

# *M.Sc. Computer Science*

## *Syllabus*

**(For the students admitted from 2019-2020 onwards)**



**Department of Computer Science  
Bishop Heber College (Autonomous)**

**Nationally Re-accredited at the 'A' by NAAC with a CGPA of 3.58 out of 4  
Recognized by UGC as "College of Excellence"  
Tiruchirappalli 620017**

# **Department of Computer Science**

## **Vision**

The Department of Computer Science is driven to provide excellent educational opportunities that accomplished the needs of our students, and empower them as an active technocrat in the top – notch IT industry and nation building.

## **Mission**

- Facilitating the quality technical education through enriched curriculum to solve the real-world problems.
- Creating the knowledge of innovative and sustainable research areas of computational science to build technological advanced society/nation.
- Educating the professional ethics, attitude, human values and career building skills for their professional and personal life.

## Programme Outcomes

Upon completion of MSc Computer Science degree, graduates will possess the following computer science skills and abilities.

**PO1.** Acquire the knowledge of mathematical foundations, algorithmic principles, computer science theory and data analytics in modelling and designing of computer-based applications.

**PO2.** Recognize, create and analyse computing problems in appropriate domains and to provide effective solution in the area of computing.

**PO3.** Design solutions for complex problems including design of experiments, design of system components or processes that meet specified needs for societal and nation development.

**PO4.** Efficient usage of modern computing IT tools and configure the software tools by understanding its limitations for design and development applications.

**PO5.** Interact effectively with teams to accomplish shared computing designs, evaluation and implementation goals.

**PO6.** Comprehend to write effective reports, design a valid documentation, make interactive presentations, ability to provide and obtain clear instructions

**PO7.** Propose the state of art in some of the areas of interest and provide solutions, resulting with a modern, user friendly tool with prolonged existence.

**PO8.** Understand professional and ethical responsibilities and analyze the impact of computing on individuals, organizations, and the society.

**PO9.** Recognize the need and have the ability to engage in independent and life-long learning in the widest context of technological change.

## Programme Specific Outcomes

**PSO1.** Demonstrate and solve complex problems in the domain of Computer Science using software engineering best practices in the core knowledge areas such as Algorithms, Networking, Web design, Cloud Computing, Internet of Things and Data analytics.

**PSO2.** Acclimatize for rapid changes in tools and technologies to function in multi-disciplinary work environment, having good interpersonal skills as a leader of a team with addition to appreciation in professional and societal responsibilities

**PSO3.** Develop the abilities and skills to engage in independent and lifelong learning, teaching, Research & Development activities in India or Abroad in areas of their choice in computer science.

**PSO4.** Possess familiarity and practical proficiency in broad area of programming concepts which provide new ideas and innovations, in order to become an Entrepreneur and Software Engineer.

## Programme Articulation Matrix

Sem	Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
<b>I</b>	P18CS101	H	H	H	H	H	H	M	M	M	H	H	H	H
	P18CS102	H	H	H	H	H	H	M	M	M	H	H	H	H
	P20CS103	H	M	H	L	L	H	H	-	-	H	H	H	H
	P18CS1:1	H	M	M	M	M	M	M	H	H	H	H	M	M
	P18CS1P1	H	H	H	H	H	H	M	M	M	H	H	H	H
	P18CS1P2	H	H	H	H	H	H	M	M	M	H	H	H	H
<b>II</b>	P18CS204	H	H	H	H	H	H	-	-	-	H	H	H	H
	P18CS205	H	H	H	H	H	H	M	M	M	H	H	H	H
	P18CS206	H	H	H	H	H	H	-	-	-	H	H	H	H
	P18CS2:1	H	H	H	H	H	H	-	-	-	H	H	H	H
	P18CS2P3	H	H	H	H	H	H	M	M	M	H	H	H	H
	P18CS2P4	H	H	H	H	H	H	M	M	M	H	H	H	H
	P19CS3:1	H	H	H	H	H	H	M	M	M	H	H	H	H
	P18VL2:1 P18VL2:2						H	H	H	H			H	H
<b>III</b>	P20CS307	H	H	H	H	H	H	M	M	M	H	H	H	H
	P20CS308	H	H	H	H	H	H	M	M	M	H	H	H	H
	P18CS309	H	H	H	H	H	H	-	-	-	H	H	H	H
	P18CS4:1	H	H	H	H	H	H	-	-	-	H	H	H	H
	P18CS3P5	H	H	H	H	H	H	M	M	M	H	H	H	H
	P18CS3P6	H	H	H	H	H	H	M	M	M	H	H	H	H
<b>IV</b>	P18CS410	H	H	H	H	H	H	-	-	-	H	H	H	H
	P18CS411	H	H	H	H	H	H	-	M	-	H	H	H	H
	P18CS5:1	H	H	H	H	H	H	-	M	-	H	H	H	H
	P18CS4PJ	H	H	H	H	H	H	M	M	M	H	H	H	H

