RDDs (Resilient Distributed Datasets) in Spark, General RDD Operations: Transformations & Actions, RDD Lineage, RDD Persistence

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Overview, Distributed Persistence. HIVE: Hive Shell, Hive Services, Hive Meta store, Comparison with Traditional Databases.

### **UNIT-III: MapReduce and YARN framework**

Introduction to Map Reduce, Processing data with Hadoop using MapReduce, Introduction to YARN, Architecture, Managing Resources and Applications with Hadoop YARN. Big data technologies and Databases: NoSQL: Introduction to NoSQL - Features and Types-Advantages & Disadvantages -Application of NoSQL.

### **UNIT-IV: Data Analytics Techniques**

Data Analytics Overview: Descriptive, diagnostic, predictive, and prescriptive analytics, Basic Data Statistics: Mean, median, mode, variance, correlation. Data Visualization: Techniques for visualizing data using charts (histograms, scatter plots, box plots). Tools for Visualization: Introduction to Tableau or PowerBI for creating interactive dashboards. Exploratory Data Analysis (EDA): Summarizing and visualizing datasets to identify patterns and trends.

### **UNIT-V: Big Data Applications**

Application Evolution, Big Data Analysis Fields - Structured Data Analysis, Text Data Analysis, Web Data Analysis, Multimedia Data Analysis, Network Data Analysis, Mobile Traffic Analysis, Key Applications - Application of Big Data in Enterprises, Application of IoT Based Big Data, Application of Online Social Network Oriented Big Data, Applications of Healthcare and Medical Big Data, Collective Intelligence, Smart Grid.

### **Textbooks:**

- Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd.,2016.
- Mike Frampton, “Mastering Apache Spark”, Packt Publishing, 2015.

### **Reference Books:**

- Tom White, “Hadoop: The Definitive Guide”, O’Reilly, 4th Edition, 2015.
- Mohammed Guller, “Big Data Analytics with Spark”, Apress, 2015
- Donald Miner, Adam Shook, “Map Reduce Design Pattern”, O’Reilly, 2012

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>Digital Image Processing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-603(3)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours:</b>	<b>3 Hrs/Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The objective of this course to equip the students with the techniques & tools for digital image processing, & image analysis in the form of image segmentation, image enhancement, image filters, image transforms, Fourier transforms & fast Fourier transforms, edge detection, image segmentation & colour imaging.

## Course Outcomes:

Upon successful completion of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe the theory and algorithms that are widely used in digital image processing
CO2	Apply a proper image enhancement technique for given a set of noisy images
CO3	Compare different image segmentation and compression techniques
CO4	Formulate solutions using morphological concepts
CO5	Develop any application using different image processing techniques

## Syllabus:

### Unit 1: Digital Image Fundamental

Introduction – Steps in Digital Image Processing, Components, Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, Introduction to computational imaging, Basics of multi-resolution imaging, Concept of image metadata, Introduction to different color spaces (e.g., HSV, YCbCr)

### Unit 2: Image Enhancement

Spatial Domain, Gray level transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Homomorphic filtering, Guided filtering, Detail enhancement techniques, Introduction to deep learning-based image enhancement (brief overview), Frequency Domain, Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters, Ideal, Butterworth and Gaussian filters, Wavelet transform for image enhancement, Directional filtering in the frequency domain, Short-Time Fourier Transform (STFT) for image analysis (brief introduction).

### Unit 3: Image Restoration

Noise models, Mean filters, Order Statistics, Adaptive filters, Band reject, Band pass, Notch – Optimum notch filtering, Inverse Filtering, Constrained Least Square Filtering, Wiener filtering, Non-local means denoising, Block-matching and 3D filtering (BM3D) (brief introduction), Deep learning for image denoising (brief overview), Restoration in the presence of motion blur.

### Unit 4: Image Compression

Fundamentals – Image Compression models, Error Free Compression, Variable Length Coding – Bit, Plane Coding, Lossless Predictive Coding, Lossy Compression, Lossy Predictive Coding, Wavelet Coding, and Compression Standards – JPEG2000, Image compression using neural networks (brief overview), Fractal image compression (brief introduction), Region of Interest (ROI) based compression, Modern image formats and their compression techniques (e.g., HEIF, AVIF - very brief introduction).

### Unit 5: Image Segmentation & Representation

Segmentation – Detection of Discontinuities, Edge Linking and Boundary detection, Region based segmentation, Graph cuts for image segmentation, Active contour models (snakes) (brief introduction), Introduction to semantic segmentation using deep learning (brief overview), Representation – Boundary descriptors, Simple Descriptors, Shape numbers, Regional descriptors, Simple and Topological Descriptors, Scale-invariant feature transform (SIFT) (brief introduction), Histogram of Oriented Gradients (HOG) (brief introduction), Introduction to feature learning using convolutional neural networks (brief overview), Introduction to Image Processing Toolbox, Practice of Image Processing Toolbox, and Case studies–Various Image Processing Techniques, Using the toolbox for advanced segmentation and feature extraction tasks, Case studies involving deep learning-based image processing techniques alongside traditional methods.

#### Text Books:

- Digital Image Processing. Gonzales R. C. & Woods R. E. 3rd Ed., Pearson Education.2010.
- Fundamentals of Digital Image Processing. Jain A. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing. Jayaraman S., Esaki R. S., Kumar T. V., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.
- Digital Image Processing Using MATLAB. Gonzalez R. C., Woods R. E., Eddins S. L., 3rd Ed. Tata McGraw Hill Pvt. Ltd, 2011.

#### Reference Books:

- Digital Image Processing and analysis, Chanda B., Majumder D. D. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing and Pattern Recognition, Pakhira M. K., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.
- Fundamentals of Digital Image Processing, Annadurai S., Shanmugalakshmi R., 1st Ed. Pearson Education, 2007.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>: Cryptography and Information Security</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-604</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The course covers fundamental aspects of security in a modern networked environment with the focus on system design aspects and cryptography in the specific context of network / internetwork security. It also dwells into basics of cryptographic techniques, algorithms and protocols required to achieve these properties; computational issues in implementing cryptographic protocols and algorithms; and system/application design issues in building secure networked systems.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand basics of Cryptography and Information Security.
CO2	Understand various symmetric key algorithm and apply them on real world data.
CO3	Analyze the different conventional and public key encryption algorithms
CO4	Demonstrate various methods to calculate authentication codes using Message Authenticate Code.
CO5	Categorize viruses and mechanisms used for intrusion detection

## Syllabus:

### Unit <sup>2</sup> I: Introduction

Introduction to security attacks, services and mechanism, Classical encryption techniques, substitution ciphers and transposition ciphers, cryptanalysis, steganography, Modular Arithmetic, Classical encryption techniques: substitution techniques, transposition techniques, steganography, Stream and block ciphers.

### Unit - II: Symmetric Key Cryptography

Introduction to group, field, finite field of the form  $GF(p)$ , modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Block ciphers principles, Shannon's theory of confusion and diffusion, feistel structure, Data encryption standard (DES), Strength of DES, block cipher modes of operations, Triple DES, Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4.

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## **Unit <sup>2</sup> III: Public Key Cryptography**

Mathematics Of Asymmetric Key Cryptography: Primes, Primality Testing, Factorization, Euler's totient function, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Exponentiation and logarithm, Discrete Logarithmic Problem.

## **Unit <sup>2</sup> IV: Message Authentication And Integrity**

Principles of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elgamel encryption, Message Authentication and Hash Function, Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS.

## **Unit - V: Security Practice And System Security**

Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

### **Text Books:**

- William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
- Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
- C K Shyamala, N Harini, Dr. T.R.Padmabhan Cryptography and Security ,Wiley
- Bruce Schneier, "Applied Cryptography". John Wiley & Sons
- Bernard Menezes," Network Security and Cryptography", Cengage Learning.
- Atul Kahate, "Cryptography and Network Security", McGraw Hill

### **Reference Books:**

- C K Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", 1st Edition, Wiley India
- Forouzan Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Mc Graw Hill
- Mark Stamp, "Information Security, Principles, and Practice", Wiley India.
- WM. Arthur Conklin, Greg White, "Principles of Computer Security", TMH.
- Neal Krawetz, "Introduction to Network Security", CENGAGE Learning.
- Bernard Menezes, "Network Security and Cryptography", CENGAGE Learning.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VII</b>
<b>Name of the Course</b>	<b>: Distributed Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-605</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces the fundamental concepts, principles, and techniques of distributed computing. It focuses on the design and implementation of distributed systems where components located on networked computers communicate and coordinate their actions by passing messages. Key topics include communication models, synchronization, consistency, fault tolerance, distributed file systems, and distributed algorithms. Through theoretical study and practical assignments, students will learn how to build scalable, reliable, and efficient distributed applications.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand models of distributed computing
CO2	Analyze algorithms for coordination, communication and synchronization in distributed systems
CO3	Analyze distributed shared memory models
CO4	Design and Implement distributed file systems
CO5	Design distributed algorithms for handling deadlocks

## Syllabus:

### Unit-1: Distributed Computing

Introduction: Definition, Relation to parallel systems, synchronous vs asynchronous execution, design issues and challenges A Model of Distributed Computations: A Model of distributed executions, Models of communication networks, Global state of distributed system, Models of process communication.

### Unit-2: Logical Time

Logical clocks, scalar time, vector time, Matrix time, virtual time, Physical clock synchronization – NTP, Global state and snapshot recording algorithms: System model, Snapshot algorithms for FIFO channels, Variations of Chandy-Lamport algorithm, Snapshot algorithms for non-FIFO channels, Snapshots in a causal delivery system, Monitoring global state, Necessary and sufficient conditions for consistent global snapshots, Finding consistent global snapshots in a distributed computation.

### **Unit-3: Message ordering and group communication**

Message ordering paradigms, Group communication, Causal order (CO), Total order, Multicast, Propagation trees for multicast, Application-level multicast algorithms, Fault-tolerant group communication, Multicast algorithms at the network layer. Termination detection: System model of a distributed computation, Termination detection using distributed snapshots, weight throwing and spanning-tree-based algorithms, Message-optimal termination detection, and Termination detection in a general distributed computing model, Termination detection in the atomic computation model, Termination detection in a faulty distributed system

### **Unit-4: Distributed mutual exclusion algorithms**

Lamport's algorithm, Ricart-Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms, Maekawa's algorithm, Agarwal-El Abbadi quorum-based algorithm, Token-based algorithms, Suzuki-Kasami's broadcast algorithm, Raymond's tree-based algorithm.

### **Unit-5: Deadlock detection in distributed systems:**

System model, Models of deadlocks, Knapp's classification of distributed deadlock detection algorithms, Mitchell and Merritt's algorithm for the single resource model, Chandy-Misra-Haas algorithm for the AND model, Chandy-Misra-Haas algorithm for the OR model, Check pointing and rollback recovery : Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Koo-Toueg coordinated check pointing algorithm, Juang-Venkatesan algorithm for asynchronous check pointing and recovery, Failure detectors: Unreliable failure detectors, The consensus problem, Atomic broadcast

### **Text Books:**

- Ajay D. Kshemakalyani, Mukesh Singhal, "Distributed Computing", Cambridge University Press, 2008
- Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems - Principles and Paradigms", PHI, 2004

### **Reference Books:**

- Pradeep K. Sinha Distributed Operating Systems: Concepts and Design Publisher: PHI Learning
- Gerard Tel Introduction to Distributed Algorithms Publisher: Cambridge University Press
- M. L. Liu Distributed Computing: Principles and Applications Publisher: Pearson Education
- Randy Chow and Theodore Johnson Distributed Operating Systems and Algorithms Publisher: Addison-Wesley

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<b>Programme :</b>	<b>B.Tech.</b>	<b>Semester :</b>	<b>V</b>
<b>Name of the Course:</b>	<b>Computer Network Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-606</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>2 Hrs. / week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Descriptions:

This lab is designed to Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	The students will be able to develop fundamental communication systems with customize requirement(s).
CO2	The students will be able to design computer network as per the specifications given.
CO3	The students will acquire analytical ability to identify the problems area in the hardware planning of computer network with possible trouble shooting technique.
CO4	The students will be able to diagnose the possible Bugs in the software application and to provide the possible trouble shoot.
CO5	Project planning Network planning, design, selection of hardware components and its configuration.

## The following concepts will be covered in the lab:

- Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
- Study of Network Devices in Detail.
- Study of network IP.
- Connect the computers in Local Area Network.
- Study of basic network command and Network configuration commands.
- Implement the data link layer farming methods such as character count, character stuffing and bit stuffing
- Performing an Initial Switch Configuration
- Performing an Initial Router Configuration
- Configuring and Troubleshooting a Switched Network
- Connecting a Switch

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- Configuring WEP on a Wireless Router

## **Text Books:**

- “Internetworking with TCP/IP, Principles Protocols and Architecture” 5th Edition Vol1 by Duglas E Comer by PHI.
- “TCP/IP Protocol Suit” 4th Edition by Behrouz A Forouzen Tata McGraw Hills.
- “Computer Network - a Systems Approach” by Larry L Petersnand Bruce S Davie 5th Edition by Morgan Kaufmabb Elsevier.
- “Data Networks” 2nd Edition by Dimitri Betsekas Robert Gallager by PHI.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>Software Engineering Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-607</b>		
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab deals with the analysis and design of a software problem. The tool used in a lab is rational rose. this tool is used for an object oriented design of a problem. We draw a UML diagram in a rational rose which deals with the objects and classes in a system. The Unified Modeling Language or UML is a mostly graphical modelling language that is used to express designs. It is a standardized language in which to specify the artefacts and components of a software system. It is important to understand that the UML describes a notation and not a process. It does not put forth a single method or process of design, but rather is a standardized tool that can be used in a design process.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Provide users with a ready-to-use, expressive visual modeling language so they can develop and exchange meaningful models
CO2	Generate a high-level design of the system from the software requirements
CO3	Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

## List of Experiments:

- Development of problem statement.
- Preparation of Software Requirement Specification Document
- Data flow diagram.
- Entity – Relationship Diagram
- Study and usage of any Design phase CASE tool:
  - Class Diagram
  - Sequence Diagram
  - State Chart Diagram
  - Use-Case Diagram
  - Activity Diagram
- Develop test cases for various white box and black box testing techniques.

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## **Sample Projects**

- Passport automation System
- Book Bank
- Online Exam Registration
- Stock Maintenance System
- Online course reservation system
- E-ticketing
- Software Personnel Management System
- Credit Card Processing
- E-book management System.
- Recruitment system

## **Text Books :**

- The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, 2nd Edition, 2005.
- Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
- Software Engineering- Sommerville, 7th edition, Pearson Education.

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<b>Programme</b>	<b>: B. Tech</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course:</b>	<b>Soft Computing Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-608(1)</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Descriptions:

This course will cover fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA). Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices. In summary, this course will provide exposure to theory as well as practical systems and software used in soft computing.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Explore methods that implements neural network techniques.
CO2	Practice the fuzzy set relations using different operations.
CO3	Design Regression techniques for a set of data points.
CO4	Capture an appropriate classification model for analytical tasks.

## The following concepts will be covered in the lab:

- Introduction to Soft Computing
  - Concept of computing systems.
  - "Soft" computing versus "Hard" computing
  - Characteristics of Soft computing
  - Some applications of Soft computing techniques
  - Solving single-objective optimization problems using Gas
- Program to implement logic gates.
- Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
- Implement svm classification by fuzzy concepts.
- Implementation of Genetic Application
- Implementation of Perceptron Learning Algorithm
- Implementation of Unsupervised Learning Algorithm
- Write a program to implement artificial neural network without back propagation.
- Implement travelling sales person problem (tsp) using genetic algorithms.
- Implement crisp partitions for real-life iris dataset
- Implement linear regression and multi-regression for a set of data points
- Perceptron net for an AND function with bipolar inputs and targets.
- Program for Pattern storage of 10 digits with Discrete Hopfield Network

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## **Text Books:**

- G. A. Vijayalakshami, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran”, PHI.
- E. Goldberg, “Genetic Algorithms: Search and Optimization”.
- Chin Teng Lin, “Neuro-Fuzzy Systems”, C. S. George Lee, PHI.
- Joe choong, “Build\_Neural\_Network\_With\_MS\_Excel\_sample”.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>Big Data Analytics Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-608(2)</b>		
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The Big Data Analytics course introduces students to key tools and technologies such as Python, Hadoop, MongoDB, and Apache Spark for processing and analyzing large datasets. Students will learn to perform data visualization, implement MapReduce programs, and apply NoSQL database operations. The course emphasizes hands-on experience with data storage, manipulation, and analysis using Big Data frameworks.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To Visualize and process data using Python plotting techniques
CO2	To Perform NoSQL operations such as CRUD operations, arrays, and advanced queries using MongoDB.
CO3	To Implement and execute MapReduce programs for data processing

## List of Experiments

- Install, configure and run python, numPy and Pandas.
- Install, configure and run Hadoop and HDFS.
- Visualize data using basic plotting techniques in Python.
- Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB.
- Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB.
- Implement word count / frequency programs using MapReduce.
- Implement a MapReduce program that processes a dataset.
- Implement clustering techniques using SPARK.
- Implement an application that stores big data in MongoDB / Pig using Hadoop / R.

## Text Books :

- Hadoop: The Definitive Guide Tom White, 4th Edition, O'Reilly Media
- Big Data: Principles and Paradigms, Rajendra Akerkar, Wiley-IEEE Press
- Learning Spark: Lightning-Fast Big Data Analysis Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia, O'Reilly Media.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course:</b>		<b>Digital Image Processing Lab</b>	<b>Course Code:</b>		<b>SOE-B-CSE-23-608(3)</b>
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This course is an introduction to image processing, image analysis techniques and concepts. Areas include: Imaging sensors and their principles; Image representation and storage, coding and compression techniques, lossy versus lossless; techniques for noise reduction.

## Course Outcomes:

At the end of the course, students should be able to:

CO Number	Course Outcome
CO1	Learn concepts, process and practice DIP methodologies
CO2	Learn image processing in spatial and frequency domain
CO3	Learn image restoration and segmentation

## Following concepts will be covered in the lab

- Implement Low Pass Filters – Gaussian, Butterworth, Ideal
- Implement High Pass Filters – Gaussian, Butterworth, Ideal
- Perform Image Enhancement in Spatial Domain through Gray Level Transformations
- Image Filtering in the Frequency Domain
- Apply Wavelet Transforms for Image Decomposition and Denoising
- Implement Transformation Functions and Histogram Equalization
- Perform Histogram Specification (Matching)
- Implement Image Compression using Transform Coding
- Image Restoration using Inverse and Wiener Filtering
- Implementation of Morphological Operations, Image Segmentation, and Edge Detection

## Textbooks:

- Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, (various editions available), Pearson (or Prentice Hall depending on the edition), (various years depending on the edition).
- Chris Solomon and Toby Breckon, Fundamentals of Digital Image Processing: A Practical Approach with Examples in Matlab, 1st edition, Wiley-Blackwell, 2011.
- Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd edition, Gatesmark Publishing, 2009.
- Wilhelm Burger and Mark J. Burge, Digital Image Processing: An Algorithmic Introduction Using Java (Texts in Computer Science), 1st edition, Springer, 2008.

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- John C. Russ and F. Brent Neal, *Introductory Digital Image Processing with MATLAB Imaging Toolboxes*, 1st edition, CRC Press, 2008.

## **Reference Books:**

- Richard Szeliski, *Computer Vision: Algorithms and Applications*, 2nd edition, Springer, 2022.
- Milan Sonka, Vaclav Hlavac, and Roger Boyle, *Image Processing, Analysis, and Machine Vision*, 4th edition, Cengage Learning, 2014.
- Al Bovik (Editor), *Handbook of Image and Video Processing*, 2nd edition, Academic Press, 2005.
- John C. Russ, *The Image Processing Handbook*, 7th edition, CRC Press, 2016.
- Mark Nixon and Alberto S. Aguado, *Feature Extraction and Image Processing for Computer Vision*, 4th edition, Academic Press, 2019.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course</b>	<b>:</b>	<b>Cryptography and Information Security Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-609</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

To give practical exposure on basic security attacks, encryption algorithms, authentication techniques and digital signature.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Develop code for classical Encryption Techniques to solve the problems.
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3	Apply the different cryptographic operations of public key cryptography

## The following concepts will be covered in the lab:

- Symmetric key cryptography.
- Asymmetric key cryptography.
- Key exchange protocol.
- Authentication algorithms.
- Digital signature standards.