**Programme Structure**  
**M. Sc., Computer Science**  
**(Applicable to Candidates admitted from the Academic Year 2019-2020 onwards)**

Sem	Course	Course Code	Course Title	Hours / Week	Credits	Marks		
						CIA	ESE	Total
I	Core I	P18CS101	Data and Visual Analytics	5	4	25	75	100
	Core II	P18CS102	Mobile Application Development	5	4	25	75	100
	Core III	P18CS103	Mathematical Foundation for Computer Science	5	4	25	75	100
	Elective I	P18CS1:1 P18CS1:2 P18CS1:3	1a) Managing Software Development 1b) Design and Implementation of Compilers 1c) Multimedia Systems and Design	5	4	25	75	100
	Core Practical I	P18CS1P1	Data and Visual Analytics Lab	5	3	40	60	100
	Core Practical II	P18CS1P2	Mobile Application Development Lab	5	3	40	60	100
II	Core IV	P18CS204	Machine Learning	4	4	25	75	100
	Core V	P18CS205	Real Time Web App Development	4	4	25	75	100
	Core VI	P18CS206	Cloud and Big Data Computing	4	4	25	75	100
	Elective II	P18CS2:1 P18CS2:2	2a) Network Management 2b) Web Services	4	4	25	75	100
	Core Practical III	P18CS2P3	Machine Learning Lab	4	3	40	60	100
	Core Practical IV	P18CS2P4	Real Time Web App Development Lab	4	3	40	60	100
	Elective III	P19CS3:1 P18CS3:2	3a) Block Chain and Crypto-currencies 3b) Client Server Computing	4	4	25	75	100
VLO	P18VL2:1 P18VL2:2	RI/MI	2	2	25	75	100	
III	Core VII	P18CS307	Computer Vision	5	4	25	75	100
	Core VIII	P18CS308	Text and Web Mining	5	4	25	75	100
	Core IX	P18CS309	Human Computer Interaction Design	5	4	25	75	100
	Elective IV	P18CS4:1 P18CS4:2 P18CS4:3	4a) Design and Implementation of Data Warehouse 4b) Mobile Computing 4c) Distributed Object Technology	5	4	25	75	100
	Core Practical V	P18CS3P5	Computer Vision Lab	5	3	40	60	100
	Core Practical VI	P18CS3P6	Text and Web Mining Lab	5	3	40	60	100
IV	Core X	P18CS410	Neural Networks and Deep Learning	5	4	25	75	100
	Core XI	P18CS411	Computer and Network Security	5	4	25	75	100
	Elective V	P18CS5:1 P18CS5:2 P18CS5:3	5a) Supply Chain Management 5b) Linked Open Data and Semantic Web 5c) Advanced Microprocessors And Microcontrollers	5	4	25	75	100
	Core Project	P18CS4PJ	Project	---	6	---	---	100
Total Credits					90			

## CORE I: DATA AND VISUAL ANALYTICS

**SEMESTER: I**  
**CREDITS: 4**

**CODE: P18CS101**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #.	Course Outcomes	Level	Unit Covered
CO1	Experiment with the basic Python commands	K3	I
CO2	Develop array operations using NumPy and pandas data structures	K3	II
CO3	Discover data loading operations in Python	K4	III
CO4	Evaluate data wrangling methods in Python	K5	III
CO5	Construct Plotting, Visualization, Data Aggregation and Group operations	K6	IV
CO6	Create applications in Time Series and Financial analysis	K6	V

### 2. A. SYLLABUS

#### UNIT – 1: Python – Preliminaries and Environment

Significance of python in Data Analysis -Installation and setting up Python-Discussion on the essential libraries of Python- An Example – “Counting Time Zones” -Basics of IPython: Commands.

**Usage of Command history in Python :**Interacting with Operating System using Shell commands-Software development tools used with PythonHTML Note books in IPython-Productive code development using IPython.

#### UNIT – 2 Numpy and Panda Libraries in Python

The Numpy n-d array, Basic Operations on Array-Boolean indexing, Fancy indexing, Transposing and swapping-Universal Functions: Element wise array functions-Data processing with arrays-File input and output with arrays. Ex: Random Walks.

**Introduction to Panda Data structure:** Essential panda functionalities -Computing and summarizing descriptive statistics-Handling Missing Data-Hierarchical indexing.

#### UNIT – 3 Data Loading and Wrangling in Python

Reading and writing data in text format- Exploring Binary data formats-Interacting with HTML Language Interaction with MongoDB -Merging and combining of Datasets-Reshaping and pivoting process in python.

**Data Transformations:** Different types of String Manipulations-Introduction to USDA Food Database Working with USDA Database.

#### UNIT – 4 Plotting, Visualization, Data Aggregation and Group operations

Introduction to Matplotlib API - Plotting functions used in Panda-Python visualization and Tool Eco-System-Usage of Group-by mechanics in Python-Data Aggregation-Group wise operations and transformations-Quantile and bucket analysis- Filling Missing Values

**Working Example:** Random Sampling and Permutation-Pivot tables and Cross tabulation.

#### UNIT – 5 Time series, Financial and Data Applications

Date and Time data types - Basics of Time Series-Data Ranges, Frequencies and shifting-Time Zone Handling-Period and Period Arithmetic-Resampling and Frequency Conversion-Data Mingling basics.

**Introduction to group transforms and analysis:** Signal Frontier Analysis- Future Contract Rolling

### B. TOPICS FOR SELF STUDY

- Data Analysis using Scrapy
- Data Analysis using Scikit Learn
- Visualization using Seaborn
- Visualization using Bokeh

### C. TEXT BOOK(S)

1. Wes. Mc Kinney , “*Python for Data Analysis*”, First Edition,[ O’Reilly ], 2013 (Chapters 1,2,3,4,5,6,7,8,9,10,11)

### D. REFERENCE BOOK(S)

1. Cyrille Rossant. Learning I “*Python for interactive Computing and data visualization*”, First edition [Packt].

### E. WEB LINKS

- <https://docs.scrapy.org/en/latest/intro/tutorial.html>
- <https://scikit-learn.org/stable/tutorial/index.html>
- <https://seaborn.pydata.org/tutorial.html>
- <https://hub.gke2.mybinder.org/user/bokeh-bokeh-notebooks-9jp7mbkr/notebooks/tutorial/00%20-%20Introduction%20and%20Setup.ipynb>

## 3. SPECIFIC LEARNING OUTCOMES

Unit	Course Content	Learning Outcomes	Level
	After the completion of a topic in an unit, students will be able to		
<b>I</b>	<b>Python preliminaries and Environment</b>		
1.1	Significance of Python in Data Analysis	Recognize the importance of Python in data analysis	K2
1.2	Installation and setting up Python	Experiment with the installation and setup procedure of Python using different operating systems	K3
1.3	Discussion on the essential libraries of Python	Outline the essential Python libraries	K2
1.4	An example- “Counting Time Zones”	Create an example using DataFrame to count time zones with pandas	K6
1.5	Basics of IPython: Commands	Interpret the basic IPython commands using relevant examples	K2
	<b>Usage of Command history in Python</b>		
1.6	Interacting with Operating System using Shell commands	Summarize IPython system-related Shell commands and Aliases	K2
1.7	Software development tools used with PythonHTML Notebooks in IPython	Explain different software development tools used in IPython	K2
		Execute IPython debugger commands in IPython HTML notebook	K3
1.8	Productive code development using IPython	Make use of the tips for productive code development using IPython	K3
<b>II</b>	<b>Numpy and Panda libraries in Python</b>		
2.1	The NumPy nd array: Basic operations on arrays	Develop an nd array	K3
		Analyse the basic indexing and slicing methods	K4
		Apply Boolean and Fancy Indexing methods	K3
2.2	Universal functions	Demonstrate the different unary and binary element-wise array functions	K2
2.3	Data processing using arrays	Analyze the various mathematical and statistical methods	K4
		Explain the sorting operations	K5
		Illustrate the various array set operations	K2