## Text Books:

- William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education.
- Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
- C K Shyamala, N Harini, Dr. T.R.Padmabhan Cryptography and Security ,Wiley
- Bruce Schneier, "Applied Cryptography". John Wiley & Sons
- Bernard Menezes," Network Security and Cryptography", Cengage Learning.
- Atul Kahate, "Cryptography and Network Security", McGraw Hill

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VI</b>
<b>Name of the Course</b>	<b>:</b>	<b>Internet Technology <sup>2</sup> II Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-610</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab course provides hands-on experience in developing backend applications using Node.js, Express.js, TypeScript, and MongoDB. Students will learn to create RESTful APIs, manage server-side logic, implement middleware, and interact with NoSQL databases to build scalable and secure applications.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Set up and build server-side applications using Node.js, Express.js, and TypeScript
CO2	Develop RESTful APIs and perform CRUD operations with MongoDB using Mongoose
CO3	Implement authentication, validation, and middleware for secure backend development

## The following Concepts/Experiments will be covered in the lab:

- Create a simple Node.js application demonstrating module usage, file system access, and basic server setup.
- Build a basic web server using Express.js with routing and response handling for GET and POST requests.
- Develop a REST API for user data with operations like GET, POST, PUT, DELETE.
- Implement middleware functions for logging, request parsing, and global error handling in Express.js.
- Create a database in MongoDB and connect it using Mongoose to store and retrieve structured data.
- Perform Create, Read, Update, and Delete operations in MongoDB via Express routes.
- Write basic TypeScript programs demonstrating types, interfaces, and classes.
- Convert a Node.js application to TypeScript and use tsconfig.json for configuration.
- Add user authentication in your Express app using JSON Web Tokens (JWT) and bcrypt.
- Implement file upload and serve static HTML/CSS/JS files using Express.js.

## Mini Project: Full-Stack Backend Development

- Title: Student Record Management System / Blogging Platform / E-commerce Backend API

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### **Description:**

Build a full-fledged RESTful API backend using Node.js, Express.js, TypeScript, and MongoDB. The project should include:

- a. User authentication and authorization
- b. CRUD operations on core entities
- c. Middleware usage
- d. API response handling with status codes
- e. MongoDB schema design with Mongoose
- f. Deployment using any cloud platform (optional)

### **Text Books:**

- "Node.js Design Patterns" by Mario Casciaro
- "Learning Node.js Development" by Andrew Mead
- "Pro Express.js" by Azat Mardan

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VI</b>
<b>Name of the Course</b>	<b>: Professional Development</b>	<b>Course Code:</b>	<b>SOE-B-CSE-23-612</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>1 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Description:

This course will focus on enhancing employability skills to bridge the industry-academia gap and make the students industry ready. The module will be instrumental in terms of boosting the confidence level of the candidates and incorporating the required skill sets i.e. 21<sup>st</sup> century skills, interview success attributes, resume building, preparing cover letter, professional networking, public speaking, professional dressing, grooming, personal hygiene etc. Students will also be taught methods on acing an interview and various rounds of interviews conducted by esteemed organizations. This will enable them to perform better during campus recruitment processes.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Analyzing expectations of industries , discovering self and developing interview skills to succeed.
CO2	Creating strong professionals network with his skills of team building and leadership for perfect fit in corporate environment
CO3	Understanding ways & means to find suitable job opportunities and would be making suitable resume and cover letter
CO4	Exhibiting good communication skills through public speaking , telephones, E- Mails, online meetings, assertiveness etc.
CO5	Analyzing recruitment processes, document requirements, facing group discussions and interviews with full confidence.

## Syllabus:

### Unit-I Personal Excellence:

- Industry Expectation (21<sup>st</sup> Century skills)
- Interview Success Attributes
- Self-Discovery
- Team Building & Leadership
- Professional Networking
- Grooming for Corporate environment

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## **Unit-II: Professional Preparedness:**

- Job Seeking
- Resume Building
- Cover Letter preparation
- Public Speaking- Tools & Techniques
- Corporate Etiquettes- Telephone, Email, Messenger Apps, Online Meetings
- Expressing opinions assertively- Agreement & Disagreement
- Verbal Ability- Orientation
- Aptitude & Reasoning- Orientation

## **Unit-III: Selection Process Techniques:**

- Recruitment Processes of Various companies
- Company Profile Briefing by students (3 dream Companies)
- Professional Documents Docket- File & Soft Copy
- Group discussion (GD)- Concept and Practices
- Personal Interviews- Concept and Practices
- Activity- Organizing job fair

## **Text Books:**

- Stephen E. Lucas, The Art of Public Speaking, Third Edition, Singapore: McGraw-Hill, 1989
- Sonya Hamlin, how to Talk so People Listen, New York: Throson, 1993
- Jeff Davidson, The Complete Guide to Public Speaking, Manjul Books PVT. Bhopal, 2006
- Turk, Cristopher, Effective Speaking, Second Indian Reprint, Taylor and Francis Group, Delhi, 2010
- P.D. Chaturvedi – Busines Communication (Pearson Education, 3st Edition 2006).
- Rajendra Pal –Business Communication (Sultan chand & Sons Publication)

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Academic Semester VII

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P)/2
			L	T	P	PRE**		ESE*	Total Marks	(L+T+P)
						Mid Sem	TA			
CSE	SOE-B-CSE-22-701	Industry Internship	--	--	20	--	125	125	250	10
CSE	SOE-B-CSE-22-702(X)	Professional Elective IV	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-703(X)	Professional Elective V	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-704(X)	Professional Elective lab IV	0	0	2	0	30	20	50	1
CSE	SOE-B-CSE-22-705(X)	Professional Elective lab V	0							

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### Professional Elective - IV

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-702(1)	Unix and Shell Programming
2	SOE-B-CSE-22-702(2)	NoSQL Database
3	SOE-B-CSE-22-702(3)	Deep Learning Techniques

### Professional Elective - IV Lab

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-704(1)	Unix and Shell Programming Lab
2	SOE-B-CSE-22-704(2)	NoSQL Database Lab
3	SOE-B-CSE-22-704(3)	Deep Learning Techniques Lab

### Professional Elective - V

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-703(1)	Web Analytics
2	SOE-B-CSE-22-703(2)	Natural Language Processing
3	SOE-B-CSE-22-703(3)	Image Processing and Applications

### Professional Elective - V Lab

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-705(1)	Web Analytics Lab
2	SOE-B-CSE-22-705(2)	Natural Language Processing Lab
3	SOE-B-CSE-22-705(3)	Image Processing and Applications Lab

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Unix and Shell Programming	Course Code:	SOE-B-CSE-22 - 702(1)
Credits	: 3	No of Hours :	3 Hrs. / Week
Max Marks	: 100		

### Course Description:

This course introduces students to the Unix operating system and the powerful world of shell programming. It covers essential Unix concepts, commands, file systems, and utilities. Students learn how to automate tasks using shell scripts, manage processes, handle file permissions, and work with advanced text processing tools like sed, awk, and regular expressions. Through hands-on practice, students develop the skills to write efficient shell programs for real-world applications and system administration tasks.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Navigate Unix/Linux systems efficiently.
CO2	Write and debug shell scripts to automate routine tasks.
CO3	Use Unix utilities to manipulate and process text files.
CO4	Understand and manage user and file permissions.
CO5	Apply scripting techniques to solve practical computing problems.

### Syllabus:

#### Unit I: Introduction To Unix:

Architecture of Unix, Features of Unix , Unix Commands – PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip UNIX UTILITIES: Introduction to unix file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin. Text processing utilities and backup utilities , detailed commands to be covered are tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio.

#### Unit II: Introduction To Shells:

Unix Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, - Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization. FILTERS: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

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### Unit III: Grep:

Operation, grep Family, Searching for File Content. SED: Scripts, Operation, Addresses, commands, Applications, grep and sed. AWK: Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands in awk, Applications, awk and grep, sed and awk.

### Unit IV: Interactive Korn Shell:

Korn Shell Features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, Options, Startup Scripts, Command History, Command Execution Process. KORN SHELL PROGRAMMING: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

### Unit V : Interactive C Shell:

C shell features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, On-Off Variables, Startup and Shutdown Scripts, Command History, Command Execution Scripts. C SHELL PROGRAMMING: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples. FILE MANAGEMENT: File Structures, System Calls for File Management system, INODES, Structure of Regular File, Directories, Conversions of a Path, name to an INODE, Super Block, INODE Assignment to a New File create, open, close, read, write, lseek, link, symlink unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

### Text Books:

- Unix and shell Programming, Behrouz A. Forouzan, Richard F. Gilberg, Thomson
- Your Unix the ultimate guide, Sumitabha Das, TMH. 2nd Edition.

### Reference Books:

- Unix for programmers and users, 3rd edition, Graham Glass, King Ables, Pearson education.
- Unix programming environment, Kernighan and Pike, PHI. / Pearson Education
- The Complete Reference Unix, Rosen, Host, Klee, Farber, Rosinski, Second Edition, TMH.
- Unix Shell programming, Yashwanth Kanitkar, 1st Edition, BPB Publisher

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: NoSQL Database	Course Code:	SOE-B-CSE-22 -702( 2)
Credits	: 3	No of Hours :	3 Hrs. / Week
Max Marks	: 100		

### Course Description:

This course provides an in-depth study of NoSQL databases, focusing on their need, design, types, and applications in big data systems. Students will understand the key differences from relational databases, the importance of the CAP theorem, and how to model and manage data using various NoSQL paradigms including key-value, document, column-family, and graph databases. The course will emphasize both theoretical foundations and practical hands-on experience using modern NoSQL tools.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Understand the evolution and characteristics of NoSQL databases and differentiate them from traditional RDBMS.
CO2	Categorize various types of NoSQL databases and identify appropriate use cases.
CO3	Design and implement key-value and document-oriented data models using tools like Redis and MongoDB.
CO4	Apply and manage column-family and graph databases such as Cassandra and Neo4j for real-time applications.
CO5	Evaluate performance, consistency, and scalability trade-offs in distributed NoSQL systems.

### Syllabus:

#### Unit 1: Introduction to NoSQL

Introduction to NoSQL – Characteristics – Comparison with RDBMS – CAP Theorem – ACID vs BASE – Polyglot persistence – Overview of structured, semi-structured, and unstructured data – Applications of NoSQL in Big Data and Real-Time Web.

#### Unit 2: Key -Value Stores

Key-value model – Architecture and storage structure – Data modeling techniques – Features and limitations – Tools: Redis, Riak – CRUD operations – Real-world use cases.

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### Unit 3: Document -Oriented Databases

Document structure: JSON, BSON – Data modeling and nesting – Indexing, querying and aggregation – Schema design practices – MongoDB architecture – CRUD operations – Replication and Sharding.

### Unit 4: Column -Family Databases

Concept of wide-column stores – Data organization – Partitioning and clustering – Schema modeling – Consistency and availability – Cassandra and HBase overview – Query mechanism – CAP in practice.

### Unit 5: Graph Databases

Graph models – Nodes, relationships, properties – Graph traversal algorithms – Cypher query language – Indexes and constraints – Neo4j features and case studies – Applications in social networks and recommendation systems.

### Text Books:

- “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence” , Pramod J. Sadalage and Martin Fowler, Addison-Wesley, 2012.
- “Making Sense of NoSQL: A Guide for Managers and the Rest of Us” , Dan McCreary and Ann Kelly, Manning Publications, 2013.

### Reference Books:

- “Professional NoSQL”, Shashank Tiwari, Wrox Press, 2011.
- “NoSQL For Dummies” ,Adam Fowler, Wiley, 2015.
- “MongoDB Applied Design Patterns” ,Rick Copeland, O'Reilly Media, 2013..

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Programme	: B. Tech.	Semester	: VII
Name of the Course:	Deep Learning Techniques	Course Code:	SOE-B-CSE-22 -702( 3)
Credits	: 3	No of Hours	: 3 Hrs./week
Max Marks	: 100		

### Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

### Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Gain the knowledge about neural networks.
CO2	Introduce the basic concepts and techniques of deep learning.
CO3	Apply optimization techniques in in real life applications.
CO4	Develop the skills in deep learning for solving practical problems. To be familiar with a set of well-known deep neural network, convolutional neural network, filters optimization techniques.
CO5	Apply RNN and LSTM for sentiment analysis

### Syllabus:

#### UNIT -I: Basics of Neural Networks

Biological Neuron, idea of computational units, McCulloch–Pitts unit and thresholding logic, linear perceptron, perceptron learning algorithm, linear separability, convergence theorem for perceptron learning algorithm, limitations of single-layer perceptron, introduction to activation functions (Sigmoid, Tanh, ReLU), bias term and its significance.

#### UNIT -II: Feedforward Networks and Deep Neural Networks

Multilayer perceptron, gradient descent, backpropagation, empirical risk minimization, regularization, autoencoders, difficulty of training deep neural networks, greedy layer-wise training, role of initialization and activation in deep networks, batch vs stochastic gradient descent, mini-batch gradient descent, variants of autoencoders (denoising, sparse, variational - brief introduction).

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### UNIT -III: Optimization in Deep Neural Networks

Newer optimization methods for neural networks (Adagrad, Adadelta, RMSProp, Adam, Nesterov Accelerated Gradient), second-order methods for training, saddle point problem in neural networks, regularization methods (dropout, drop connect, batch normalization), learning rate schedules (step decay, cosine annealing, warm restarts), gradient clipping in deep networks, early stopping as regularization.

### UNIT -IV: Recurrent Neural Networks

Backpropagation through time, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), bidirectional LSTMs, bidirectional RNNs, applications of RNNs (language modeling, sequence prediction), attention mechanism (brief introduction), comparison of LSTM and GRU architectures.

### UNIT -V: Convolutional Neural Networks

Convolution in n-dimensions, convolutional layers, pooling strategies, visualization of filters, padding and stride, parameter calculation in CNNs, overview of modern CNN architectures (LeNet, AlexNet, VGG, ResNet - brief), transfer learning and pre-trained CNN models (basic concept).

### Text Books:

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

### Reference Books:

- Raúl Rojas, “Neural Networks: A Systematic Introduction”, 1996.
- Christopher Bishop, “Pattern Recognition and Machine Learning”, 2007.

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Unix and Shell Programming Lab	Course Code:	SOE-B-CSE-22 - 704(1)
Credits	: 1	No of Hours	: 2 Hrs/Week
Max Marks	: 50		

### Course Descriptions:

This lab course provides hands-on experience with the Unix operating system and shell programming. Students will practice fundamental Unix commands, explore the file system, manage processes, and develop shell scripts to automate tasks. The lab emphasizes problem-solving skills, scripting for system administration, and the use of Unix utilities for text processing and data management. Through a series of structured experiments and mini-projects, students gain practical proficiency in Unix environments.

### Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Efficiently use Unix/Linux commands for system navigation and management.
CO2	Develop shell scripts for automating a variety of tasks.
CO3	Perform text processing and data manipulation using Unix utilities.

The following Concepts/Experiments will be covered in the lab:

1.
  - a) Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.
  - b) Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.
2.
  - a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
  - b) Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
3.
  - a) Write a shell script to list all of the directory files in a directory.
  - b) Write a shell script to find factorial of a given integer.
4.
  - a) Write an awk script to count the number of lines in a file that do not contain vowels.
  - b) Write an awk script to find the number of characters, words and lines in a file.

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5.
  - a) Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files.
  - b) Write a c program that makes a copy of a file using standard I/O and system calls.
6.
  - a) Implement in C the following Unix commands using System calls o cat , ls, mv
  - b) Write a C program to emulate the Unix ls -l command.
7. Write a program that takes one or more file/directory names as command line input and reports the following information on the file.
  - a) File type.
  - b) Number of links.
  - c) Time of last access.
  - d) Read, Write and Execute permissions.
8.
  - a) Write a C program to list for every file in a directory, its inode number and file name.
  - b) Write a C program that demonstrates redirection of standard output to a file. Ex: ls > f1.
9.
  - a) Write a C program to create a child process and allow the parent to display “parent” and the child to display “child” on the screen.
  - b) Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex:- ls -l | sort
10.
  - a) Write a C program to create a Zombie process.
  - b) Write a C program that illustrates how an orphan is created.
11.
  - a) Write C programs that illustrate communication between two unrelated processes using named pipe.
  - b) Write a C program (sender.c) to create a message queue with read and write permissions to write 3 messages to it with different priority numbers.
  - c) Write a C program (receiver.c) that receives the messages (from the above message queue as specified in (21)) and displays them.
12.
  - a) Write a shell script to accept three numbers and display the largest.
  - b) Write a shell script to find the number of files in a directory.
  - c) Write a shell script to display first ten positive numbers using until loop.
13.
  - a) Write a shell script to check if a particular user has logged in or not. If not, continue the loop till he/she logs in. Once the required user logs in, display a message.
  - b) Write a shell script to accept the name, grade, and basic salary from the user. Write the details into a file called employee, separating the fields with a colon (,) continue the process till the user wants.
14.
  - a) Write a shell script to check whether a file is existing or not.
  - b) Write a shell script to find the mode of a file in a directory.
  - c) Write a shell script which will accept different numbers and find their sum.
15.
  - a) Write a menu driven program to display a menu of options and depending upon the user’s choice execute the associated command.
  - b) Write a shell script to calculate the total salary payable to all the employees from the employee file. The salary should be taken from the 8th field of the employee file.
16.
  - a) Write a shell script to copy the source file to the target file.
  - b) Write a shell script to print the first 10 odd numbers using the while loop.

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c) Write a shell script to reverse the digits of a given number.

Text Books :

- Unix Shell programming, Yashwanth Kanitkar, 1st Edition, BPB Publisher
- Unix for programmers and users, 3rd edition, Graham Glass, King Ables, Pearson education.
- Unix programming environment, Kernighan and Pike, PHI. / Pearson Education
- The Complete Reference Unix, Rosen, Host, Klee, Farber, Rosinski, Second Edition, TMH

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Programme	:	B.Tech.	Semester	:	VII
Name of the Course	:	NoSQL Database Lab	Course Code:	:	SOE-B-CSE-22-704(2)
Credits	:	1	No of Hours	:	2 Hrs. / Week
Max Marks	:	50			

### Course Descriptions:

The objectives of this lab course are to provide hands-on experience in working with NoSQL databases, understanding their architecture, and applying key concepts such as document-based, column-oriented, graph, and key-value stores. The emphasis will be on practical implementation, querying, and optimization techniques used in NoSQL database systems

### Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Understand the fundamental concepts of NoSQL databases and their use cases.
CO2	Implement basic CRUD operations in different types of NoSQL databases.
CO3	Perform indexing and optimization techniques to enhance query performance.

The following Concepts/Experiments will be covered in the lab:

- Introduction to NoSQL databases: Key concepts and architecture
- CRUD operations in MongoDB (Document-based database)
- Querying and indexing in MongoDB.
- Working with Cassandra (Column-oriented database)
- Query execution and data modelling in Cassandra.
- Redis as a key-value store: Implementation and operations.
- Introduction to Neo4j (Graph database) and Cypher queries.
- Comparison of NoSQL databases with relational databases.
- Performance benchmarking and optimization techniques.
- Mini-project: Implementing a real-world NoSQL database solution.

### Text Books :

- "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" – Pramod J. Sadalage & Martin Fowler
- "MongoDB: The Definitive Guide" – Kristina Chodorow
- "Cassandra: The Definitive Guide" – Jeff Carpenter & Eben Hewitt
- "Graph Databases" – Ian Robinson, Jim Webber, & Emil Eifrem

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Programme	:	B.Tech.	Semester	:	VII
Name of the Course:		Deep Learning Techniques Lab	Course Code:		SOE-B-CSE-22 -704( 3)
Credits	:	1	No of Hours	:	2 Hrs. / Week
Max Marks	:	50			

### Course Descriptions:

This laboratory course provides hands-on experience in designing, implementing, and evaluating deep learning models. Students will learn to utilize popular deep learning frameworks and libraries to tackle real-world problems in areas such as image recognition, natural language processing, and time series analysis. Through practical exercises and projects, students will gain a deep understanding of the fundamental concepts and techniques in deep learning, including neural network architectures, training methodologies, optimization algorithms, and regularization techniques. Emphasis will be placed on developing practical skills in data preprocessing, model development, hyperparameter tuning, and performance evaluation. Students will also learn to interpret results and critically analyze the strengths and limitations of different deep learning approaches.