2.4	File input and output with arrays	Implement file input and output operations with arrays in both text and binary formats	K3
2.5	An example: Random Walks	Illustrate array operations in the simulation of random walks	K2
<b>Introduction to Panda data structure</b>			
2.6	Essential Panda functionalities	Relate the fundamental mechanics with the data contained in a Series or DataFrame	K2
		Interpret the Panda functionalities such as Reindexing, Indexing, Selection, Filtering, Sorting and Ranking	K5
2.7	Computing and summarizing descriptive statistics	Inspect the various descriptive summary statistics	K4
		Illustrate unique values, value counts and memberships	K2
2.8	Handling missing data	Assess all the missing data handling methods	K5
2.9	Hierarchical indexing	Create a Series using hierarchical indexing	K6
<b>III Data Loading and Wrangling in Python</b>			
3.1	Reading and writing data in text format	Explain read and write operations in text and delimited formats	K5
		Discuss read and write operations with HTML and XML formats	K6
3.2	Exploring binary data formats	Analyze HDF5 format for storing data	K4
3.3	Interacting with HTML language Interaction with MongoDB	Relate Python with HTML	K2
		Demonstrate data storing and loading process in MongoDB	K2
3.4	Merging and combining of datasets	Study merge operation on index	K4
		Inspect concatenation data combination	K4
3.5	Reshaping and Pivoting process in Python	Apply reshaping with hierarchical indexing	K3
		Perform pivoting process to change data format	K6
3.6	Data Transformations	Elaborate upon the various data transformation operations such as filtering and cleaning	K6
3.7	Different types of String manipulations	Interpret all the Python built-in string methods and vectorized string methods	K2
		Assess the regular expression methods	K5
3.8	Introduction to USDA Food database-Working with USDA database	Examine USDA Food database and work with it using Python functions	K4
<b>IV Plotting, Visualization, Data Aggregation and Group operations</b>			
4.1	Introduction to matplotlib API	Understand about figures, subplots, colors, markers, line styles, ticks, labels, legends and annotations in matplotlib	K2
4.2	Plotting functions used in pandas	Build line plots, bar plots, histograms, density plots and scatter plots	K3
4.3	Python visualization and Tool Eco system	Compare Python visualization tools such as Chaco and Mayavi	K4
4.4	Usage of GroupBy mechanics in Python	Perform the various grouping operations in Python	K3
4.5	Data Aggregation	Implement data aggregation methods such as count, sum, mean, median, std, var, min, max, prod, first and last	K3
4.6	Group-wise operations and transformations	Experiment with transform and apply methods	K3
		Perform quantile and bucket analysis	K3
		Solve an example for filling missing values with group-specific values	K3



4.7	Working example: Random sampling and Permutation	Construct an example for Random sampling and Permutation	K6
4.8	Pivot tables and cross tabulation	Analyze the usage of pivot tables	K4
		Compute group frequencies using cross tabulation	K3
<b>V</b>	<b>Time series, Financial and Data applications</b>		
5.1	Date and Time data types	Examine datetime module types	K4
5.2	Basics of Time Series	Utilize Time Series basics such as Indexing, Selection and Subsetting in data analysis	K3
5.3	Date Ranges, Frequencies and Shifting	Generate Date Ranges	K6
		Create Frequencies and Data Offsets	K6
		Elaborate on Shifting (Leading and Lagging) data	K6
5.4	Time zone handling	Operate with Time zone-aware Timestamp objects	K3
5.5	Period and period arithmetic	Analyze Period frequencies	K4
		Change Timestamps to Periods	K6
		Create a PeriodIndex from arrays	K6
5.6	Resampling and frequency conversion	Apply Upsampling, Downsampling and Interpolation in Time series data	K3
5.7	Data Munging topics	Infer about Time series and cross section alignment	K4
		Build operations with Time Series of different frequencies	K3
		Interpret Splicing operation with data sources	K5
5.8	Introduction to group transforms and analysis	Analyze group factor exposures	K4
		Compare Decile and Quartile analysis	K4
5.9	Signal Frontier Analysis and Future Contract Rolling	Design an example application for Signal Frontier Analysis	K6
		Create an example application for Future Contract Rolling	K6