### Course Outcomes:

At the end of the course, students should be able to:

CO Number	Course Outcome
CO1	Implement and experiment with fundamental deep learning models
CO2	Apply data preprocessing techniques for deep learning tasks
CO3	Evaluate and compare the performance of deep learning models

### Following concepts will be covered in the lab

- Implementing a Simple Neural Network (MLP) from Scratch
- Image Classification using Convolutional Neural Networks (CNNs)
- Training a Deep Neural Network for Regression Tasks
- Building a Convolutional Autoencoder for Image Denoising
- Transfer Learning with Pretrained CNN Models (VGG, ResNet, etc.)
- Implementing Recurrent Neural Networks (RNN) for Text Generation
- Training Long Short-Term Memory (LSTM) Networks for Time Series Prediction
- Building a Generative Adversarial Network (GAN) for Image Generation
- Hyperparameter Tuning in Neural Networks
- Implementing Dropout and Batch Normalization to Prevent Overfitting

### Software Requirements:

- Python.

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### Text Books:

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

### Reference Books:

- Raúl Rojas, “Neural Networks: A Systematic Introduction”, 1996.
- Christopher Bishop , “Pattern Recognition and Machine Learning”, 2007.

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Web Analytics	Course Code:	SOE-B-CSE-22 - 703(1)
Credits	: 3	No of Hours :	3 Hrs. / Week
Max Marks	: 100		

### Course Description:

This course introduces students to the principles, tools, and techniques of web analytics. With the exponential growth of digital platforms, understanding how users interact with websites is essential for making informed business and marketing decisions. The course covers the setup and usage of popular analytics tools like Google Analytics, measurement of website traffic, user behavior, and conversion performance. Students will learn how to interpret analytical data, create meaningful reports, and apply optimization strategies to improve user experience and business outcomes. The course also includes advanced tracking techniques and real-world applications in digital marketing, e-commerce, and content optimization.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Explain the significance of web analytics in digital marketing and e-commerce ecosystems.
CO2	Configure and utilize web analytics platforms (such as Google Analytics) for data collection and reporting.
CO3	Evaluate website traffic patterns, user behavior, and conversion processes.
CO4	Develop data-driven strategies to enhance website performance and user experience.
CO5	Apply web analytics techniques to real-world business scenarios across various industries.

### Syllabus:

#### Unit I: Introduction to Web Analytics

Introduction to Web Analytics ,Need and Importance of Web Analytics ,Web Metrics: Visits, Page Views, Unique Visitors, Bounce Rate, Conversion Rate ,Types of Web Analytics: Off-site and On-site ,Introduction to Google Analytics

#### Unit II: Data Collection and Tools

Web Data Collection Mechanisms (Cookies, Log Files, Web Beacons) ,Tagging and Tracking Codes ,Setting up Google Analytics Account ,Analytics Dashboard Overview ,Data Segmentation and Filtering.

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### Unit III: Key Performance Indicators and Reporting

Defining and Measuring KPIs ,Traffic Sources and Channels ,Behavior Analysis: Site Content, Landing Pages, Exit Pages ,Goal Setup and Funnel Visualization ,Custom Reports and Dashboards.

### Unit IV: Campaign and Conversion Analysis

Tracking Marketing Campaigns (UTM parameters) ,Social Media and Email Campaign Tracking ,A/B Testing and Multivariate Testing ,Conversion Optimization Techniques ,Attribution Models.

### Unit V : Advanced Topics and Case Studies

Mobile and App Analytics ,E-commerce Analytics ,Real-Time Analytics and Dashboards ,Ethical Considerations and Privacy in Web Analytics ,Case Studies of Web Analytics in Different domains.

### Text Books:

- Avinash Kaushik, *Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity*, Wiley India.

### Reference Books:

- Justin Cutroni, *Google Analytics*, O'Reilly Media.
- Brian Clifton, *Advanced Web Metrics with Google Analytics*, Wiley.
- Marshall Sponder, *Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics*, McGraw-Hill.
- Eric T. Peterson, *Web Analytics Demystified: A Marketer's Guide to Understanding How Your Web Site Affects Your Business*, Celilo Group Media.

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Natural Language Processing	Course Code	: SOE-B-CSE-22 -703(2)
Credits	: 3	No of Hours	: 3 Hrs/Week
Max Marks	: 100		

### Course Description:

The course will provide foundational knowledge of natural language processing. The course will cover basic concepts of language design, grammars, syntax, semantics, and the designing of NLP systems.

### Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Tag a given text with basic Language features
CO2	Design an innovative application using NLP components
CO3	Implement a rule-based system to tackle morphology/syntax of a language
CO4	Design a tag set to be used for statistical processing for real-time applications
CO5	Compare and contrast the use of different statistical approaches for different types of NLP applications.

### Syllabus :

#### Unit -I: Introduction

Origins and challenges of NLP, The evaluation of NLP applications, Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

#### Unit -II: Word level analysis

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models. Corpora and their construction: representativeness

#### Unit -III: Syntactic Analysis

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing –

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Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

### Unit -IV: Semantics and pragmatics

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods. Computational Phonetics and Speech Processing

### Unit -V: Discourse analysis and lexical resources

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus

### Text Books:

- Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, 2014.
- Steven Bird, Ewan Klein, Edward Loper, “Natural Language Processing with Python”, 1st Edition, O\_Reilly Media, 2009

### Reference Books:

- Breck Baldwin, “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015
- Richard M Reese, “Natural Language Processing with Java”, O\_Reilly Media, 2015
- Nitin Indurkha, Fred J. Damerau, “Handbook of Natural Language Processing”, 2nd Edition, Chapman and Hall/CRC Press, 2010.
- Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Image Processing and Applications	Course Code:	: SOE-B-CSE-22 -703( 3)
Credits	: 3	No of Hours:	: 3 Hrs/Week
Max Marks	: 100		

### Course Description:

The objective of this course to equip the students with the techniques & tools for digital image processing, & image analysis in the form of image segmentation, image enhancement, image filters, image transforms, Fourier transforms & fast Fourier transforms, edge detection, image segmentation & colour imaging.

### Course Outcomes:

Upon successful completion of this course, the student will be able to:

CO Number	Course Outcome
CO1	Describe the theory and algorithms that are widely used in digital image processing
CO2	Apply a proper image enhancement technique for given a set of noisy images
CO3	Compare different image segmentation and compression techniques
CO4	Formulate solutions using morphological concepts
CO5	Develop any application using different image processing techniques

### Syllabus:

#### Unit 1: Digital Image Fundamental

Introduction – Steps in Digital Image Processing, Components, Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, Introduction to computational imaging, Basics of multi-resolution imaging, Concept of image metadata, Introduction to different color spaces (e.g., HSV, YCbCr)

#### Unit 2: Image Enhancement

Spatial Domain, Gray level transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Homomorphic filtering, Guided filtering, Detail enhancement techniques, Introduction to deep learning-based image enhancement (brief overview), Frequency Domain, Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters, Ideal, Butterworth and Gaussian filters, Wavelet transform for image enhancement, Directional filtering in the frequency domain, Short-Time Fourier Transform (STFT) for image analysis (brief introduction).

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### Unit 3: Image Restoration

Noise models, Mean filters, Order Statistics, Adaptive filters, Band reject, Band pass, Notch – Optimum notch filtering, Inverse Filtering, Constrained Least Square Filtering, Wiener filtering, Non-local means denoising, Block-matching and 3D filtering (BM3D) (brief introduction), Deep learning for image denoising (brief overview), Restoration in the presence of motion blur.

### Unit 4 : Image Segmentation & Representation

Segmentation – Detection of Discontinuities, Edge Linking and Boundary detection, Region based segmentation, Graph cuts for image segmentation, Active contour models (snakes) (brief introduction), Introduction to semantic segmentation using deep learning (brief overview), Representation – Boundary descriptors, Simple Descriptors, Shape numbers, Regional descriptors, Simple and Topological Descriptors, Scale-invariant feature transform (SIFT) (brief introduction), Histogram of Oriented Gradients (HOG) (brief introduction), Introduction to feature learning using convolutional neural networks (brief overview), Introduction to Image Processing Toolbox, Practice of Image Processing Toolbox, and Case studies–Various Image Processing Techniques, Using the toolbox for advanced segmentation and feature extraction tasks, Case studies involving deep learning-based image processing techniques alongside traditional methods.

### Unit 5 : Image applications

Medical imaging such as MRI and CT scan enhancement, tumor detection, and biomedical edge detection, remote sensing for land use classification, change detection, and vegetation indexing, and industrial applications like defect detection, barcode/QR recognition, and machine vision. It also explores document image analysis through OCR, skew correction, and signature verification, face and object recognition using OpenCV and feature descriptors like SIFT and ORB, security and surveillance through motion detection, background subtraction, and number plate recognition, and applications in augmented reality and gaming including marker-based AR, real-time filters, and gesture recognition.

### Text Books:

- Digital Image Processing. Gonzales R. C. & Woods R. E. 3rd Ed., Pearson Education.2010.
- Fundamentals of Digital Image Processing. Jain A. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing. Jayaraman S., Esaki R. S., Kumar T. V., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.
- Digital Image Processing Using MATLAB. Gonzalez R. C., Woods R. E., Eddins S. L., 3rd Ed. Tata McGraw Hill Pvt. Ltd, 2011.

### Reference Books:

- Digital Image Processing and analysis, Chanda B., Majumder D. D. PHI Learning Pvt. Ltd., 2011.
- Digital Image Processing and Pattern Recognition, Pakhira M. K., 2nd Ed., Tata McGraw Hill Pvt. Ltd, 2010.

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Programme	:	B.Tech.	Semester	:	VII
Name of the Course	:	Web Analytics Lab	Course Code:	:	SOE-B-CSE-22 -705(1)
Credits	:	1	No of Hours	:	2 Hrs. / Week
Max Marks	:	50			

### Course Descriptions:

This lab component provides hands-on experience in configuring, using, and interpreting web analytics tools. Students will work with platforms such as Google Analytics to analyze website performance, user behavior, and conversion effectiveness. Through practical exercises and mini-projects, they will apply analytical insights to optimize digital strategies and improve site performance.

### Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Set up and configure web analytics accounts and dashboards.
CO2	Implement tracking codes and goals on a sample website.
CO3	Analyze and interpret web traffic, user behavior, and conversion data.

The following Concepts/Experiments will be covered in the lab:

1. Introduction to Web Analytics Tools
  - Creating a Google Analytics account
  - Exploring dashboard and reports interface
2. Tracking Website Traffic
  - Implementing Google Analytics tracking code on a sample website
  - Analyzing real-time and audience overview reports
3. Setting Up Goals and Events
  - Creating goals for lead capture and form submissions
  - Tracking button clicks and external link clicks using event tracking
4. Traffic Source Analysis
  - Interpreting acquisition reports: Organic, Referral, Direct, Paid
  - Campaign tagging using UTM parameters
5. User Behavior Analysis
  - Studying behavior flow and site content performance
  - Analyzing bounce rate, average session duration, and pageviews
6. Conversion Funnel Setup
  - Creating a multi-step goal funnel (e.g., product checkout)
  - Identifying drop-off points in the conversion process
7. Heatmap and Session Recording Tools

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- Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd edition, Gatesmark Publishing, 2009.
- Wilhelm Burger and Mark J. Burge, Digital Image Processing: An Algorithmic Introduction Using Java (Texts in Computer Science), 1st edition, Springer, 2008.
- John C. Russ and F. Brent Neal, Introductory Digital Image Processing with MATLAB Imaging Toolboxes, 1st edition, CRC Press, 2008.

### Reference Books:

- Richard Szeliski, Computer Vision: Algorithms and Applications, 2nd edition, Springer, 2022.
- Milan Sonka, Vaclav Hlavac, and Roger Boyle, Image Processing, Analysis, and Machine Vision, 4th edition, Cengage Learning, 2014.
- Al Bovik (Editor), Handbook of Image and Video Processing, 2nd edition, Academic Press, 2005.
- John C. Russ, The Image Processing Handbook, 7th edition, CRC Press, 2016.
- Mark Nixon and Alberto S. Aguado, Feature Extraction and Image Processing for Computer Vision, 4th edition, Academic Press, 2019.

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Programme	: B.Tech.	Semester	: VII
Name of the Course	: Professional Development	Course Code:	HUM -B-SOE701
Credits	: 1	No of Hours	: 1 Hrs. / Week
Max Marks	: 50		

### Course Description:

This course will focus on concepts of 'Campus to Corporate' to bridge the industry-academia gap and make the students industry ready. The module will enhance the employability skills of the candidates by incorporating the required skill sets i.e. self-development, Wheel of life, Self-esteem, VUCA Coping skills, Emotional intelligence, stress management, growth mind-set etc. Students will also be taught methods on becoming a better version of themselves and assertive communicators. This will enable them to perform better during campus recruitment processes and enable them to crack the job interviews and group discussion organized by renowned corporate giants.

### Course Outcomes:

At the end of this course, the student will be able to:

CO Number	Course Outcome
CO1	Achieving high level of awareness through wheel of life, emotional intelligence, self-esteem and personal resilience.
CO2	Understanding and analysing self and devising a strategy for self-growth and development.
CO3	Adapting a positive mind-set conducive for growth through optimism and constructive thinking.
CO4	Demonstrating employability skills before hiring managers through public speaking, group discussion, resume building, occupational research and personal interview.
CO5	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.

### Syllabus:

#### Unit -I Personal Development :

- Continuous Self development
- Wheel of life
- Conflict management
- Self esteem
- VUCA coping skills
- Emotional intelligence

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- Motivation and attitude
- Stress management
- Personal resilience

### Unit -II: Professional Development :

- Team building & leadership
- Self-Discovery
- SWOT analysis
- Leap to success
- Fostering positive communication
- Transactional analysis

### Unit -III: Career Development :

- Making business phone calls
- Public speaking
- Extempore speech
- Resume Building/ Cover Letter
- Occupational Research
- Group discussion (GD) and Personal Interviews Concept & Practice

### Unit -IV: Entrepreneurship Development :

- Personal finance and budget management
- Planning and strategy skills
- Problem solving
- Decision making
- Personal branding and impression management
- Executive/Officers like qualities
- Crossroads- A case study based presentation

### Text Books:

- Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education
- Tracy, Brian, Time Management (2018), Manjul Publishing House
- Hill, Napoleon, Think and grow rich (2014), Amazing Reads
- Scott, S.J., SMART goals made simple (2014), Createspace Independent Pub
- Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan
- Burne, Eric, Games People Play (2010), Penguin UK

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## Academic Semester VIII

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P) /2
			L	T	P	PRE**		ESE*	Total Marks	
						Mid Sem	TA			
CSE	SOE-B-CSE-22-801	Major Project	–	–	20	--	125	125	250	10
CSE	SOE-B-CSE-22-802(X)	Professional Elective VI	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-803(X)	Professional Elective VII	3	0	0	30	20	50	100	3
CSE	SOE-B-CSE-22-804	Distributed Computing	3	0	0	30	20	50	100	3
CSE	HUM-B-SOE801	Professional Development-II	0	0	2	0	15	10	25	1
CSE	SOE-B-CSE-22-805(X)	Professional Elective lab VI	0	0	2	0	30	20	50	1
		<b>Total</b>	<b>9</b>	<b>0</b>	<b>24</b>	<b>90</b>	<b>230</b>	<b>305</b>	<b>625</b>	<b>21</b>

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## **Professional Elective - VI**

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-802(1)	Full Stack Web Development
2	SOE-B-CSE-22-802(2)	Software Testing Methodologies
3	SOE-B-CSE-22-802(3)	BI and Analytics

## **Professional Elective – VI Lab**

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-805(1)	Full Stack Web Development Lab
2	SOE-B-CSE-22-805(2)	Software Testing Methodologies Lab
3	SOE-B-CSE-22-805(3)	BI and Analytics Lab

## **Professional Elective – VII**

Sr. No.	Subject Code	Subject
1	SOE-B-CSE-22-803(1)	Augmented and Virtual Reality
2	SOE-B-CSE-22-803(2)	Wireless Sensor Network
3	SOE-B-CSE-22-803(3)	Software Project Management
4	SOE-B-CSE-22-803(4)	Human computer Interaction

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VII</b>
<b>Name of the Course</b>	<b>: Distributed Computing</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-804</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces the fundamental concepts, principles, and techniques of distributed computing. It focuses on the design and implementation of distributed systems where components located on networked computers communicate and coordinate their actions by passing messages. Key topics include communication models, synchronization, consistency, fault tolerance, distributed file systems, and distributed algorithms. Through theoretical study and practical assignments, students will learn how to build scalable, reliable, and efficient distributed applications.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand models of distributed computing
CO2	Analyze algorithms for coordination, communication and synchronization in distributed systems
CO3	Analyze distributed shared memory models
CO4	Design and Implement distributed file systems
CO5	Design distributed algorithms for handling deadlocks

## Syllabus:

### Unit 1:

Introduction to DS, Message Passing, Leader Election, Distributed Models, Causality and Logical Time

### Unit 2:

Logical Time, Global State & Snapshot and Distributed Mutual Exclusion-Non-Token and Quorum based approaches

### Unit 3:

Distributed Mutual Exclusion-Token based approaches, Consensus & Agreement, Check pointing & Rollback Recovery

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## **Unit 4:**

Deadlock Detection, DSM and Distributed MST, Termination Detection, Message Ordering & Group Communication, Fault Tolerance and Self-Stabilization Distributed Randomized Algorithms, DHT and P2P Computing

## **Unit 5:**

Case Studies: GFS, HDFS, Map Reduce and Spark, Case Studies: Sensor Networks, Authentication & Security in DS

## **Text Books:**

- Ajay D. Kshemakalyani, Mukesh Singhal, "Distributed Computing", Cambridge University Press, 2008
- Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems - Principles and Paradigms", PHI, 2004

## **Reference Books:**

- Pradeep K. Sinha Distributed Operating Systems: Concepts and Design Publisher: PHI Learning
- Gerard Tel Introduction to Distributed Algorithms Publisher: Cambridge University Press
- M. L. Liu Distributed Computing: Principles and Applications Publisher: Pearson Education
- Randy Chow and Theodore Johnson Distributed Operating Systems and Algorithms Publisher: Addison-Wesley

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VIII</b>
<b>Name of the Course</b>	<b>: Full Stack Web Development</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-802(1)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course is designed to equip students with in-demand skills required for full-stack web development using the MERN (MongoDB, Express.js, React.js, and Node.js) stack. It covers both frontend and backend development, client-server interaction, database handling, RESTful API design, deployment, and version control. Through hands-on projects and industry-oriented practices, students will gain comprehensive expertise in building scalable and responsive web applications.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Develop responsive front-end web applications using HTML, CSS, JavaScript, and React.js.
CO2	Implement dynamic user interactions using React components, hooks, and routing.
CO3	Build robust backend systems with Node.js and Express.js, and create RESTful APIs.
CO4	Manage data with MongoDB and Mongoose, including authentication and security features.
CO5	Deploy and maintain full-stack applications using modern tools and CI/CD workflows.

## Syllabus:

### Unit 01: Front-End Fundamentals with HTML, CSS, and JavaScript

Introduction to Web Development and HTML5 , Styling with CSS (Flexbox, Grid, Media Queries) ,Bootstrap and Responsive Design Techniques ,JavaScript Basics: Variables, Data Types, Control Flow ,DOM Manipulation and Event Handling ,Git and GitHub: Version Control Essentials

### Unit 02: React.js and Component-Based Development

Introduction to React and JSX, React Components, Props, and State, Hooks: useState, useEffect, and Custom Hooks, React Router and Client-Side Routing, Context API and Lifecycle Methods, Building Reusable and Dynamic UI Components.

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## **Unit 03: Backend Development with Node.js and Express.js**

Node.js Basics and Event-Driven Architecture ,Express.js Framework and Middleware ,RESTful API Development and CRUD Operations ,Asynchronous Programming: Callbacks, Promises, Async/Await , Authentication and Authorization (JWT) , Error Handling and Security Best Practices.