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS100	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H		L		L								
CO2	H	M	M	M	H	H							
CO3	H	H	H	H	M	L	M		H	M	H	L	
CO4	H	H	M	L	H			H	M	H	M	M	H
CO5	H			H	H		H	H	H	H	H	M	H
CO6	H		H	H	H		H	H	H	H	H	H	H

#### 5. ASSESSMENT METHODS

##### DIRECT:

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT:

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. Ramah Sivakumar**

## CORE II: MOBILE APPLICATION DEVELOPMENT

**SEMESTER: I**  
**CREDITS: 4**

**CODE: P18CS102**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Create android project from XML Layout	K3	I
CO2	Debug android app and create UI fragment	K3	II
CO3	Design and develop user interfaces for the Android platform	K4	III
CO4	Design mobile apps with audio play back	K5	IV
CO5	Create database and communicate with mobile application	K6	V
CO6	Apply Java programming concepts to Android application development	K6	V

### 2. A. SYLLABUS

#### UNIT I: Fundamentals mobile app

Mobile app basics - Creating an Android project - Navigating in Eclipse - Laying out the user Interface - From Layout XML to view objects - Wiring up widgets - Android build tools - Creating a new class - Adding an Icon - Logging the activity life cycle.

#### UNIT II: Mobile app manipulation

Debugging Android apps - The DDMS perspective - Android specific debugging - Setting up a second activity - Compatibility and Android programming - The need for UI flexibility - Hosting a UI fragment - Creating a UI fragment - Adding a UI fragment to the fragment manager - The reason all our activities will use fragments.

#### UNIT III: User Interfaces with layouts and widgets

XML layout attributes - Using the Graphical layout tool - Creating a list fragment - An abstract activity for hosting a fragment - Starting an activity from a fragment - Fragment arguments - Creating crime pager activity - Creating a dialog fragment - Passing data between two fragments - More dialogs.

#### UNIT IV: Audio playback using media player

Adding resources - Creating hello moon fragment - Audio playback - Rotation and retained fragments - Options menus - Saving and loading data in criminal Intent - Using the camera API - Taking a picture - Using implicit Intents - Styles and Includes.

#### UNIT V: Mobile app back ground services

Creating an Intent service - Controlling your alarm - Waking up on Boot - Filtering foreground notifications - Setting up the Drag and Draw project - Creating a custom view - Tracking the device's location - Local Databases with SQLite - Adding the maps API to Run tracker - Showing the user's location on a map.

### B. TOPICS FOR SELF STUDY

- Fultter Basics Concepts
- Development of Mobile Apps using Flutter )
- Kotlin Programming – Basics
- Kotlin – Mobile Apps Development

### C. TEXT BOOK(S):

1. Android Programming “*THE BIG NERD RANCH GUIDE*”, BILL PHILLIPS and BRAIN HARDY, Pearson Technology Group, First edition, September 2013, ISBN-13 978-0321804334

### D. REFERENCE BOOK(S):

1. Donn Felker and Joshua Dobbs, “*Android Application Development – For Dummies*”, Wiley Publishing Inc., 2011.

### E. WEB LINKS

- <https://flutter.dev/docs/reference/tutorials>
- <https://kotlinlang.org/docs/reference/android-overview.html>

### 3. SPECIFIC LEARNING OUTCOMES

Unit	Course Contents	Learning Outcomes	Level
<b>I</b>	<b>Fundamentals of mobile app</b>		
1.1	Mobile app basics	Basic knowledge of mobile technologies	K2
1.2	Creating an Android project	Develop an Android project	K3
1.3	Navigating in Eclipse	Identify location and navigate to a resource	K3
1.4	Laying out the user Interface	Create consistency and use common UI elements	K3
1.5	From Layout XML to view objects	Create View and ViewGroup objects	K4
1.6	Wiring up widgets	Ready to wire up your button widgets	K4
1.7	Android build tools	Identify the component of the Android SDK require for building Android apps	K3
1.8	Creating a new class	Launch Android studio, create a new project	K5
1.9	Adding an Icon	Free icons of Add in various design styles for web, mobile, and graphic design projects	K5
1.10	Logging the activity life cycle	To navigate transitions between stages of the activity lifecycle	K6
<b>II</b>	<b>Mobile app manipulation</b>		
2.1	Debugging Android apps	Select a device to debug your app	K4
2.2	The DDMS perspective	Identify the services provided by DDMS	K4
2.3	Android specific debugging	Examine the concepts of debugging	K5
2.4	Setting up a second activity	Design and develop a second activity	K5
2.5	Compatibility and Android programming	Explain the technical details of the Android platform	K6
2.6	The need for UI flexibility	Create user interfaces which users find easy to use	K3
2.7	Hosting a UI fragment	Fragments contributes a portion of UI to the host activity	K4
2.8	Creating a UI fragment	Design and develop a UI fragment	K3
2.9	Adding a UI fragment to the fragment manager	Static and dynamic way of adding UI fragment to the android activity	K4
2.10	The reason all our activities will use fragments	Reuse a fragments in multiple activities	K6
<b>III</b>	<b>User Interfaces with layouts and widgets</b>		
3.1	XML layout attributes	Identify the properties of XML layout	K3
3.2	Using the Graphical layout tool	Demonstrate the android graphical layout tool	K5
3.3	Creating a list fragment	Design and develop a list fragment	K4
3.4	An abstract activity for hosting a fragment	Identify generic fragment-hosting layout	K5
3.5	Starting an activity from a fragment	Demonstrate MainActivity class with a placeholder fragment	K5
	Fragment arguments	Elaborate the interaction with fragments	K6
3.6	Creating crime pager activity	Develop a crime pager activity	K4

3.7	Creating a dialog fragment	Design a dialog fragment	K4
3.8	Passing data between two fragments	Create a UI related data in the life cycle of activities and fragments.	K5
3.9	More dialogs	Users to take an action before they can proceed	K5
<b>IV</b>	<b>Audio playback using media player</b>		
4.1	Adding resources	Creating and using resource files in Android	K4
4.2	Creating hello moon fragment	Develop a hello moon fragment	K4
4.3	Audio playback	Design a Media player class	K4
4.4	Rotation and retained fragments	Activity with retained fragment is rotated	K5
4.5	Options menus	Primary collection of menu items for an activity	K3
4.6	Saving and loading data in criminal Intent	Find a convenient place to save the data	K4
4.7	Using the camera API	Control the camera hardware directly using the framework APIs	K5
4.8	Taking a picture	The camera app shoots both still images and video.	K4
4.9	Using implicit Intents	Classify all components which are registered for the specific action	K6
4.10	Styles and Includes	A style resource defines the format and look for a UI	K5
<b>V</b>	<b>Mobile app back ground services</b>		
5.1	Creating an Intent service	Develop an Intent service	K4
5.2	Controlling your alarm	Identify the components of control activity	K4
5.3	Waking up on Boot	Start activity on wake up/sleep	K5
5.4	Filtering foreground notifications	Obtain a foreground process without a permanent user notification	
5.5	Setting up the Drag and Draw project	Drag a project up and down to sort your projects	K5
5.6	Creating a custom view	Design and develop a custom view activity	K4
5.7	Tracking the device's location	Identify the device location	K5
5.8	Local Databases with SQLite	To provide local data storage for individual applications and devices	K6
5.9	Adding the maps API to Run tracker	Classify the various API for run tracker	K6
5.10	Showing the user's location on a map	Use the location component to show the Users current location on the map	K5

## 5. MAPPING SCHEME (CO, PO & PSO)

P18CS102	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	M	M
CO3	H	H	H	M	M		M		H	M	M	H	M
CO4	H	H	H	M	M		M		H	H	M	H	M
CO5	H	H	M	H	M		M		H	L	M	H	M
CO6	H	M	H	H	H	M	H	M	H	H	M	M	M