## **Unit 04: Database with MongoDB and Mongoose**

Introduction to NoSQL and MongoDB, Creating Schemas and Models with Mongoose, CRUD Operations in MongoDB, Indexing, Aggregation, and Data Relationships, Authentication, Authorization, and Access Control, Backup, Data Migration, and Performance Optimization

## **Unit 05: State Management, Integration & Deployment**

State Management with Redux: Actions, Reducers, Store, Integration of Redux with React Applications, Testing REST APIs and Debugging, Project Work: MERN Stack Food Delivery App, Deployment with Netlify, Vercel, and Render, CI/CD Basics and Environment Configuration

### **Text Books:**

- “Learning React: Modern Patterns for Developing React Apps” by Alex Banks and Eve Porcello – O'Reilly.
- “Node.js, MongoDB and Angular Web Development” by Brad Dayley – Addison-Wesley.
- “Full-Stack React, TypeScript, and Node” by David Choi – Packt Publishing.

### **Reference Books:**

- “Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node” by Vasanth Subramanian – Apress.
- “Eloquent JavaScript” by Marijn Haverbeke – No Starch Press.
- Online Documentation & Tutorials: React.js, Node.js, Express.js, MongoDB official docs.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Software Testing Methodologies</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-802(2)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course introduces the fundamental principles and methodologies used in software testing to ensure the quality, reliability, and performance of software applications. It provides a systematic approach to testing by covering various functional and structural testing techniques, test planning, test case design, defect management, and software quality assurance. Students will learn about both manual and automated testing strategies and gain hands-on experience with widely used testing tools like Selenium and JUnit. The course also covers advanced testing techniques and integration with modern development practices such as agile and continuous integration. It prepares students to design effective test plans, detect and manage software defects, and contribute meaningfully to the software development lifecycle.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the role and importance of software testing in the software development lifecycle and differentiate between various testing methodologies.
CO2	Apply black-box and white-box testing techniques to design effective and comprehensive test cases.
CO3	Demonstrate the ability to conduct integration, system, and performance testing, and understand their application in real-world scenarios.
CO4	Develop and manage test plans, test cases, and defect tracking reports using standard templates and tools.

## Syllabus:

### Unit 1: Introduction to Software Testing

Importance of software testing, Software Development Life Cycle (SDLC) vs. Software Testing Life Cycle (STLC), Verification vs. Validation, Types of Testing: Manual, Automation, Static, Dynamic, Software testing principles and myths

### Unit 2: Functional Testing Techniques

Black-box testing techniques: Boundary Value Analysis (BVA), Equivalence Class Partitioning, Decision Table Testing, Cause-Effect Graphing, Requirement-based testing and positive/negative testing.

### **Unit 3: Structural (White-box) Testing Techniques**

Control flow testing, Statement coverage, Branch coverage, Condition coverage, Path coverage, Loop testing, Basis path testing, Cyclomatic complexity.

### **Unit 4: Integration and System Testing**

Top-down and bottom-up integration, Big Bang Integration, Drivers and stubs, System testing types: Performance Testing, Load Testing, Stress Testing, Security Testing, Compatibility Testing.

### **Unit 5: Test Planning and Management**

Test plan: objectives, scope, strategy, deliverables, Test case design: templates and management, Test metrics and measurements, Defect lifecycle and management, Bug tracking systems (e.g., JIRA, Bugzilla)

### **Text Books:**

- Software Testing Techniques – Boris Beizer
- Software Testing: Principles and Practices – Naresh Chauhan

### **Reference Books:**

- Foundations of Software Testing – Dorothy Graham, Erik van Veenendaal
- Online references and tool documentation (Selenium, JUnit, etc.)

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<b>Programme :</b>	<b>B. Tech.</b>	<b>Semester :</b>	<b>VIII</b>
<b>Name of the Course:</b>	<b>BI and Analytics</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-802(3)</b>
<b>Credits :</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs./week</b>
<b>Max Marks :</b>	<b>100</b>		

## Course Descriptions:

This course gives the fundamental description about Business Intelligence and technique for gathering, storing, analyzing, sharing and providing access to data, to help University Enterprise or any other organization to make a better decision

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Learn concept, process, and practice of the data science and how methodologies are applied to visualize information from raw data.
CO2	Learn BI involving predictive and statistical approach.
CO3	Implement BI techniques by using various tools and Create data visualization.
CO4	Implement and apply machine learning algorithms.
CO5	Select appropriate algorithms for solving a particular group of real-world problems.

## Syllabus:

### UNIT-I: An Overview of Business Intelligence, Analytics, and Decision Support

Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.

### UNIT-II: Performance Dashboard:

Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

### UNIT-III: Neural Networks and Sentiment Analysis

Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process., Sentiment Analysis, Speech Analytics.

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## **UNIT-IV: Model-Based Decision Making**

Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spread sheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons.

## **UNIT-V: Automated Decision Systems and Expert Systems**

Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

### **Text Books:**

- Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, Pearson.
- Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang, David King, “Business Intelligence and Analytics: System for Decision Support”, 10th Edition, Pearson Global Edition, 2013

### **Reference Books:**

- Hans-Georg Kemper and Henning Baars “Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT”.
- David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Augmented and Virtual Reality</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-803(1)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

The objective of this course is to provide a foundation to the fast growing field of AR and make the students aware of the various AR devices.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe how AR systems work and list the applications of AR.
CO2	Understand and analyses the hardware requirement of AR.
CO3	Use computer vision concepts for AR and describe AR techniques
CO4	Analyze and understand the working of various state of the art AR devices
CO5	Acquire knowledge of mixed reality

## Syllabus:

### Unit I: Introduction to Augmented Reality:

What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

### Unit II: Augmented Reality Hardware:

Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception, Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

### Unit III: Computer Vision for Augmented Reality & A.R. Software

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components

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for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

### **Unit IV: AR Techniques- Marker based & Markerless tracking:**

Marker-based approach- Introduction to marker-based tracking, types of markers, marker camera pose and identification, visual tracking, mathematical representation of matrix multiplication Marker types- Template markers, 2D barcode markers, imperceptible markers. Marker-less approach- Localization based augmentation, real world examples Tracking methods- Visual tracking, feature based tracking, hybrid tracking, and initialization and recovery

### **Unit V: AR Devices & Components & Introduction to Mixed reality:**

AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems, Introduction to mixed reality, Applications of mixed reality, Input and Output in Mixed reality, Computer Vision and Mixed Reality, simultaneous localization and mapping (SLAM), variants of SLAM

### **Text Books:**

- Allan Fowler-AR Game Developmentll, 1st Edition, A press Publications, 2018, ISBN 978-1484236178 2.
- Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition

### **Reference Books:**

- Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
- Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

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<b>Programme :</b>	<b>B.Tech.</b>	<b>Semester :</b>	<b>VIII</b>
<b>Name of the Course :</b>	<b>Wireless Sensor Network</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-803(2)</b>
<b>Credits :</b>	<b>3</b>	<b>No of Hours :</b>	<b>3 Hrs/Week</b>
<b>Max Marks :</b>	<b>100</b>		

## **Course Description:**

The goal of this course is to introduce the students to wireless network protocols and architecture. This course covers the various aspects of wireless networking such as: fundamentals of cellular communication, mobile radio propagation, multiple access techniques, mobile ad-hoc networks and routing in wireless and mobile networks. With the increased availability of low-cost micro-electromechanical system (MEMS) devices, several applications of networked sensors and actuators have gathered interest in recent times. Such networks are called Wireless Sensor Networks (WSNs) and they need special algorithms and software owing to the resource-constrained nature of the devices that constitute them. This course starts with a brief introduction of WSNs. It then introduces the concepts of localization and time synchronization and methods to perform them in WSNs. After examining the issues in medium access control, routing, transport and application layers in WSNs, the most important algorithms for WSNs in each of these layers are discussed. Finally, WSN middleware and operating systems are introduced with examples.

## **Course Outcomes:**

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Describe the overview of wireless sensor networks and enabling technologies for wireless sensor networks (L2)
CO2	Analyze Network Architectures and sensor node hardware/software platforms
CO3	Comprehend network architecture principles and design goals, service interfaces, and gateway concepts in sensor networks.
CO4	Evaluate the performance and characteristics of Medium Access Control (MAC) protocols in wireless sensor networks.
CO5	Understand the physical layer and network layer protocols, including routing strategies, signal propagation, and encoding techniques.

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### **Syllabus:**

#### **Unit-I: Overview Of Wireless Sensor Networks**

Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.

#### **Unit-II: Architectures**

Network Architecture-Sensor Networks - Scenarios-Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals ,Gateway Concepts, Operating Systems and Execution Environments-Introduction To Tiny OS and nes C-Internet to WSN Communication

#### **Unit-III: Networking Sensors**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment to fMAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.

#### **Unit-IV: Infrastructure Establishment**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control

#### **Unit-V: Sensor Network Platforms And Tools:**

Sensor Node Hardware-Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming

#### **Text Books:**

- Wireless communication & networking by Mark & Zuang, PHI.
- Wireless Communications and networks, William Stallings, PHI.

#### **Reference Books:**

- Wireless network performance handbook, by Smith, McGraw-Hill.
- Principles of wireless networks, by Pahlavan, PHI.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Software Project Management</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-803(3)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course will enable students to understand the fundamental principles of software project management with a good knowledge of responsibilities of project manager. Also, to be familiar with the different methods and techniques used for project management.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Apply project management concepts and techniques to an IT project.
CO2	Apply Key project management system techniques like PERT, CRM.
CO3	Explain project management in terms of the software development process.
CO4	Use of Project Management Tools and Techniques
CO5	Apply project management concepts through working in a group as team leader.

## Syllabus:

### Unit-I: Introduction to software project management

Definition and importance of software project management, Software vs. conventional projects, Project life cycle, Roles of a software project manager, Project success and failure factor

### Unit-II: Software Development Team

Three Vital Aspects of Software Project Management - The Team - Meaning of Leadership - Communicating in Harmony - Personality traits - Project Organizations. Project Planning: Top-Down and Bottom-Up Planning - Types of Activity - Project Duration: Schedule Monitoring Tools - Gantt Chart, PERT Chart, Critical Path.

### Unit-III: Software Coding

Programming principles and coding guidelines - method of incrementally developing code - managing the evolving code Testing - Unit testing and Code Inspection - Testing concepts and testing process - Design of Test case and Test plan - Black-box testing - White box testing.

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## **Unit-IV: Project Management Tools and Techniques**

Tools for scheduling (MS Project, OpenProject), Version control and collaboration tools (Git, Jira), Project communication and documentation tools, Case studies and practical applications.

## **Unit-V: Software Project Management Framework**

Methods to estimate project time and cost, Resource Management, Identification, Analysis, mitigation, and monitoring of Project Risks - Ensuring Project quality and quality management, Configuration Management, Change management, CMMI, different levels and need of accreditation.

### **Text Books:**

- Software Engineering, A Precise Approach: Pankaj Jalote, Wiley India-2010.
- Software Project Management: Saikat Dutt /S. Chandramouli, Pearson-Second Edition.

### **Reference Books:**

- Software Engineering: Ian Sommerville, Pearson, Ninth Edition.
- Software Engineering a practitioner's approach – Roger S Pressman, Seventh Edition.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: Final</b>
<b>Name of the Course</b>	<b>: Human-Computer Interaction</b>	<b>Course Code:</b>	<b>SOE-B-CSE-21-F03(1)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs/Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces students to the core theories and practices of Human-Computer Interaction (HCI). As an interdisciplinary domain, HCI blends cognitive psychology, neurocognitive engineering, human factors, computer science, and design thinking. Students will gain theoretical knowledge and practical experience regarding human perception, cognition, and learning in the context of interactive systems, enabling them to design, implement, and evaluate effective user interfaces.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the physiological, perceptual, and cognitive components of human learning and memory.
CO2	Acquire theoretical and practical skills in designing and implementing user interfaces.
CO3	Analyze interaction problems from technical, cognitive, and functional perspectives.
CO4	Develop awareness of general HCI challenges when designing information and interactive systems.
CO5	Explore multimodal interfaces, including visual, auditory, and tactile displays for information presentation.

## Syllabus:

### Unit I: Introduction to HCI

Definition, History and Evolution, Relationship to Ergonomics and Human Factors, Key Challenges and Themes in HCI, Human vs. Computer: Philosophy of Mind, Brain vs. Circuit Models, Human Memory Systems: Sensory Buffers (iconic, echoic, haptic), Working Memory, Long-Term Memory, Memory and HCI: Enhancing Recall and Recognition, Reasoning, Logic Structures, and Impact on Interface Design

### Unit II: Sensation, Perception, and Cognition

User as an Information Processing System, Basics of Human Sensation, Perception, and Cognition, Psychophysics, Problem Solving, Reasoning Models, Human Error and Interface

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Design Challenges, Understanding User Needs and Thought Processes, Evaluation Techniques: Expert Analysis (Cognitive Walkthroughs, Heuristic Evaluation), User Participation Methods (Observation, Query Techniques, Physiological Recording), Empirical and Experimental Research Methods in HCI: Hypothesis Testing, Sampling, Experimental Designs.

### **Unit III: Vision and Audition**

Visual Displays: Sensation, Perception, and Cognitive Aspects, Visual Illusions, Design Guidelines (Typography, Color, Iconography, Layout Principles), Auditory Interfaces: Hearing Physiology, Perception, Text-to-Speech (TTS) and Speech Recognition Systems, Designing Effective Auditory Displays: Verbal vs. 3D Spatial Sound

### **Unit IV: Brain-Computer Interfaces (BCI) and Haptics**

Introduction to BCIs and Brain Plasticity, Neu ergonomics and Neurocognitive Engineering, Applications: Medical (Neuro-prosthetics) and Commercial BCIs, Sensory Substitution Devices: Design and Theories, Touch Interfaces and Haptic Technology: Cutaneous, Kinesthetic, and Haptic Subsystems, Mechanoreceptors and Exploratory Procedures in Haptic Design, Force-feedback, Vibrotactile, and Cutaneous Device Applications

### **Unit V: Virtual and Augmented Reality (VR/AR)**

Virtual Reality (VR): Technologies, Benefits, and Challenges, Augmented Reality (AR): Concepts and Applications, Ubiquitous Computing and Ambient Intelligence, Wearable Devices and Miniaturized Platforms, Use Cases and Emerging Trends (e.g., Spatial Computing, Context-Aware Systems)

### **Text Books:**

- Shneiderman, Plaisant, Cohen, and Jacobs, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th Edition, Addison Wesley.
- Dix, Finlay, Abowd, and Beale, Human-Computer Interaction, 3rd Edition, Pearson Education.
- Wickens, Lee, Liu, and Gordon-Becker, Introduction to Human Factors Engineering, 2nd Edition, Pearson.

### **Reference Books:**

- Rajendra Kumar, Human-Computer Interaction, Laxmi Publications, 2nd Edition.
- Tan, D.S., & Nijholt, A., Brain-Computer Interfaces: Applying Our Minds to Human-Computer Interaction.
- K. Meena & R. Sivakumar, Human-Computer Interaction, PHI Learning.

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Full Stack Web Development Lab</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-805(1)</b>
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

This lab course complements the theory of Full Stack Web Development using the MERN stack. It provides hands-on experience in developing modern, scalable web applications. Students will work on real-world problems, covering frontend design using React.js, backend services with Node.js and Express.js, and database management with MongoDB. The course emphasizes project-based learning to build a complete MERN application with deployment.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Build responsive front-end interfaces using HTML, CSS, and JavaScript.
CO2	Create dynamic web applications using React.js and state management tools.
CO3	Design and implement RESTful APIs and integrate them with MongoDB.

## The following Concepts/Experiments will be covered in the lab:

- **Experiment 1:** Create a personal portfolio website using HTML5, CSS3, and Bootstrap  
*Focus: Frontend structure, styling, and responsive layout*
- **Experiment 2:** Build an interactive to-do list using JavaScript  
*Focus: DOM manipulation, events, and local storage*
- **Experiment 3:** Develop a basic React application with functional components  
*Focus: JSX, component props, and conditional rendering*
- **Experiment 4:** Implement React Hooks (useState, useEffect) in a task tracker  
*Focus: State management and side effects*
- **Experiment 5:** Create a multi-page React application using React Router  
*Focus: Routing, navigation, and component structure*
- **Experiment 6:** Develop a RESTful API with Node.js and Express.js  
*Focus: Routing, middleware, and CRUD operations*
- **Experiment 7:** Connect MongoDB with Node.js using Mongoose  
*Focus: Schema design, database connection, and CRUD*

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- **Experiment 8:** Implement JWT-based authentication for a MERN app  
*Focus: Login, protected routes, token storage*
- **Experiment 9:** Integrate Redux in a React application for state management  
*Focus: Actions, reducers, store configuration*
- **Experiment 10:** Deploy a MERN stack application on cloud platforms  
*Focus: Build optimization, hosting, CI/CD basics*

## **Text Books:**

- “Full-Stack React Projects” by Shama Hoque – Packt Publishing
- “Learning React” by Alex Banks & Eve Porcello – O’Reilly
- “Node.js, MongoDB, and Angular Web Development” by Brad Dayley – Addison-Wesley

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<b>Programme</b>	<b>:</b>	<b>B.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course</b>	<b>:</b>	<b>Software Testing Methodologies Lab</b>	<b>Course Code:</b>	<b>:</b>	<b>SOE-B-CSE-22-805(2)</b>
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Description:

This laboratory course is designed to provide hands-on experience with key software testing techniques and tools used in industry. Students will learn to design, write, and execute test cases using both manual and automated testing approaches. The lab emphasizes black-box and white-box testing methods, test case documentation, integration testing, and the use of industry-standard tools such as JUnit for unit testing, Selenium WebDriver for automation, and Bugzilla/JIRA for defect tracking. By engaging in practical testing scenarios, students will gain the technical skills needed to ensure software quality, reliability, and performance in real-world development environments.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Design and implement test cases using black-box and white-box testing techniques.
CO2	Perform manual testing on software applications and identify bugs or anomalies.
CO3	Use JUnit to develop and execute unit test cases for Java-based applications.
CO4	Automate web-based application testing using Selenium WebDriver.
CO5	Report and manage software defects using bug tracking tools like Bugzilla or JIRA.

## Lab Experiments:

- **Study of Software Testing Life Cycle (STLC)**
  - Understand phases: Requirement Analysis, Test Planning, Test Case Design, Test Execution, Defect Logging, and Closure.
- **Write Test Cases for a Simple Application**
  - Test case design using BVA (Boundary Value Analysis)
  - Equivalence Class Partitioning
- **Decision Table and State Transition Testing**
  - Generate test cases from decision tables
  - Create and test a state transition diagram
- **White-box Testing**

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- Code walkthrough and dry run
- Control flow testing using statement, branch, and path coverage
- **Integration Testing using Stubs and Drivers**
  - Top-down and bottom-up integration

### **Text Books:**

- Software Testing Techniques – Boris Beizer
- Software Testing: Principles and Practices – Naresh Chauhan

### **Reference Books:**

- Foundations of Software Testing – Dorothy Graham, Erik van Veenendaal
- Online references and tool documentation (Selenium, JUnit, etc.)

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<b>Programme</b>	<b>:</b>	<b>B. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>VIII</b>
<b>Name of the Course:</b>	<b>BI and Analytics Lab</b>	<b>Course Code:</b>	<b>SOE-B-CSE-22-805(3)</b>		
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Description:

This course is about the implementation of basic machine learning algorithms. Students will learn to create machine learning models.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Understand the implementation procedures for the machine learning algorithms
CO2	Construct machine learning models based on the attributes of applications and datasets
CO3	Understand different metrics for evaluation of machine learning models

## The following concepts will be covered in the lab:

- Executive dashboard design for a given business analytics scenario using Tableau Public.
- Generate visual analytics for a given business tasks and data using Tableau Public.
- Enhancing customer experience with predictive analytics and data mining by taking suitable business scenario (Use Weka/RapidMiner/Spark/R/Microsoft power BI).
- Cluster analysis using k-means algorithm for a given customer data set (use Python/R/any other tool).
- Identify frequent item sets using the Apriori algorithm for a given transaction data set (use Python/R/any other tool).
- Use a dataset of customer product reviews (e.g., Amazon reviews) to classify the sentiment of each review as positive, negative, or neutral using a pre-trained machine learning model (e.g., Naïve Bayes). Evaluate the accuracy of your sentiment classifier. (use Python/R/any other tool).
- Use text mining techniques to analyse a collection of news articles. Identify the most frequent terms and
- perform topic modelling using Latent Dirichlet Allocation (LDA) to find hidden topics within the articles. (use Python/R/any other tool).
- Given a dataset representing a social network (e.g., Twitter follower data), create a graph and perform Social Network Analysis (SNA) to find the most influential users using centrality measures like degree, closeness, and between centrality. (use Python/R/any other tool).

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## **Text Books:**

- David Poole, Alan Mackworth, Randy Goebel, “Computational Intelligence: a logical approach”, Oxford University Press.
- R. O. Duda, P. E. Hart and D.G. Stork, “Pattern Classification”, John Wiley, 2001.
- G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem-solving”, Fourth Edition, Pearson Education.
- Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective, Morgan Kaufmann (Elsevier), 2016.
- Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence - Computational Frameworks, Practices, and Applications, CRC Press, 2023.
- Ira J. Haimowitz, DATA ANALYTICS FOR BUSINESS - Lessons for Sales, Marketing, and Strategy, Routledge (Taylor & Francis), 2023.

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<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: VIII</b>
<b>Name of the Course</b>	<b>: Professional Development</b>	<b>Course Code:</b>	<b>HUM-B-SOE801</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours :</b>	<b>1 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Description:

In this course, students will be taught to apply design thinking, interpersonal skills, empathy, group decision making, problem solving, business development engineering, professional networking, work-life balance etc., Since they would be venturing into the corporate world. Special emphasis will also be given to maintaining professional work space, earning recognition and handling difficult interpersonal relations.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Achieving high level of awareness through empathy, work-life balance and interpersonal skills
CO2	Understanding and applying design thinking and professional work ethics & networking for self-growth and professional development.
CO3	Organizing and conducting academic and professional events
CO4	Demonstrating employability skills before hiring managers through public speaking, group discussion, resume building, occupational research and personal interview.
CO5	Applying industry readiness strategies to survive in VUCA world.

## Syllabus:

### Unit-I Idea Building:

- Ideathon
- Design Thinking & Budgeting
- Group Decision Making and Problem Solving
- Selling Yourself.

### Unit-II: Managing Client/Customer Relations:

- Organizing meetings
- Professional Events
- Handling Difficult Clients/Customers
- Networking Professionally
- Business Development Engineering

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### **Unit-III: Professional Work Ethics:**

- Work life Balance
- Empathy
- Maintaining Professional Workspace
- Earning Recognition
- Handling Difficult interpersonal situations

### **Unit-IV: Industry Readiness:**

- Video Resumes
- Mock GD
- Mock PI
- Campus Recruitment Test (Non Tech)
- Cross Roads Case Study Based Team Presentation.

### **Text Books:**

- Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education
- Burne, Eric, Games People Play (2010), Penguin UK
- Carnegie, Dale, How to Win Friends and Influence People (2004), RHUK
- Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan
- Steinburg, Scott, Netiquette Essentials (2013), Lulu.com

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## Academic Semester I

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P) /2
			L	T	P	PRE**		ESE*	Total Marks	
						Mid Sem	TA			
CSE	CSE25-M-CS101	Mathematics for Data Science	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS102	Advanced Data Structures and Algorithms	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS103	Data Analytics and Applications	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS104	Machine Learning	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS105(X)	Program Elective I	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS106	Advanced Data Structures and Algorithms Lab	0	0	2	-	15	35	50	1
CSE	CSE25-M-CS107	Data Analytics and Applications Lab	0	0	2	-	15	35	50	1
CSE	CSE25-M-CS108	Machine Learning Lab	0	0	2	-	15	35	50	1
CSE	CSE25-M-CS109(X)	Program Elective Lab I	0	0	2	-	15	35	50	1
ME	ME25-M-MTA106	Intellectual Property Rights	0	0	2	-	15	35	50	1
		<b>Total</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>75</b>	<b>150</b>	<b>525</b>	<b>750</b>	<b>20</b>

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## **Program Elective - I**

Sr. No.	Subject Code	Subject
1	CSE25-M-CS105 (1)	Computer Vision
2	CSE25-M-CS105 (2)	IoT Technology & Applications
3	CSE25-M-CS105 (3)	Cryptography and Information Security

## **Program Elective Lab - I**

Sr. No.	Subject Code	Subject
1	CSE25-M-CS109 (1)	Computer Vision Lab
2	CSE25-M-CS109 (2)	IoT Technology & Applications Lab
3	CSE25-M-CS109 (3)	Cryptography and Information Security Lab

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: I</b>
<b>Name of the Course</b>	<b>: Mathematics for Data Science</b>	<b>Course Code:</b>	<b>CSE25-M-CS101</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course provides a comprehensive foundation in mathematical concepts and techniques essential for data science. It covers linear algebra, calculus, probability, statistics, and optimization, emphasizing their applications in data analysis, machine learning, and statistical modeling. The course integrates theoretical understanding with practical problem-solving to equip students with the skills needed to handle real-world data science challenges.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Apply linear algebra concepts, including matrices, vector spaces, and eigenvalues, to solve data science problems such as dimensionality reduction and data transformations.
CO2	Utilize calculus techniques, including differentiation and integration, to optimize data models and understand gradient-based algorithms in machine learning.
CO3	Implement probability theory and random variables to model uncertainty and perform Bayesian inference in data science applications.
CO4	Analyze and interpret statistical methods, including hypothesis testing and regression, to draw meaningful conclusions from data.
CO5	Formulate and solve optimization problems using techniques like gradient descent and Lagrange multipliers for machine learning and predictive modeling.

## Syllabus:

### Unit 1: Linear Algebra for Data Science

Vectors and matrices: operations, norms, and dot products, Matrix factorization: LU decomposition, QR decomposition, Eigenvalues and eigenvectors: applications in PCA and spectral clustering, Vector spaces, linear transformations, and singular value decomposition (SVD), Applications: data representation, image compression, and recommender systems.

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### Unit 2: Calculus for Data Science

Functions, limits, and continuity, Differentiation: partial derivatives, gradients, and Jacobians, Integration: definite and indefinite integrals, numerical integration, Multivariable calculus: chain rule, Taylor series, and applications in optimization, Applications: gradient descent, backpropagation, and loss function optimization.

### Unit 3: Probability and Random Variables

Probability basics: axioms, conditional probability, Bayes' theorem, Random variables: discrete and continuous distributions, expectation, variance, Common distributions: binomial, Poisson, normal, and exponential, Joint and marginal distributions, covariance, and correlation, Applications: probabilistic modeling, Monte Carlo simulations, and Bayesian methods.

### Unit 4: Statistical Methods for Data Science

Descriptive statistics: mean, median, variance, and percentiles, Inferential statistics: hypothesis testing, p-values, confidence intervals, Regression analysis: linear regression, logistic regression, and regularization, Time series analysis and multivariate statistics, Applications: A/B testing, predictive modeling, and data-driven decision-making.

### Unit 5: Optimization Techniques

Unconstrained optimization: gradient descent, stochastic gradient descent, Constrained optimization: Lagrange multipliers, KKT conditions, Convex optimization: convex sets, functions, and duality, Numerical methods: Newton's method, conjugate gradient method, Applications: training machine learning models, hyperparameter tuning, and resource allocation.

### Text Books:

- Strang, G. (2016). Introduction to Linear Algebra (5th ed.). Wellesley-Cambridge Press.
- Stewart, J. (2015). Calculus: Early Transcendentals (8th ed.). Cengage Learning.
- Ross, S. M. (2019). A First Course in Probability (10th ed.). Pearson.
- Boyd, S., & Vandenberghe, L. (2004). Convex Optimization. Cambridge University Press.

### Reference Books:

- Deisenroth, M. P., Faisal, A. A., & Ong, C. S. (2020). Mathematics for Machine Learning. Cambridge University Press.
- Hastie, T., Tibshirani, R., & Friedman, J. (2009). The Elements of Statistical Learning (2nd ed.). Springer.
- Montgomery, D. C., & Runger, G. C. (2019). Applied Statistics and Probability for Engineers (7th ed.). Wiley.
- Axler, S. (2015). Linear Algebra Done Right (3rd ed.). Springer.

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: I</b>
<b>Name of the Course</b>	<b>: Advanced Data Structures and Algorithms</b>	<b>Course Code:</b>	<b>CSE25-M-CS102</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The objectives of this course are to equip students with fundamental knowledge and advanced technical competence in data structures and algorithms at the post graduate level. The course emphasizes algorithmic design techniques, optimization strategies, complexity analysis, and real-world applications. Topics covered include dynamic programming, amortized analysis, randomized and approximation algorithms, graph algorithms, and modern data structures.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Analyze and implement advanced data structures for computational efficiency
CO2	Utilize algorithmic paradigms for designing optimal solutions.
CO3	Apply mathematical foundations and complexity analysis to algorithmic evaluations.
CO4	Implement and optimize graph algorithms, network flow techniques, and approximation methods.
CO5	Explore cutting-edge algorithmic trends such as randomized techniques and quantum computing algorithms.

## Syllabus:

### Unit 1: Advanced Data Structures

AVL Trees, Red-Black Trees, B-Trees, Splay Trees, Fibonacci Heaps, Treaps, Skip Lists, Perfect Hashing, Bloom Filters, Cuckoo Hashing, Suffix Trees, Suffix Arrays, Tries.

### Unit 2: Algorithm Design & Complexity Analysis

Strassen's Matrix Multiplication, Fast Fourier Transform, Matrix Chain Multiplication, Longest Common Subsequence, Huffman Coding, Job Scheduling, Matroid Theory, Aggregate Analysis, Accounting Method, Potential Method.

### Unit 3: Graph Algorithms & Network Flow

Tarjan's Algorithm, Dijkstra's Algorithm, Bellman-Ford Algorithm, A\* Search, Prim's Algorithm, Kruskal's Algorithm, Ford-Fulkerson Algorithm, Push-Relabel Algorithm.

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## **Unit 4: Randomized & Approximation Algorithms**

Las Vegas Algorithm, Monte Carlo Algorithm, Markov Chains, Randomized Quicksort, Vertex Cover, Set Cover, Traveling Salesman Problem, Polynomial-Time Approximation Schemes (PTAS).

## **Unit 5: Advanced Topics & Research Trends**

P vs. NP, NP-hard, NP-complete, Grover's Algorithm, Shor's Algorithm, MapReduce, Streaming Algorithms, Graph Neural Networks (GNNs).

### **Text Books:**

- "Introduction to Algorithms" – Cormen, Leiserson, Rivest, and Stein
- "Algorithms" – Robert Sedgewick and Kevin Wayne
- "Randomized Algorithms" – Rajeev Motwani and Prabhakar Raghavan
- "Data Structures and Network Algorithms" – Robert Tarjan

### **Reference Books:**

- "Approximation Algorithms" – Vijay V. Vazirani
- "Algorithm Design" – Jon Kleinberg and Éva Tardos
- "Computational Complexity: A Modern Approach" – Sanjeev Arora & Boaz Barak

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<b>Programme</b>	<b>:</b>	<b>M. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>I</b>
<b>Name of the Course:</b>		<b>Data Analytics and Applications</b>	<b>Course Code:</b>		<b>CSE25-M-CS103</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course introduces students to the fundamental concepts and techniques of data analytics, including data preprocessing, statistical analysis, and machine learning. It explores the use of big data technologies such as Hadoop, Spark, and NoSQL databases for scalable data management and analysis. Students will gain hands-on experience with data visualization tools and cloud-based analytics platforms. The course also discusses real-world applications of data analytics across industries, emphasizing ethical considerations and emerging trends.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Understand and apply foundational concepts of data analytics, including data types, statistical analysis, and preprocessing techniques.
CO2	Develop and evaluate machine learning models using supervised, unsupervised, and advanced analytics methods.
CO3	Utilize big data frameworks like Hadoop, Spark, and NoSQL databases for large-scale data storage, processing, and analysis.
CO4	Design and implement effective data visualization solutions and use modern cloud-based analytics tools to derive insights.
CO5	Analyze real-world data analytics applications across industries, while considering ethical, privacy, and security implications.

## Syllabus:

### UNIT-I: Introduction to Data Analytics and Statistical Methods

Overview of Data Analytics: Types of data (structured, semi-structured, unstructured), applications in business, healthcare, finance, and IoT. Data Preprocessing and Cleaning: Handling missing data, outlier detection, normalization, and standardization. Descriptive and Inferential Statistics: Measures of central tendency, correlation, regression analysis, hypothesis testing, and confidence intervals.

### UNIT-II: Machine Learning for Data Analytics

Introduction to Machine Learning: Supervised, unsupervised, and reinforcement learning. Supervised Learning Algorithms: Decision Trees, Support Vector Machines, Naive Bayes, and

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K-Nearest Neighbors. Unsupervised Learning Algorithms: Clustering techniques (K-Means, Hierarchical), Principal Component Analysis (PCA). Model Evaluation: Cross-validation, confusion matrix, precision, recall, and F1-Score.

### **UNIT-III: Advanced Data Analytics Techniques**

Data Analytics Overview: Descriptive, diagnostic, predictive, and prescriptive analytics, Deep Learning: Neural networks, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN). Natural Language Processing (NLP): Text preprocessing, sentiment analysis, word embeddings, and topic modeling. Time Series Analysis and Forecasting: ARIMA, exponential smoothing, LSTM. Reinforcement Learning: Q-Learning, Markov Decision Processes (MDP).

### **UNIT-IV: Data Analytics Tools and Big Data Technologies**

Data Analytics Tools: Python, R, MATLAB for analytics. Big Data Frameworks: Hadoop, Spark, Hive, Pig for large-scale data processing. Data Visualization Tools: Tableau, PowerBI, and D3.js. Cloud Platforms: AWS, Azure for data storage, processing, and visualization.

### **UNIT-V: Applications, Ethics, and Future Directions**

Applications of Data Analytics: In business intelligence, healthcare, financial analytics, IoT, and social media. Ethics and Privacy: Data governance, privacy issues, regulations (GDPR, HIPAA), and responsible AI. Future Trends: Quantum computing, edge analytics, and AI integration in data analytics.

### **Text Books:**

- Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking — Foster Provost, Tom Fawcett, 1st Edition, O'Reilly Media.
- David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
- Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

### **Reference Books:**

- Big Data: Principles and Paradigms — Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, 1st Edition, Wiley Press.
- Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython — Wes McKinney, 2nd Edition, O'Reilly Media.
- Learning Spark: Lightning-Fast Big Data Analysis — Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, 1st Edition, O'Reilly Media.

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: I</b>
<b>Name of the Course</b>	<b>: Machine Learning</b>	<b>Course Code:</b>	<b>CSE25-M-CS104</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours:</b>	<b>3 Hrs/Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The course will cover both fundamental concepts of Machine Learning such as supervised and unsupervised learning. This course also covers the applications as well as case studies of both the areas. Machine Learning is a flourishing subject in Computer Science which devises models that can automatically learn from data and detect patterns from data. The applications of machine learning are diverse ranging from self- driven cars to disaster management systems. With easy availability of data from different devices and measurements, machine learning techniques become imperative in analysing trends hidden in the data. This course focuses on the major tasks of machine learning that can robustly address data that is non-linear, noisy as well as high-dimensional in nature.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To introduce various key paradigms of machine learning approaches.
CO2	To familiarize with mathematical relationships across various machine-learning algorithms
CO3	To understand various key approaches in supervised learning.
CO4	To understand various key approaches in unsupervised learning.
CO5	To illustrate the concept of the neural network.

## Syllabus:

### Unit-I:

Use of Machine Learning, Types of machine learning systems, Machine learning challenges, Testing and validating, Working with real data, Obtaining the data, Visualizing the data, Data preparation, Training and fine-tuning the model, Feature engineering, Data normalization and scaling techniques, Handling imbalanced datasets, Introduction to ML pipelines using Scikit-learn, Automating ML workflows with tools like AutoML.

### Unit-II:

Bayesian Learning, Naïve Bayes Classifier, K-Nearest Neighbour, Support Vector Machines, Decision Tree classifier, Linear Regression, Logistic Regression, Performance evaluation of a model: basics of confusion metrics, evaluation metrics, Techniques to improve Classification

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Accuracy: Cross-validation, Ensemble methods, Bagging, Boosting, Random Forest, Introduction to ROC-AUC and Precision-Recall curves, Hyperparameter tuning using Grid Search and Random Search, Introduction to Explainable AI (XAI).

### Unit-III:

Supervised vs. Unsupervised Learning, Applications, Clustering, K-Means clustering, Agglomerative hierarchical clustering, Density-Based Methods, Evaluation of clustering, Outliers and Outlier detection methods, Introduction to DBSCAN and OPTICS, Silhouette score for cluster validation, Applications of clustering in image segmentation and market analysis, Visualization of clusters using t-SNE and UMAP.

### Unit-IV:

The curse of dimensionality, Main approaches for dimensionality reduction, Principal Component Analysis (PCA), Non-Negative Matrix Factorization (NMF), Ensemble Learning: voting classifiers, bagging, random patches and random spaces, random forests, boosting, stacking, Feature selection vs. feature extraction, Introduction to Linear Discriminant Analysis (LDA), Ensemble model interpretation, Real-world ensemble applications in finance and healthcare.

### Unit-V:

Implementing MLPs with Keras, Fine-tuning neural network hyperparameters, Deep Neural Networks: Vanishing/Exploding Gradients Problem, Avoiding Overfitting through regularisation, Dropout Regularization, Batch normalization, Activation functions and their impact, Introduction to CNN and RNN architectures, Visualizing training performance using TensorBoard, Real-world use cases of deep learning in image and speech recognition.

### Text Books:

- Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep learning, MIT press, 2016.
- Aurelion Geron, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools and Techniques to build Intelligent Systems, 2/e, O'Reilly Media, 2019.

### Reference Books:

- Tom M. Mitchell, "Machine Learning" First Edition by Tata McGraw- Hill Education.
- Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
- Christopher M. Bishop, "Pattern Recognition and Machine Learning" By Springer, 2007.
- Mevi P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>I</b>
<b>Name of the Course</b>	<b>:</b>	<b>Advanced Data Structures and Algorithms Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS106</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The objective of this lab course is to provide hands-on experience with advanced data structures and algorithmic techniques. The course focuses on practical implementation of key algorithms, optimization strategies, and performance analysis. It enables students to gain technical proficiency in applying algorithmic paradigms and data structures for solving complex computational problems.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Implement and analyze advanced data structures efficiently.
CO2	Apply algorithmic paradigms such as dynamic programming and greedy methods in real-world scenarios.
CO3	Perform performance evaluation and optimization techniques for complex algorithms.

## The following Concepts/Experiments will be covered in the lab:

- Balanced Search Trees (AVL, Red-Black, B-Trees)
- Hashing Techniques (Perfect Hashing, Bloom Filters, Cuckoo Hashing)
- Graph Algorithms (Dijkstra's, Bellman-Ford, Floyd-Warshall)
- Network Flow Algorithms (Ford-Fulkerson, Push-Relabel)
- String Data Structures (Suffix Trees, Tries, KMP Algorithm)
- Dynamic Programming Techniques (Matrix Chain Multiplication, Longest Common Subsequence)
- Randomized Algorithms (Monte Carlo, Las Vegas, Randomized Quicksort)
- Approximation Algorithms (Vertex Cover, Set Cover, Traveling Salesman Problem)

## Text Books :

- "Introduction to Algorithms" – Cormen, Leiserson, Rivest, and Stein
- "Algorithms" – Robert Sedgewick and Kevin Wayne
- "Randomized Algorithms" – Rajeev Motwani and Prabhakar Raghavan

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: I</b>
<b>Name of the Course:</b>	<b>Data Analytics and Applications Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS107</b>
<b>Credits</b>	<b>: 1</b>	<b>No of Hours</b>	<b>: 2 Hrs/Week</b>
<b>Max Marks</b>	<b>: 50</b>		

## Course Descriptions:

This lab course provides hands-on experience in the implementation of data analytics techniques, machine learning algorithms, and big data processing tools. Students will work with Python for data preprocessing, visualization, and statistical analysis. They will also explore the use of Hadoop, Spark, and NoSQL databases (e.g., MongoDB) to handle large-scale data processing. Additionally, the lab will focus on developing interactive visualizations using Tableau or Power BI, and conducting predictive analytics on real-world datasets.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Apply data preprocessing, cleaning, and exploratory data analysis techniques on real-world datasets using Python tools.
CO2	Implement machine learning models and clustering algorithms to derive insights from structured and unstructured data.
CO3	Demonstrate proficiency in handling big data using Hadoop, Spark, and MapReduce frameworks.