## **5. ASSESSMENT METHODS**

### **DIRECT:**

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

### **INDIRECT:**

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. B. Karthikeyan**

## CORE III: MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

**SEMESTER: I**  
**CREDITS: 4**

**CODE: P18CS103**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Examine and Evaluate the Logical propositions and predicates	K4	I
CO2	Solve the counting problems using Combinatorics and Probability	K5	II
CO3	Demonstrate the concepts of Sets and Relations for solving the complex problems	K4	III
CO4	Apply the knowledge on Graphs and Trees to real world applications.	K5	IV
CO5	Design the Languages using Grammars.	K5	V
CO6	Construct the different types of Machine using Languages and Grammars for computability.	K6	V

### 2. A. SYLLABUS

#### Unit I : The foundations: Logic and Proofs

Propositions – Conditional statements – Converse contrapositive and inverse – Bi Conditionals and Implicit Bi conditionals – Truth tables – Operators – Translating English statements – system specification – Boolean searches and Logic puzzles – Logical equivalence and De Morgans law – Constructing new logical equivalence – Propositional satisfiability – Predicates and Quantifiers – Nested Quantifiers – Valid arguments in propositional logic – Rules of inference – Using rules of inference to build arguments – Rules of inference for quantified statements.

#### Unit II : Basic Counting and Probability

The basics of Countings – The Pigeonhole Principle – Permutations – Combinations – Generalized Permutation and Combinations – Generating Permutation and Combinations – Applications of Recurrence Relations – Divide and Conquer Algorithms and Recurrence Relations – Generating functions – Inclusion - Exclusion.

#### Unit III: Relations

Relations and their properties – n-ary Relations and their applications – Representing relations using Matrices – Representing relations using digraphs – Closures – Paths in directed graphs and transitive closures – Warshall's Algorithm – Equivalence Relations – Equivalence classes – Partial Orderings

#### Unit IV : Graphs and Trees

Graphs and Graph models – Graph terminology and special types of graphs – Representing Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton paths – Shortest path problems – Planar Graphs – Introduction and applications of Trees – Tree Traversal – Spanning Trees and Minimum Spanning Trees.

#### Unit V : Modelling Computation

Languages and Grammars – Types of Grammars and Definitions – Derivation trees – Bacus Normal Form(BNF) – Finite state machines with output – Finite state machines with No output – Constructing NFA – Constructing DFA – Definition of Turing Machine and Turing Machine to recognize sets – Computing functions with Turing Machine and types.

### B. TOPICS FOR SELF STUDY

- Catalan Number
- Equivalence Relations
- Functions
- Advanced Counting

### C. TEXT BOOK(S)

1.Kenneth H. Rosen, “ Discrete Mathematics and Its Applications”, The Mc Graw- Hill companies, 7<sup>th</sup> edition, 2012.

### D. REFERENCES BOOK(S)

1.Mahima Ranjan Adhikari and Avishek Adhikari, “*Basic Modern Algebra with Applications*”, Springer 2014.

2.Kolman, Busby and Ross, “*Discrete Mathematical Structures*”, 6<sup>th</sup> edition, PHI.2009.

### E. Web Links

- <https://nptel.ac.in/courses/106/106/106106183/>
- [http://www.cs.ucr.edu/~acald013/public/tmp/sol\\_dmaia\\_rosen.pdf](http://www.cs.ucr.edu/~acald013/public/tmp/sol_dmaia_rosen.pdf)
- <https://www.archerimagine.com/articles/100daysofdiscretemath/100Days-of-DiscreteMath-log-file.html>
- <https://freevideolectures.com/course/3517/discrete-mathematics-i>