## List of Experiments

- Perform data cleaning operations such as handling missing values, normalization, and outlier detection using Python libraries (NumPy, Pandas).
- Calculate basic statistics (mean, median, mode, standard deviation, correlation) and visualize datasets using Matplotlib and Seaborn.
- Implement Linear Regression and Decision Tree Classifier models on sample datasets using Scikit-learn.
- Apply K-Means and Hierarchical Clustering algorithms on real-world datasets and visualize the clusters.
- Install and configure Hadoop and HDFS. Perform file operations and basic commands on HDFS.
- Develop and run a MapReduce program (such as Word Count) for processing large datasets.

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- Create dashboards and interactive reports using Tableau or Power BI with sample datasets.
- Conduct EDA and develop a simple predictive analytics model using a real-world dataset.

## **Text Books :**

- Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking Foster Provost, Tom Fawcett, 1st Edition, O'Reilly Media.
- Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython Wes McKinney, 2nd Edition, O'Reilly Media.
- Hadoop: The Definitive Guide Tom White, 4th Edition, O'Reilly Media.

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>I</b>
<b>Name of the Course:</b>		<b>Machine Learning Lab</b>	<b>Course Code:</b>		<b>CSE25-M-CS108</b>
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The laboratory augments the lecture course in Machine Learning (ML) by providing experience with different programming techniques. The laboratory introduces Commonly used AI and ML algorithms for various application

## Course Outcomes:

After Completion of the course Students will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To formulate the different machine learning problems.
CO2	Apply various learning approaches to real time problems using Classification.
CO3	Solve different classification and regression problems using various supervised learning algorithms.

## The following concepts will be covered in the lab:

- Import real-world dataset (e.g., Titanic, Iris, etc.), handle missing values, encode categorical data, scale features, and visualize data using Matplotlib/Seaborn.
- Train and evaluate a Logistic Regression or Decision Tree model on a labeled dataset (e.g., predicting diabetes or heart disease).
- Compare accuracy and performance of Naïve Bayes vs. K-Nearest Neighbors on a classification task.
- Generate confusion matrix, calculate accuracy, precision, recall, F1-score, and plot ROC curve for a binary classifier.
- Use GridSearchCV or RandomizedSearchCV to fine-tune hyperparameters of SVM or Random Forest classifiers.
- Apply K-Means and DBSCAN clustering on an unlabeled dataset, visualize the clusters, and evaluate using silhouette score.
- Apply PCA and NMF on high-dimensional data (e.g., handwritten digits dataset) and visualize reduced features in 2D.
- Implement Random Forest (bagging) and AdaBoost or Gradient Boosting (boosting) and compare their performance.
- Build and train a Multilayer Perceptron (MLP) using Keras on a dataset like MNIST or Fashion-MNIST.
- Demonstrate overfitting in a deep neural network, then apply L2 regularization and dropout to improve generalization.

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## **Text Books :**

- Aurelion Geron, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools and Techniques to build Intelligent Systems, 2/e, O'Reilly Media, 2019
- Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep learning, MIT press, 2016

## **References:**

- Tom M. Mitchell, "Machine Learning" First Edition by Tata McGraw- Hill Education.
- Ethem Alpaydin, "Introduction to Machine Learning " 2nd Edition, The MIT Press, 2009
- Christopher M. Bishop, "Pattern Recognition and Machine Learning" By Springer, 2007.
- Mevi P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: I</b>
<b>Name of the Course</b>	<b>: Computer Vision</b>	<b>Course Code:</b>	<b>CSE25-M-CS105 (1)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces the fundamental concepts and techniques in the field of computer vision. It focuses on enabling students to understand the basics of image formation, feature extraction, object detection, motion estimation, and 3D reconstruction. The course also discusses real-world applications of computer vision in areas such as robotics, augmented reality, and automated surveillance.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the fundamentals of image formation, image representation, and perception.
CO2	Apply filtering and edge detection techniques to extract features from images.
CO3	Implement algorithms for object recognition and classification.
CO4	Analyze motion in image sequences and apply structure-from-motion techniques.
CO5	Explore practical applications of computer vision using modern tools and frameworks.

## Syllabus:

### Unit 1: Introduction to Computer Vision and Image Formation

Basics of computer vision, components of a vision system. Human vs. computer vision. Digital image representation, image formation and geometric camera models. Color spaces, sampling, quantization, camera calibration, lens distortion.

### Unit 2: Image Filtering and Edge Detection

Linear and nonlinear filtering: Gaussian, median, bilateral filters. Edge detection: Sobel, Prewitt, Canny edge detectors. Image gradients and edge linking. Scale-space representation, Laplacian of Gaussian.

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## **Unit 3: Feature Detection and Matching**

Corner and blob detection: Harris, FAST, DoG. Feature descriptors: SIFT, SURF, ORB. Feature matching, RANSAC for robust estimation. Homography and fundamental matrix estimation.

## **Unit 4: Segmentation and Object Recognition**

Thresholding, region growing, clustering methods (K-means, Mean-shift). Graph-based segmentation, watershed algorithm. Object detection using HOG, Viola-Jones. Deep learning-based methods: CNN basics, YOLO, SSD.

## **Unit 5: Motion Analysis and 3D Vision**

Optical flow: Lucas-Kanade, Horn-Schunck methods. Motion segmentation. Epipolar geometry, stereo vision, depth estimation. Structure-from-motion, 3D reconstruction pipeline.

### **Text Books:**

- “Computer Vision: Algorithms and Applications”, Richard Szeliski, Springer.
- “Multiple View Geometry in Computer Vision”, Hartley R. & Zisserman A., Cambridge University Press.
- “Programming Computer Vision with Python”, Jan Erik Solem, O’Reilly Media.

### **Reference Books:**

- “Digital Image Processing”, Gonzalez R. C. & Woods R. E., Pearson Education.
- “Deep Learning for Computer Vision”, Rajalingappaa S., Packt Publishing.
- “Learning OpenCV 4”, Bradski G. & Kaehler A., O’Reilly Media.

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: I</b>
<b>Name of the Course</b>	<b>: IoT Technology and Applications</b>	<b>Course Code:</b>	<b>CSE25-M-CS105 (2)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course introduces the fundamentals of the Internet of Things (IoT), exploring the technologies, architectures, communication protocols, and platforms that enable smart and connected solutions. Students will learn about sensor networks, data acquisition, cloud integration, and IoT security. The course also emphasizes real-world applications across domains like smart cities, healthcare, agriculture, and industrial automation. Through theoretical learning and hands-on projects, students will develop the skills to design and implement basic IoT solutions.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Explain the concepts, architectures, and enabling technologies of IoT systems.
CO2	Analyze the various IoT communication models and protocols.
CO3	Design IoT-based solutions using appropriate sensors, communication networks, and platforms.
CO4	Apply data management strategies and security principles to IoT deployments.
CO5	Evaluate real-world IoT applications across different domains and propose innovative solutions.

## Syllabus:

### Unit 1: Introduction to IoT

Definition, characteristics, and evolution of IoT, Physical and logical design of IoT, IoT enabling technologies, IoT levels and deployment templates, IoT vs M2M vs CPS

### Unit 2: IoT Architecture and Protocols

IoT reference architecture (three-layer, five-layer models), Protocols: MQTT, CoAP, HTTP, AMQP, DDS, Communication models: Request-response, publish-subscribe, Wireless sensor networks (WSN) and IoT

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## **Unit 3: Sensing, Communication, and Networking**

Sensors and actuators, RFID technology, Wireless technologies for IoT: Bluetooth, ZigBee, 6LoWPAN, LoRaWAN, NB-IoT, Introduction to IPv6 and IoT networking issues, Edge, Fog, and Cloud Computing in IoT

## **Unit 4: IoT Platforms and Data Management**

Overview of IoT platforms: AWS IoT, Google Cloud IoT, Microsoft Azure IoT, Device management, data collection, storage, and analytics, IoT data visualization tools, Introduction to Big Data analytics for IoT

## **Unit 5: Security and Privacy in IoT**

IoT security issues: device, network, cloud, Cryptography for IoT, Authentication and access control for IoT devices, Privacy-preserving techniques

## **Unit 6: IoT Applications and Case Studies**

Smart home and smart cities, Industrial IoT (IIoT), Healthcare and medical applications, Agricultural IoT, Future trends: AI in IoT, Blockchain for IoT, 5G and IoT

### **Text Books:**

- Arshdeep Bahga and Vijay Madisetti Internet of Things: A Hands-on Approach Publisher: Universities Press
- Raj Kamal Internet of Things: Architecture and Design Principles Publisher: McGraw Hill Education

### **Reference Books:**

- Adrian McEwen and Hakim Cassimally Designing the Internet of Things, Publisher: Wiley
- Pethuru Raj and Anupama C. Raman The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Publisher: CRC Press
- Olivier Hersent, David Boswarthick, Omar Elloumi The Internet of Things: Key Applications and Protocols Publisher: Wiley
- Samuel Greengard The Internet of Things (MIT Press Essential Knowledge series) Publisher: MIT Press

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: I</b>
<b>Name of the Course</b>	<b>: Cryptography and Information Security</b>	<b>Course Code:</b>	<b>CSE25-M-CS105 (3)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The course covers fundamental aspects of security in a modern networked environment with the focus on system design aspects and cryptography in the specific context of network / internetwork security. It also dwells into basics of cryptographic techniques, algorithms and protocols required to achieve these properties; computational issues in implementing cryptographic protocols and algorithms; and system/application design issues in building secure networked systems.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand basics of Cryptography and Information Security.
CO2	Understand various symmetric and asymmetric key algorithm and apply them on real world data.
CO3	Demonstrate various methods to calculate authentication codes using Message Authenticate Code and Digital Signature
CO4	Understand key management and distribution techniques.
CO5	Summarize the intrusion detection and its solutions to overcome the attacks

## Syllabus:

### Unit-I:

Introduction to security attacks, services and mechanism, Classical encryption techniques, substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard (DES), Strength of DES, block cipher modes of operations, Triple DES

### Unit-II:

Introduction to group, field, finite field of the form  $GF(p)$ , modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryption, Fermat's and Euler's theorem, Primarily testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, security of RSA.

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## **Unit-III:**

Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, Hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA), Digital Signatures: Digital Signatures, RSA Digital Signature, Elgamal Digital Signature, Digital signature standards (DSS).

## **Unit-IV:**

Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos. Electronic mail security: pretty good privacy (PGP), S/MIME.

## **Unit-V:**

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic transaction (SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls.

## **Text Books:**

- William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
- Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
- C K Shyamala, N Harini, Dr. T.R.Padmnabhan Cryptography and Security ,Wiley
- Bruce Schiener, "Applied Cryptography". John Wiley & Sons
- Bernard Menezes," Network Security and Cryptography", Cengage Learning.
- Atul Kahate, "Cryptography and Network Security", McGraw Hill

## **Reference Books:**

- C K Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", 1st Edition, Wiley India
- Forouzan Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Mc Graw Hill
- Mark Stamp, "Information Security, Principles, and Practice", Wiley India.
- WM. Arthur Conklin, Greg White, "Principles of Computer Security", TMH.
- Neal Krawetz, "Introduction to Network Security", CENGAGE Learning.
- Bernard Menezes, "Network Security and Cryptography", CENGAGE Learning.

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>I</b>
<b>Name of the Course</b>	<b>:</b>	<b>Computer Graphics Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS109 (1)</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>: 2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The objective of this course is to provide practical exposure to fundamental and advanced techniques in the field of computer vision. The course will help students implement various computer vision algorithms involving image processing, feature detection, object recognition, motion analysis, and 3D reconstruction using suitable tools and programming environments.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Implement image filtering and edge detection techniques.
CO2	Apply feature detection and matching algorithms.
CO3	Implement segmentation and object detection methods.

## The following Concepts/Experiments will be covered in the lab:

- Image smoothing using Gaussian, Median and Bilateral filters
- Edge detection using Sobel, Prewitt and Canny detectors
- Corner and Blob detection: Harris, SIFT, ORB
- Feature matching using Brute-Force and FLANN
- Object detection using HOG and pre-trained CNN models
- Image segmentation using thresholding and clustering (K-means)

## Text Books :

- "Computer Graphics C version", Hearn D. & Baker M. P. 2nd Ed. Pearson.
- "Computer Graphics Principles and Practice in C", Foley J. D., Dam A. V., Feiner S. K. & Hughes J. F. 2nd Ed. Pearson.
- "Computer Graphics", Maurya R. K. Wiley India Publication.
- "Computer Graphics", Bhattacharya S. Oxford Publication.

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>I</b>
<b>Name of the Course</b>	<b>:</b>	<b>IoT Technology &amp; Applications Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS109 (2)</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs/Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## **Course Description:**

This lab course provides hands-on experience in building Internet of Things (IoT) solutions. Students will work with sensors, actuators, microcontrollers (such as Arduino or Raspberry Pi), and cloud platforms to design and deploy IoT systems. The lab focuses on real-time data collection, device communication, cloud integration, and visualization of IoT data. Students will gain practical skills in configuring IoT hardware, using IoT communication protocols, ensuring security, and creating end-to-end IoT applications across various domains.

## **Course Outcomes (COs):**

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Set up and configure sensors, actuators, and IoT devices.
CO2	Develop programs for data acquisition, processing, and communication.
CO3	Integrate IoT systems with cloud platforms and visualize real-time data.
CO4	Implement security measures in simple IoT applications.
CO5	Design and deploy mini-projects in different IoT application domains.

## **List of Experiments:**

1. Introduction to Arduino / Raspberry Pi:
  - a. Setup and programming basics
  - b. GPIO pin control (LED blinking)
2. Sensor Interfacing:
  - a. Interfacing temperature sensor (e.g., DHT11/DHT22) and reading values
  - b. Interfacing humidity or light sensors and logging data

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3. Actuator Control:
  - a. Controlling a motor or buzzer using Arduino/Raspberry Pi
  - b. PWM (Pulse Width Modulation) control for dimming LEDs
4. IoT Communication:
  - a. Sending sensor data to PC via serial communication
  - b. Setting up WiFi module (e.g., ESP8266/NodeMCU) for wireless communication
5. Cloud Integration:
  - a. Connecting to IoT cloud platforms like ThingSpeak, Blynk, or AWS IoT Core
  - b. Uploading live sensor data to the cloud and visualizing it
6. Data Visualization:
  - a. Graphical visualization of real-time temperature/humidity data
  - b. Data dashboard creation using cloud tools
7. IoT Protocol Implementation:
  - a. MQTT communication between device and broker
  - b. Sending messages via publish-subscribe model
8. Home Automation Project:
  - a. Design a simple IoT-based system for switching devices (e.g., lights, fans) using a smartphone app
9. Security Experiment:
  - a. Implement basic encryption techniques in data transmission
  - b. Secure communication using TLS for MQTT
10. Mini-Project Development:
  - a. Students to develop a working prototype of an IoT solution (e.g., smart parking, smart irrigation, health monitoring system)

### Text Books:

- Arshdeep Bahga and Vijay Madisetti Internet of Things: A Hands-on Approach Publisher: Universities Press
- Raj Kamal Internet of Things: Architecture and Design Principles Publisher: McGraw Hill Education

### Reference Books:

- Adrian McEwen and Hakim Cassimally Designing the Internet of Things Publisher: Wiley
- Pethuru Raj and Anupama C. Raman The Internet of Things: Enabling Technologies, Platforms, and Use Cases Publisher: CRC Press
- Donald Norris The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black Publisher: McGraw Hill Education
- Marco Schwartz Internet of Things Projects with ESP8266 Publisher: Packt Publishing

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>I</b>
<b>Name of the Course</b>	<b>:</b>	<b>Cryptography and Information Security Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS109 (3)</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

To give practical exposure on basic security attacks, encryption algorithms, authentication techniques and digital signature.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Develop code for classical Encryption Techniques to solve the problems.
CO2	Build cryptosystems by applying symmetric and public key encryption algorithms.
CO3	Construct code for authentication algorithms.

## The following concepts will be covered in the lab:

- Symmetric key cryptography.
- Asymmetric key cryptography.
- Key exchange protocol.
- Authentication algorithms.
- Digital signature standards.

## Text Books :

- William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education.
- Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
- C K Shyamala, N Harini, Dr. T.R.Padmnabhan Cryptography and Security ,Wiley
- Bruce Schneier, "Applied Cryptography". John Wiley & Sons
- Bernard Menezes," Network Security and Cryptography", Cengage Learning.
- Atul Kahate, "Cryptography and Network Security", McGraw Hill

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<b>Program:</b>	<b>M.Tech.</b>	<b>Semester:</b>	<b>I</b>
<b>Name of the Course:</b>	<b>Intellectual Property Rights</b>	<b>Course Code:</b>	<b>ME25-M-MTA106</b>
<b>Credits:</b>	<b>1</b>	<b>No of Hours:</b>	<b>2</b>
<b>Max Marks:</b>	<b>50</b>		

## Course Description:

This course offers lectures and case studies to impart teaching and learning. It is designed to provide a detailed knowledge of Intellectual Property Rights, Copyright, Trademarks, Industrial Designs, and recent trends in IPR. This course covers IPR in detail.

## Course Outcomes:

After Completion of the course, Students will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand Intellectual Property Rights in detail, Patents and its types.
CO2	Understand Copyright Infringement and Fair Use.
CO3	Understand the Trademarks and its Registration and Protection of Trademarks.
CO4	Understand the Concept, Importance and Registration, Protection of Industrial Designs
CO5	Understand IPR and Research & Development.

## Syllabus:

### Unit-1: Introduction to Intellectual Property Rights:

Definition, Nature, Scope, and Types of Intellectual Property (IP), Importance of IPR in Technology and Innovation, International Framework.

Patents: Definition and Scope, Patent Filing Procedure (National & International), Patentability Criteria.

### Unit-2: Copyrights:

Definition, Rights of Copyright Holder, Copyright in Digital Era (Software, Multimedia), Copyright Infringement and Fair Use.

### Unit-3: Trademarks:

Definition, Importance, and Types; Registration and Protection of Trademarks, Trademark Infringement, and Passing off.

### Unit-4: Industrial Designs:

Concept and Importance, Registration and Protection. Trade Secrets and Confidential Information, Importance in Industries, Legal Aspects of Trade Secrets.

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## **Unit-5: IPR Research & Development:**

Role of IPR in Scientific and Technological Developments, Technology Transfer and Licensing, Case Studies on Patent & Copyright Issues.

### **Text Books:**

- Deborah E. Bouchoux, Intellectual Property Rights, Cengage Learning.
- Dr. B. L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing.
- R. Radhakrishnan & S. Balasubramanian, Intellectual Property Rights: Text and Cases, Excel Books
- V.K. Ahuja, Intellectual Property Rights in India, LexisNexis.
- Robert P. Merges & John F. Duffy, Patent Law and Policy, Wolters Kluwer

### **References Books:**

- Siva Prasad, The Law of Intellectual Property Rights, Asia Law House,
- William M. Landes & Richard A. Posner, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, Harvard University Press.
- W.R. Cornish & David Llewelyn, Intellectual Property Rights: A Global Perspective, Cambridge University Press.
- V. Sople, Managing Intellectual Property, PHI Learning Pvt. Ltd.
- Rajkumar S. Dukki, Fundamentals of Intellectual Property Rights: For Engineers, Scientists, and Entrepreneurs, Springer

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## Academic Semester II

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P) /2
			L	T	P	PRE**		ESE*	Total Marks	
						Mid Sem	TA			
CSE	CSE25-M-CS110	Next Generation Databases	3	0	0	15	15	70	100	3
ME	ME25-M-MTA108	Research Methodology	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS111	Deep Learning	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS112(X)	Program Elective II	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS113	Cloud Computing	3	0	0	15	15	70	100	3
CSE	CSE25-M-CS114	Next Generation Databases Lab	0	0	2	-	15	35	50	1
CSE	CSE25-M-CS115	Deep Learning Lab	0	0	2	-	15	35	50	1
CSE	CSE25-M-CS116(X)	Program Elective Lab II	0	0	2	-	15	35	50	1
CSE	CSE25-M-CS117	Cloud Computing Lab	0	0	2	-	15	35	50	1
ME	ME25-M-MTA114	Scientific Paper Writing	0	0	2	-	15	35	50	1
		<b>Total</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>75</b>	<b>150</b>	<b>525</b>	<b>750</b>	<b>20</b>

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## **Program Elective - II**

Sr. No.	Subject Code	Subject
1	CSE25-M-CS112 (1)	Information Retrieval
2	CSE25-M-CS112 (2)	Data Mining and Warehousing
3	CSE25-M-CS112 (3)	Blockchain Technology

## **Program Elective Lab – II**

Sr. No.	Subject Code	Subject
1	CSE25-M-CS116 (1)	Information Retrieval Lab
2	CSE25-M-CS116 (2)	Data Mining and Warehousing Lab
3	CSE25-M-CS116 (3)	Blockchain Technology Lab

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: II</b>
<b>Name of the Course</b>	<b>: Next Generation Databases</b>	<b>Course Code:</b>	<b>CSE25-M-CS110</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

The course focuses on modern database technologies that extend beyond traditional relational database systems. It covers advancements in distributed, NoSQL, NewSQL, graph, and multi-model databases along with scalable architecture, cloud-based storage, and emerging paradigms such as blockchain-based and AI-integrated databases. This course equips students with the necessary knowledge to work with evolving database solutions used in contemporary applications.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the architecture and design principles of next-generation databases.
CO2	Evaluate different types of databases, including NoSQL, NewSQL, and distributed systems.
CO3	Implement optimized data models for modern applications.
CO4	Analyze performance tuning and scalability aspects of emerging database technologies.
CO5	Explore trends in AI-driven, blockchain-based, and multi-model databases.

## Syllabus:

### Unit 1: Evolution and Classification of Next Generation Databases

Overview of relational vs. non-relational databases, classification of next-generation databases, requirements of modern applications, scalability challenges, cloud databases, edge computing for data storage.

### Unit 2: NoSQL and Distributed Databases

Key-value stores, document-based databases, column-oriented databases, graph databases, distributed data processing, CAP theorem, eventual consistency, replication, partitioning, consistency models.

### **Unit 3: NewSQL and Hybrid Approaches**

NewSQL architecture, scalability vs. ACID compliance, multi-model databases, polyglot persistence, federated database systems, case studies on Spanner, CockroachDB, and VoltDB.

### **Unit 4: AI and Blockchain-Based Databases**

AI-driven data management, predictive analytics in databases, blockchain databases, decentralized data storage, smart contracts, consensus protocols, security challenges in distributed environments.

### **Unit 5: Advanced Trends in Database Technologies**

Data lakes, data mesh architecture, serverless databases, quantum databases, edge computing for real-time data processing, future directions in database research.

### **Text Books:**

- “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence” , Pramod J. Sadalage and Martin Fowler, Addison-Wesley, 2012.
- “Making Sense of NoSQL: A Guide for Managers and the Rest of Us” , Dan McCreary and Ann Kelly, Manning Publications, 2013.

### **Reference Books:**

- “Professional NoSQL”, Shashank Tiwari, Wrox Press, 2011.
- “NoSQL For Dummies” ,Adam Fowler, Wiley, 2015.
- “MongoDB Applied Design Patterns” ,Rick Copeland, O'Reilly Media, 2013..

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<b>Program:</b>	<b>M.Tech.</b>	<b>Semester:</b>	<b>II</b>
<b>Name of the Course:</b>	<b>Research Methodology</b>	<b>Course Code:</b>	<b>ME25-M-MTA108</b>
<b>Credits:</b>	<b>3</b>	<b>No of Hours:</b>	<b>3 hours/week</b>
<b>Max Marks:</b>	<b>100</b>		

## **Course Description:**

This course provides an in-depth understanding of research methodology, equipping students with essential skills to conduct scientific research. It covers various research approaches, research design and data collection methods. Emphasis is placed on developing critical thinking skills for hypothesis formulation and data interpretation. The course also introduces students to ethical research practices and referencing techniques, enabling them to effectively communicate research findings through reports and synopses.

## **Course Outcomes:**

After Completion of the course, Students will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Explain the fundamental concepts, types, and methodologies of scientific research.
CO2	Develop appropriate research designs, hypotheses, and sampling strategies for effective data collection.
CO3	Apply data collection techniques, analyze research data, and utilize statistical tools for interpretation.
CO4	Draft well-structured research reports and present findings effectively through seminars and papers.
CO5	Demonstrate awareness of publication ethics, plagiarism detection, and integrity in research writing.

## **Syllabus**

### **Unit 1: Introduction to Research:**

Aims and Objectives of Research, Types of Research, Research Approaches, Characteristics of Scientific Research, Steps in Scientific Research, Methods of Scientific Research, research methods vs research methodology, Criteria of Good Research. Review of Literature.

### **Unit 2: Research Design and Sampling:**

Hypothesis – Qualities of a good Hypothesis, Hypothesis Testing – Logic & Important Features of a good research design; Concept and Importance of Research Design:– Experimental Design: Concept of Independent & Dependent variables. Qualitative and Quantitative Research.

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## **Unit 3: Data Collection, Methods, and Preparation:**

Types of data, Projective Techniques, Collection of Secondary Data, Case Study, Pilot Study and Pre-Testing, Questionnaire Checking, Editing and Coding of Data, Sampling: Concepts of Statistical Population, Sample Size, Sampling Error, Probability, Practical considerations in sampling and sample size

Data analysis and Visualization: Classification, Tabulation, Graphical Visualization, Types of Analysis, Statistics in Research.

## **Unit 4: Report Drafting and Presentation:**

Structure and components of research report, Seminars and paper presentations, drafting research papers, Essential components for report drafting and scientific editing tools.

## **Unit 5: Publication Ethics:**

Importance of ethics in research, Ethical issues related to publishing: Plagiarism and Self-Plagiarism, Plagiarism detection tools, originality and novelty in research, conflict of interest.

## **Text Books:**

- Donald Cooper & Pamela Schindler, Business Research Methods, TMGH.
- Alan Bryman & Emma Bell, Business Research Methods, Oxford University Press.
- C. R. Kothari, Research Methodology, New Age Publication.
- Rudolf J. Freund William J. Wilson, Statistical Methods, Academic Press, London.

## **Reference Books:**

- Chawla and Sondhi, Research Methodology, Vikas
- Paneersevam, Research Methodology, PHI.

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<b>Programme</b>	<b>:</b>	<b>M. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>II</b>
<b>Name of the Course:</b>		<b>Deep Learning</b>	<b>Course Code:</b>		<b>CSE25-M-CS111</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Gain the knowledge about neural networks.
CO2	Introduce the basic concepts and techniques of deep learning.
CO3	Apply optimization techniques in in real life applications.
CO4	Develop the skills in deep learning for solving practical problems. To be familiar with a set of well-known deep neural network, convolutional neural network, filters optimization techniques.
CO5	Apply RNN and LSTM for sentiment analysis

## Syllabus:

### UNIT-I: Basics of Neural Networks

Biological Neuron, idea of computational units, McCulloch–Pitts unit and thresholding logic, linear perceptron, perceptron learning algorithm, linear separability, convergence theorem for perceptron learning algorithm, limitations of single-layer perceptron, introduction to activation functions (Sigmoid, Tanh, ReLU), bias term and its significance.

### UNIT-II: Feedforward Networks and Deep Neural Networks

Multilayer perceptron, gradient descent, backpropagation, empirical risk minimization, regularization, autoencoders, difficulty of training deep neural networks, greedy layer-wise training, role of initialization and activation in deep networks, batch vs stochastic gradient descent, mini-batch gradient descent, variants of autoencoders (denoising, sparse, variational - brief introduction).

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## **UNIT-III: Optimization in Deep Neural Networks**

Newer optimization methods for neural networks (Adagrad, Adadelta, RMSProp, Adam, Nesterov Accelerated Gradient), second-order methods for training, saddle point problem in neural networks, regularization methods (dropout, drop connect, batch normalization), learning rate schedules (step decay, cosine annealing, warm restarts), gradient clipping in deep networks, early stopping as regularization.

## **UNIT-IV: Recurrent Neural Networks**

Backpropagation through time, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), bidirectional LSTMs, bidirectional RNNs, applications of RNNs (language modeling, sequence prediction), attention mechanism (brief introduction), comparison of LSTM and GRU architectures.

## **UNIT-V: Convolutional Neural Networks**

Convolution in n-dimensions, convolutional layers, pooling strategies, visualization of filters, padding and stride, parameter calculation in CNNs, overview of modern CNN architectures (LeNet, AlexNet, VGG, ResNet - brief), transfer learning and pre-trained CNN models (basic concept).

### **Text Books:**

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

### **Reference Books:**

- Raúl Rojas, “Neural Networks: A Systematic Introduction”, 1996.
- Christopher Bishop , “Pattern Recognition and Machine Learning”, 2007.

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>II</b>
<b>Name of the Course</b>	<b>:</b>	<b>Cloud Computing</b>	<b>Course Code:</b>		<b>CSE25-M-CS113</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours :</b>		<b>3 Hrs. / week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## Course Description:

This course provides an in-depth exploration of cloud computing technologies, focusing on the design, development, and deployment of scalable and reliable cloud-based systems. Students will gain a solid understanding of cloud architecture, service and deployment models, virtualization, storage systems, security challenges, and cloud-native application development. The course also integrates practical exposure to leading cloud platforms such as AWS, Azure, and GCP, with hands-on experience in setting up virtual machines, managing cloud storage, deploying applications using serverless models, and automating infrastructure through tools like Docker and Kubernetes. By blending theoretical knowledge with real-world applications, the course equips students to address current industry challenges and to innovate in cloud-based solution development.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the foundational concepts, service models, and deployment architectures in cloud computing.
CO2	Apply virtualization techniques and manage compute, storage, and networking resources in a cloud environment.
CO3	Design and implement scalable and distributed cloud-based applications using modern programming models.
CO4	Analyze and address security, privacy, and compliance issues in cloud computing systems.
CO5	Deploy and manage cloud services using industry-leading platforms such as AWS, Azure, or GCP.

## Syllabus:

### Unit 1: Introduction to Cloud Computing

Cloud definition and characteristics, History and evolution of cloud computing, Cloud computing reference model, Deployment models: Public, Private, Hybrid, Community, Service models: IaaS, PaaS, SaaS

### Unit 2: Virtualization in Cloud

Basics of virtualization, Hypervisors: Types and architecture, Virtual Machine Monitor (VMM), Containers vs VMs, Case studies: VMware, KVM, Xen, Docker

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## **Unit 3: Cloud Architecture and Services**

Cloud computing stack, Compute, Storage, and Network services, Load balancing and auto-scaling, Service orchestration and SLA management, Resource pooling and multi-tenancy

## **Unit 4: Cloud Storage and Databases**

Storage services: Block, File, Object (e.g., S3, Azure Blob), CAP Theorem in cloud databases, NoSQL databases (MongoDB, Cassandra, DynamoDB), Big Data and cloud integration

## **Unit 5: Security and Privacy in the Cloud**

Security risks and challenges, Identity and Access Management (IAM), Data encryption at rest and in transit, Legal and compliance issues (GDPR, HIPAA), Trust and auditability

### **Text Books:**

- Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
- John W. itinghouse james F.Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press.

### **Reference Books:**

- Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
- Cloud Security: A Comprehensive Guide to secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>II</b>
<b>Name of the Course</b>	<b>:</b>	<b>Next Generation Database Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS114</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The objectives of this lab course are to provide hands-on experience in working with NoSQL databases, understanding their architecture, and applying key concepts such as document-based, column-oriented, graph, and key-value stores. The emphasis will be on practical implementation, querying, and optimization techniques used in NoSQL database systems

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Understand the fundamental concepts of NoSQL databases and their use cases.
CO2	Implement basic CRUD operations in different types of NoSQL databases.
CO3	Perform indexing and optimization techniques to enhance query performance.

## The following Concepts/Experiments will be covered in the lab:

- Introduction to NoSQL databases: Key concepts and architecture
- CRUD operations in MongoDB (Document-based database)
- Querying and indexing in MongoDB.
- Working with Cassandra (Column-oriented database)
- Query execution and data modelling in Cassandra.
- Redis as a key-value store: Implementation and operations.
- Introduction to Neo4j (Graph database) and Cypher queries.
- Comparison of NoSQL databases with relational databases.
- Performance benchmarking and optimization techniques.
- Mini-project: Implementing a real-world NoSQL database solution.

## Text Books :

- "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" – Pramod J. Sadalage & Martin Fowler
- "MongoDB: The Definitive Guide" – Kristina Chodorow
- "Cassandra: The Definitive Guide" – Jeff Carpenter & Eben Hewitt
- "Graph Databases" – Ian Robinson, Jim Webber, & Emil Eifrem

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>II</b>
<b>Name of the Course:</b>	<b>Deep Learning Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS115</b>		
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

### Course Descriptions:

This laboratory course provides hands-on experience in designing, implementing, and evaluating deep learning models. Students will learn to utilize popular deep learning frameworks and libraries to tackle real-world problems in areas such as image recognition, natural language processing, and time series analysis. Through practical exercises and projects, students will gain a deep understanding of the fundamental concepts and techniques in deep learning, including neural network architectures, training methodologies, optimization algorithms, and regularization techniques. Emphasis will be placed on developing practical skills in data preprocessing, model development, hyperparameter tuning, and performance evaluation. Students will also learn to interpret results and critically analyze the strengths and limitations of different deep learning approaches.

### Course Outcomes:

At the end of the course, students should be able to:

CO Number	Course Outcome
CO1	Implement and experiment with fundamental deep learning models
CO2	Apply data preprocessing techniques for deep learning tasks
CO3	Evaluate and compare the performance of deep learning models

### Following concepts will be covered in the lab

- Implementing a Simple Neural Network (MLP) from Scratch
- Image Classification using Convolutional Neural Networks (CNNs)
- Training a Deep Neural Network for Regression Tasks
- Building a Convolutional Autoencoder for Image Denoising
- Transfer Learning with Pretrained CNN Models (VGG, ResNet, etc.)
- Implementing Recurrent Neural Networks (RNN) for Text Generation
- Training Long Short-Term Memory (LSTM) Networks for Time Series Prediction
- Building a Generative Adversarial Network (GAN) for Image Generation
- Hyperparameter Tuning in Neural Networks
- Implementing Dropout and Batch Normalization to Prevent Overfitting

### Text Books:

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

### Reference Books:

- Raúl Rojas, “Neural Networks: A Systematic Introduction”, 1996.

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- Christopher Bishop , “Pattern Recognition and Machine Learning”, 2007.

<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>II</b>
<b>Name of the Cloud Computing Lab Course:</b>			<b>Course Code:</b>		<b>CSE25-M-CS117</b>
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>:</b>	<b>2 Hrs. / week</b>
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

### Course Descriptions:

This laboratory course provides hands-on experience with the core concepts and practical applications of cloud computing. Students will explore leading cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) to understand cloud infrastructure, deployment models, and service models. The course emphasizes practical exposure to virtualization, cloud storage, serverless computing, cloud databases, identity management, and deployment of scalable web applications.

### Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	The students will learn to provision virtual machines, implement storage solutions, configure auto-scaling and load balancing, and deploy applications using platform services.
CO2	Introduces modern DevOps tools and practices, including containerization.
CO3	Students will be equipped with the technical skills needed to develop and manage applications in a cloud environment.
CO4	Students will be prepared for roles in cloud development, administration, and DevOps engineering.

### The following Experiments will be covered in the lab:

1. Introduction to Cloud Platforms
  - Overview and setup of AWS Free Tier / Azure Student Account / GCP
  - Navigating the cloud console
2. Launching and Configuring Virtual Machines
  - Create and configure EC2 instances (AWS) or Virtual Machines (Azure)
  - Connect via SSH and install packages
3. Working with Object Storage
  - Create and use an S3 bucket (AWS) / Blob Storage (Azure)
  - Upload, retrieve, and manage files
4. Creating and Deploying a Website
  - Host a static website on AWS S3 / Azure Blob Storage
  - Deploy a dynamic web app using AWS Elastic Beanstalk / Azure App Service
5. Load Balancing and Auto Scaling
  - Set up a Load Balancer in AWS

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- Configure auto-scaling groups based on CPU utilization
- 6. Cloud Database Services
  - Create and access Amazon RDS / Azure SQL Database
  - Connect with an application
- 7. Serverless Computing
  - Create a simple AWS Lambda function
  - Trigger using API Gateway or S3 event
- 8. Identity and Access Management (IAM)
  - Create IAM users and roles
  - Assign policies and test access controls
- 9. Virtualization with VirtualBox/Docker
  - Install and configure VirtualBox/Docker
  - Create and run containers
- 10. CI/CD in the Cloud (Optional Advanced Lab)
  - Set up a basic pipeline using AWS CodePipeline or GitHub Actions
  - Automate deployment of a simple app

### Tools & Platforms:

- AWS Educate / Free Tier
- Microsoft Azure for Students
- Google Cloud Platform (GCP) Free Tier
- Docker, VirtualBox
- GitHub, Jenkins (optional)

### Text Books:

- Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
- John W. itinghouse james F.Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press.

### Reference Books:

- Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
- Cloud Security: A Comprehensive Guide to secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley

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<b>Program:</b>	<b>M.Tech.</b>	<b>Semester:</b>	<b>II</b>
<b>Name of the Course:</b>	<b>Scientific Paper Writing</b>	<b>Course Code:</b>	<b>ME25-M-MTA114</b>
<b>Credits:</b>	<b>1</b>	<b>No of Hours:</b>	<b>2 hours/week</b>
<b>Max Marks:</b>	<b>50</b>		

## Course Description

This subject is related to the techniques of scientific study and understanding related research mobility and how to express it in a scientific framework. The area of the subject may be a particular topic/subject/area/live project/case study and identifies the key areas and express in a paper mode for the scientific audiences.

## Course Outcomes

After completion of the course, students will be able to

<b>CO Number</b>	<b>Course Outcomes</b>
CO1	Understand the research methods.
CO2	Acquire the perfection in journal reading.
CO3	Develop skills for research publication/write-up.
CO4	Effectively present research findings.
CO5	Make use of new and recent tools for creating technical reports.

## Syllabus:

In this course, students will develop the scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas.

## The work involves the following steps:

- Selecting a subject, narrowing the subject into a topic
- Stating an objective.
- Collecting the relevant bibliography (at least 15 journal papers)
- Preparing a working outline.
- Studying the papers, understanding the author's contributions, and critically analyzing each paper.
- Preparing a working outline
- Linking the papers and preparing a draft of the paper.
- Preparing conclusions based on the reading of all the papers.
- Writing the Final Paper and giving the final Presentation

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<b>Programme</b>	<b>:</b>	<b>M. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>II</b>
<b>Name of the Course:</b>	<b>:</b>	<b>Information Retrieval</b>	<b>Course Code:</b>	<b>:</b>	<b>CSE25-M-CS112 (1)</b>
<b>Credits</b>	<b>:</b>	<b>3</b>	<b>No of Hours</b>	<b>:</b>	<b>3 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>100</b>			

## **Course Description:**

The objectives of this course to understand the basic of information retrieval and various retrieval models, indexing, clustering, classification and image retrieval and machine learning techniques for text classification and clustering.

## **Course Outcomes:**

After Completion of the course Students will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	To use different information retrieval techniques in various application areas.
CO2	Perform indexing and pattern matching techniques for efficient query processing and retrieval of information.
CO3	Apply various classification and clustering techniques using machine learning.
CO4	To implement retrieval systems for web and Image search tasks.
CO5	Analyze and implement indexing techniques, query processing methods, and feedback mechanisms for efficient information access.

## **Syllabus:**

### **UNIT-I: Introduction**

Basic concepts, Practical issues, Retrieval process, Architecture, Boolean retrieval, Retrieval evaluation, Open source retrieval systems, History of web search, Boolean retrieval, Retrieval evaluation basics, Impact of the web on information retrieval, Information retrieval versus web search, Components of a search engine.

### **UNIT-II: Retrieval Models**

Taxonomy and characterization of information retrieval models, Boolean model, Vector model, Term weighting, Scoring and ranking; Language models; Set theoretic models. Probabilistic models, Algebraic models, Structured text retrieval models; Neural Retrieval Models, Models for browsing

### **UNIT-III: Cataloging and Indexing**

Objectives, Indexing Process, Automatic Indexing, Information Extraction. Static and dynamic inverted indices. Index construction and index compression; Searching; Sequential searching and pattern matching, Query operations, Query languages, Query processing;

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Relevance feedback and query expansion; Classes of automatic indexing: Statistical indexing, Natural language, Concept indexing, Hypertext linkages

### **UNIT-IV: Text Classification and Clustering**

Text classification and Naïve Bayes, k- nearest neighbors, Vector space classification, Support vector machines and Machine learning on documents, Flat clustering, Hierarchical clustering; Matrix decompositions and latent semantic indexing; Fusion and meta learning.

### **UNIT-V: Searching the web**

Searching the web, Structure of the web, IR and web search, Static and dynamic Ranking, Web crawling and indexing, Link analysis, Web as a graph, XML retrieval, Multimedia IR Models and languages, Indexing and searching, Parallel and distributed IR, Digital libraries.

### **UNIT-VI: Image Retrieval**

Introduction to content-based image retrieval, Basics of Image Retrieval Content-Based vs. Metadata-Based Retrieval Applications of Image Retrieval Systems, Challenges in image retrieval, Image representation, Indexing and retrieving images; Relevance feedback, image retrieval using Vision Transformers (ViT).

### **Textbooks:**

- C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval," Cambridge University Press.
- R. Baeza-Yates and B. Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search," 2nd Edition, ACM Press Books.
- J. Lin and C. D. Manning, "An Introduction to Neural Information Retrieval," Foundations and Trends in Information Retrieval.

### **Reference Books:**

- S. Buttcher, C. Clarke, and G. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines," MIT Press.
- R. Korfhage, "Information Storage and Retrieval," Wiley.
- P. Paliwal and S. Balakrishnan, "Principles of Information Retrieval," Anmol Publications Pvt. Ltd.

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<b>Programme</b>	<b>: M.Tech.</b>	<b>Semester</b>	<b>: II</b>
<b>Name of the Course</b>	<b>: Data Mining and Warehousing</b>	<b>Course Code:</b>	<b>CSE25-M-CS112 (2)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours :</b>	<b>3 Hrs. / Week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description:

This course provides the student with in depth knowledge of Data Warehousing principles, Data Warehouse techniques, and Business Intelligence systems. The course introduces the topics of Data Warehouse design, Extract-Transform-Load (ETL), Data Cubes, and Data Marts. Students will create Business Intelligence using Data Warehouses with several OLAP and analytical tools.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the functionality of the various data mining and data warehousing component
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analyzing techniques of various data
CO4	Describe different methodologies used in data mining and data warehousing.

## Syllabus:

### Unit-I: Data Warehousing and On-Line Analytical Processing

Data Warehousing – Introduction, Overview and Concepts: Need for data warehousing, Basic elements of data warehousing, Architecture and Infrastructure, Data Design and Data Representation, Data Cube and OLAP, OLAP in data warehouse – ROLAP, MOLAP, HOLAP, Data Warehouse Modeling, Various Data Warehouse Schemas.

### Unit-II: Introduction to Data Mining

Motivation, Importance, Definition of Data Mining, Data Mining Functionalities, KDD, Challenges, Data Mining Tasks, Data Preprocessing- Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation, Data Transformation; Measures of similarity and dissimilarity-Basics.

### Unit-III: Association Rules:

Problem Definition, Frequent Item Set Generation, Support and Confidence Measures, Applications of frequent pattern and associations. Association Rule Generation, APRIORI

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Algorithm, The Partition Algorithms, FP-Growth Algorithms etc. Constraint-Based Frequent Pattern Mining, Extended Applications of Frequent Patterns

### **Unit-IV: Classification:**

Basic Concepts, General Approaches to solving a classification problem, Evaluation of Classifiers, Classification techniques, Decision trees, Methods for expressing attribute test conditions, Measures for Selecting the Best split, Naïve-Bayes Classifier, Bayesian Belief Networks; K-nearest neighbor Classification-Algorithm and characteristics.

### **Unit-V: Clustering Techniques**

Overview, Basic Concepts of Cluster Analysis, features of cluster analysis, Clustering structures, Major Clustering Approaches, Partitioned Methods, Hierarchical Methods, Density Based Methods. OUTLIER ANALYSIS: Why outlier analysis, Identifying and handling of outliers, Distribution Based Outlier Detection etc.

### **Text Books:**

- J. Han & M. Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Ed, 2006.
- Data Mining Techniques – Arun K Pujari, University Press.

### **Reference Books:**

- W. H. Inmon, "Building the Data Warehouse", 3rd edition.
- Anahory and Murray, Data warehousing in the real world, Pearson Education/Addison Wesley.
- Margaret Dunham, Data Mining: Introductory and Advanced Topics, Published by Prentice Hall.

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<b>Programme</b>	<b>: M. Tech.</b>	<b>Semester</b>	<b>: II</b>
<b>Name of the Course:</b>	<b>Blockchain Technology</b>	<b>Course Code:</b>	<b>CSE25-M-CS112 (3)</b>
<b>Credits</b>	<b>: 3</b>	<b>No of Hours</b>	<b>: 3 Hrs./week</b>
<b>Max Marks</b>	<b>: 100</b>		

## Course Description

Blockchain is an emerging technology platform for developing decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies. The basic tenet of this platform is that it allows one to create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability. Public blockchain platforms allow us to guarantee these properties with overwhelming probabilities even when untrusted users are participants of distributed applications with ability to transact on the platform. Even though, blockchain technology has become popularly known because of its use in the implementation of Cryptocurrencies such as BitCoin, Ethereum. Explore the core concepts of blockchain technology, including distributed ledger, consensus mechanisms, and smart contracts. Discover real-world applications in finance, supply chain, healthcare, and more. Address regulatory considerations and challenges. Gain the knowledge to identify use cases and contribute to blockchain projects. Suitable for professionals seeking to leverage the transformative potential of blockchain.

## Course Outcomes:

At the end of this course, the student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand the knowledge about the design principles of blockchain and Its scope
CO2	Apply the concept & evaluate security, privacy, and efficiency of a given blockchain use case.
CO3	Design, build, and deploy distributed applications and smart contracts by identifying the need of blockchain to find the solution to the real-world problems.
CO4	Discuss the concepts used in various Consensus Protocols used in blockchain to find the solution to the real-world problems
CO5	Understand the need of Enterprise Blockchain Platforms, its features and should be able to propose Blockchain based solution for a given Use Cases.

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### **Syllabus:**

#### **Unit-I: Introduction**

Introduction to Blockchain and Digital Currency, Evolution, Blockchain as Public ledger, Structure of a Block, Transactions, Merkel Trees, Peer-to-Peer Networks, Timestamp, Double Spend Problem, Decentralization Applications, Characteristics, Benefits and Challenges.

#### **Unit-II: Cryptography in Blockchain**

Hash Functions, Public Key Cryptosystem, Public Key Generation, Digital Signature, Zero-Knowledge Proof, k-Anonymity.

#### **Unit-III: Smart Contracts And Consensus Algorithms**

Smart Contract, Applications of Smart Contracts, Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, Elements of Smart Contracts, Ethereum Operations, Incentive Model, Transactions in Ethereum, Introduction Solidity, Mining, Hardness of Mining, Incentive, Consensus, Paxos, Consensus Algorithms - PBFT, PoW, PoS, etc. :

#### **Unit-IV: Ethereum And Hyperledger**

Ethereum, Trustlessness and Immutability of Blockchain Technology, Proof of Work (PoW) and Proof of Stake (PoS), Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity, Introduction to Enterprise Blockchain Platforms and tools: Hyperledger, Corda, Ripple, Stellar, Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain vs Permissionless Blockchain.

#### **Unit-V: Blockchain For Real-World Applications**

Use cases of Blockchain. Prominent Blockchain Applications, Government Sector, Smart Card, Healthcare, IOT, Blockchain Integration with other Domains Cryptocurrencies, Banking, Supply Chain, Real-Estate, Judiciary, Insurance, etc.

#### **Text Books:**

- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive introduction", Princeton University Press, 2016.
- Roger Wattenhofer, "Blockchain Science: Distributed Ledger Technology", independently Published, ISBN-10 : 1793471738, 2019.
- Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain", Shroff/O'Reilly, 2017.

#### **Reference Books:**

- Elaine Shi, "Foundations of Distributed Consensus and Blockchains", (URL: <http://elaineshi.com/docs/blockchain-book.pdf>), 2020.

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- Alan T. Norman, “Blockchain Technology Explained: the Ultimate Beginner s Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA and Smart Contracts”, Amazon Digital Services, 2017.

<b>Programme</b>	<b>M. Tech</b>	<b>Semester</b>	<b>: II</b>
<b>Name of the Course:</b>	<b>Information Retrieval Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS116 (1)</b>
<b>Credits</b>	<b>1</b>	<b>No of Hours</b>	<b>2 Hrs. / Week</b>
<b>Max Marks</b>	<b>50</b>		

## Course Descriptions:

Information retrieval is the process through which a computer system can respond to a user's query for text-based information on a specific topic. IR was one of the first and remains one of the most important problems in the domain of natural language processing (NLP). Web search is the application of information retrieval techniques to the largest corpus of text anywhere -- the web -- and it is the area in which most people interact with IR systems most frequently.

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Apply appropriate Query technique on given real world applications
CO2	Develop user interfaces and visualization for search process to address research issues.
CO3	Identify appropriate indexing and searching method for Feature Extraction.

## The following concepts will be covered in the lab:

- To Find the Weights of specific Term in a given Documents Using Python
- Implement hands-on experience store, and retrieve information from www using semantic approaches
- Implement searching of words and patterns in a given text file using inverted index.
- Implement the Analysis and the performance of information retrieval using various classification algorithm on text
- Implement the Analysis and the performance of information retrieval using Clustering algorithm on text
- Implement how to analyse ranked retrieval of a very large number of documents with hyperlinks between them
- Implement how N-grams are used for detection and correction of spelling errors.
- Implement Domain Specific Search Engine
- Implement a relevance feedback mechanism to refine search results using user input (positive/negative feedback).
- Case Study on: Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine.

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## **Text Books:**

- Introduction to Information Retrieval, Manning C., P. Raghavan & Schutze H., First South Asian Edition. Cambridge University Press.
- Modern Information Retrieval: The concepts and Technology behind Search. Yates R.B. & Neto B. R., 2nd Ed., ACM Press Books.
- Information Retrieval - Implementing and Evaluating Search Engines. Büttcher S., Clarke C. & Cormack G., MIT Press.
- Information Storage and Retrieval, Korfhage R.. Wiley.
- Principles of Information Retrieval. Paliwal P. & Balakrishnan S., Anmol Publications Pvt. Ltd.

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<b>Programme</b>	<b>:</b>	<b>M.Tech.</b>	<b>Semester</b>	<b>:</b>	<b>II</b>
<b>Name of the Course</b>	<b>:</b>	<b>Data Mining and Warehousing Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS116 (2)</b>	
<b>Credits</b>	<b>:</b>	<b>1</b>	<b>No of Hours</b>	<b>: 2 Hrs. / Week</b>	
<b>Max Marks</b>	<b>:</b>	<b>50</b>			

## Course Descriptions:

The objective of this lab course is to provide hands-on experience with techniques and tools for data mining and data warehousing. Students will implement classification, clustering, association rule mining, and OLAP operations, applying concepts to real-world datasets using specialized software and platforms. The course ensures practical exposure to data preprocessing, model evaluation, and visualization techniques for structured and unstructured data.

## Course Outcomes:

At the end of the course, a student will be able to:

CO Number	Course Outcome
CO1	Implement fundamental data mining techniques such as classification, clustering, and association rule mining.
CO2	Perform data preprocessing, transformation, and cleaning for effective model building.
CO3	Utilize OLAP techniques for multidimensional data analysis in warehousing applications.

## The following Concepts/Experiments will be covered in the lab:

- Data Preprocessing (Cleaning, Normalization, Feature Selection)
- Classification Techniques (Decision Trees, Naïve Bayes, SVM)
- Clustering Algorithms (K-Means, Hierarchical, DBSCAN)
- Association Rule Mining (Apriori Algorithm, FP-Growth)
- Dimensional Modeling and OLAP Operations
- Data Warehousing Architecture and ETL Processes
- Big Data Analytics Frameworks (Hadoop, Spark)

## Text Books :

- "Data Mining: Concepts and Techniques" – Jiawei Han, Micheline Kamber, and Jian Pei
- "Introduction to Data Mining" – Pang-Ning Tan, Michael Steinbach, and Vipin Kumar
- "The Data Warehouse Toolkit" – Ralph Kimball and Margy Ross

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<b>Programme :</b>	<b>B.Tech.</b>	<b>Semester :</b>	<b>VI</b>
<b>Name of the Course:</b>	<b>Blockchain Technology Lab</b>	<b>Course Code:</b>	<b>CSE25-M-CS116 (3)</b>
<b>Credits :</b>	<b>1</b>	<b>No of Hours :</b>	<b>2 Hrs/Week</b>
<b>Max Marks :</b>	<b>50</b>		

## Course Descriptions:

Explore the core principles of blockchain technology and its diverse applications. Understand distributed ledger, consensus algorithms, cryptography, and smart contracts. Examine real-world use cases in finance, supply chain, healthcare, and more. Gain hands-on experience in developing and deploying smart contracts. Address regulatory considerations and challenges. Suitable for professionals interested in leveraging blockchain's transformative potential.

## Course Outcomes:

At the end of the course, a student will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
CO1	Understand and explain blockchain fundamentals, including distributed ledger, consensus mechanisms, and smart contracts.
CO2	Identify and assess appropriate use cases for implementing blockchain solutions in various industries.
CO3	Develop and interact with smart contracts on popular blockchain platforms.

## The following concepts will be covered in the lab:

- Setting up a Blockchain Development Environment
- Creating and Managing Blockchain Wallets
- Implementing a Basic Blockchain Network
- Developing and Deploying Smart Contracts
- Write a smart contract using a solidity program to perform the balance transfer from contract to other accounts
- Write solidity program to perfume the exception handling.
- Mining and Proof-of-Work (PoW) Consensus Simulation
- Setup the Hyper ledger Fabric Network with 2 Organizations 1 Peer Each in the system
- Implementing Proof-of-Stake (PoS) Consensus Algorithm
- Building Decentralized Applications (DApps) on Ethereum
- Exploring Hyper ledger Fabric for Enterprise Blockchain Solutions
- Testing and Debugging Blockchain Applications

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## **Text Books:**

- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive introduction”, Princeton University Press, 2016.
- Roger Wattenhofer, “Blockchain Science: Distributed Ledger Technology”, independently Published, ISBN-10 : 1793471738, 2019.
- Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain”, Shroff/O'Reilly, 2017.
- Elaine Shi, “Foundations of Distributed Consensus and Blockchains”, (URL: <http://elaineshi.com/docs/blockchain-book.pdf>), 2020.

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## Academic Semester III

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P) /2
			L	T	P	PRE**		ESE*	Total Marks	
						Mid Sem	TA			
CSE	CSE25-M-CS201	Industrial/Research Internship	0	0	16	-	60	140	200	8
CSE	CSE25-M-CS202	Dissertation I	0	0	24	-	90	210	300	12
		<b>Total</b>	0	0	40	0	150	350	500	20

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<b>Programme</b>	<b>: M. Tech.</b>	<b>Semester</b>	<b>: III</b>
<b>Name of the Course:</b>	<b>Industrial/Research Internship</b>	<b>Course Code:</b>	<b>CSE25-M-CS201</b>
<b>Credits</b>	<b>: 8</b>	<b>No of Hours</b>	<b>: 16 Hrs./week</b>
<b>Max Marks</b>	<b>: 200</b>		

## **Course Description:**

To provide exposure to industrial environment and develop practical ability and knowledge about practical tools/techniques in order to solve real life problems.

## **Course Outcomes:**

After Completion of the course Students will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
<b>CO1</b>	Analyze the practical application of all courses in post graduate curriculum of Computer Science and Engineering.

## **Contents**

Every student has to undergo either a Summer Internship / Research project. The internship may be undergone in an Industry/Research organization. The research project shall be registered under the guidance of any faculty member in the institute. The student is required to submit a report and present the work before an evaluation committee, nominated by the Head of the Department.

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<b>Programme</b>	<b>:</b>	<b>M. Tech.</b>	<b>Semester</b>	<b>:</b>	<b>III</b>
<b>Name of the Course:</b>		<b>Dissertation - I</b>	<b>Course Code:</b>		<b>CSE25-M-CS202</b>
<b>Credits</b>	<b>:</b>	<b>12</b>	<b>No of Hours</b>	<b>:</b>	<b>24 Hrs./week</b>
<b>Max Marks</b>	<b>:</b>	<b>300</b>			

## **Course Description:**

The project work can be an investigative analysis of a technical problem in the relevant area, planning and/or design project, experimental project or application based project on any of the topics. Each project will submit project synopsis by the end of the semester. Project evaluation committee consisting of three or four faculty members specialized in the various fields shall study the feasibility of each project work before giving consent.

## **Course Outcomes:**

After Completion of the course Students will be able to:

<b>CO Number</b>	<b>Course Outcome</b>
<b>CO1</b>	Choose an area and topic of their interest and define a research Problem.
<b>CO2</b>	Can perform a significant literature survey, and recognizing problem statement
<b>CO3</b>	Can able to think of ideas to improve state-of-the-art or suggest or think of a solution to own new problem.

## **Contents**

In this part of the dissertation work, students are expected to select any major topic in the area of Computer Science and Engineering to start dissertation work. Student can opt topics based on their choice and availability of the supervisor in the Institute/Industry. Through literature review relevant to topic of dissertation should be carried out to decide Aim, Objectives, and scope of the project work. Students should select appropriate method of solution and primary results of experiments/computations should be validated against the available standard solution in the open literature.

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## Academic Semester IV

Board of Study	Subject Code	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P) /2
			L	T	P	PRE**		ESE*	Total Marks	(L+T+P)
						Mid Sem	TA			
CSE	CSE25-M-CS203	Dissertation II	0	0	40	-	150	350	500	20
		<b>Total</b>	0	0	40	0	150	350	500	20

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<b>Programme</b>	<b>: M. Tech.</b>	<b>Semester</b>	<b>: IV</b>
<b>Name of the Course:</b>	<b>Dissertation II</b>	<b>Course Code:</b>	<b>CSE25-M-CS203</b>
<b>Credits</b>	<b>: 20</b>	<b>No of Hours</b>	<b>: 40 Hrs./week</b>
<b>Max Marks</b>	<b>: 500</b>		

## Course Description:

To undertake research in an area related to the program of study so as to make significant or at least decent contribution to research. Thesis work may be an expansion on past work in the field or an improvement to the existing state-of-the-art. It might also reaffirm the results of previous work or solve new problems, or develop new theories. In short, thesis is to contribute something new to the field with proper proof and analysis

## Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	The student shall be capable of identifying a problem related to the program of study
CO2	To carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society
CO3	Implementing the solution proposed in Dissertation-I in 3rd semester idea and getting results.
CO4	To improve the existing ones or solve chosen problem efficiently
CO5	Analyze and validate solution and show why your approach works, and in what cases it works and where/when it won't!

## Guidelines:

- This will be culmination of Dissertation I of semester III. In this Stage-II the evaluation shall be done through an Open seminar with an Examiner, who shall be an expert in Dissertation research domain. Dissertation report shall be submitted with abstract in a standardized template for uniform submission.
- M.Tech dissertation should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project.
- Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation /

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publication in a conference / Journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.