### 3. SPECIFIC LEARNING OUTCOMES

Unit	Course Contents	Learning Outcomes	Levels
<b>I</b>	<b>THE FOUNDATION: LOGIC AND PROOFS</b>		
1.1	<b>Propositions</b>	1. Define a Proposition. 2. Explain Propositions. 3. Construct Propositions for the statements. 4. Analyze whether the proposition is a tautology or not. 5. Evaluate whether the given statement is a proposition or not.	K5
1.2	<b>Operators</b>	1. Recall different types of operators. 2. Explain operators using truth table. 3. Construct truth table using operators.	K3
1.3	<b>Logical Equivalence and De Morgan’s Law</b>	1. Define and apply De Morgans’s Law. 2. Evaluate and analyse whether the given statements are equivalent or not. 3. Explain De Morgan’s Law.	K5
1.4	<b>Predicates and Quantifiers</b>	1. Define Predicates and Quantifiers.	K1
1.5	<b>Rules of Inference</b>	1. List the rules of Inference. 2. Illustrate and Identify whether the given statement is valid or not.	K3
<b>II</b>	<b>COUNTING AND PROBABILITY</b>		
2.1	<b>The basics of Countings</b>	1. Define, Demonstrate and Apply sum rule and product rule.	K3
2.2	<b>Permutations</b>	1. Define and Demonstrate Permutations. 2. Apply Permutation rules.	K3
2.3	<b>Combinations</b>	1. Define and Demonstrate Combinations. 2. Apply Combination rules	K3
2.4	<b>Applications of Recurrence Relations – Divide and Conquer Algorithms and Recurrence Relations</b>	1. Apply the recurrence relations. 2. Elicit the Divide and Conquer Algorithms	K5 K5
2.5	<b>Generating functions – Inclusion - Exclusion</b>	1. Explain concepts of Generating functions 2. Apply Inclusion and exclusion on sets	K4
<b>III</b>	<b>RELATIONS</b>		

3.1	<b>Relations and their properties</b>	1. Define Relation. 2.Explain the properties of Relation. 3. Apply composite of Relation.	K3
3.2	<b>Representing Relations</b>	1.Define Relations. 2.Explain the types of Representation of Relation and solve problems.	K3
3.3	<b>Closures-paths in directed graphs and transitive closures</b>	1.Define, Explain and Apply Closure properties of Relation.	K3
3.4	<b>Warshall's Algorithm - Equivalence Relations – Equivalence classes</b>	1.Explain Warshall's Algorithm. 2. Apply and verify the Equivalence Relations	K5
3.5	<b>Partial Orderings</b>	1.Define and Explain Equivalence Relation and Equivalence Classes.	K5
<b>IV</b>	<b>GRAPHS &amp; TREES</b>		
4.1	<b>Graphs- Graph terminology and special types of graphs</b>	1.Define Graphs. 2.Explain various types of Graphs. 3.Solve problems.	K3
4.2	<b>Representing Graphs and Graph Isomorphism</b>	1.Define Graphs. 2.Explain how to construct a Graph. 3.Illustrate Graph Representations.	K3
4.3	<b>Connectivity-Euler and Hamilton paths-shortest path problems</b>	1. Define and Explain Euler and Hamilton paths.	K2
4.4	<b>Planar Graphs</b>	1.Define,Explain Planar Graphs. 2.Apply planarity rule. 3.Construct a Planar graph. 4.Prove whether the given Graph is Planar or not.	K5
4.5	<b>Introduction and Applications of Trees- Tree Traversal – Spanning Trees and Minimum Spanning Trees</b>	1. Define Trees. 2.Explain the properties of Trees. 3. Construct Trees.	K3
<b>V</b>	<b>MODELLING COMPUTATION</b>		
5.1	<b>Languages and Grammars</b>	1.Define Grammars and Languages. 2.Explain and Compare various types of Grammars. 3.Evaluate and find which type of grammar. 4.Construct Grammars for the given Languages.	K6
5.2	<b>Derivation Trees</b>	1.What is Derivation tree? 2.Explain the types of Derivation Trees. 3.Apply the properties. 4.Construct Derivation Trees. 5.Discuss on Trees.	K6
5.3	<b>Bacus Normal Form</b>	1.Recall Bacus Normal Form. 2.Explain BNF	K2
5.4	<b>Finite State Machines</b>	1.What is Finite State Machine? 2.Explain Finite State Automata? 3.Construct NFA and DFA.	K3
5.5	<b>Turing Machine-Turing Machine to recognize sets – Computing functions with Turing Machine and types</b>	1.Define Turing Machine. 2.Explain Turing Machine.	K2



#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS103	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		H		H	H	H	H	
CO2	H	H	H	H	M		H		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	H		H		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	M

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. J. Persis Jessintha**

## ELECTIVE 1A: MANAGING SOFTWARE DEVELOPMENT

**SEMESTER: I**  
**CREDITS: 4**

**CODE: P18CS1:1**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Apply the process to be followed in the software development life-cycle models.	K3	I
CO2	Use Agile process models for collaborative decision making.	K3	II
CO3	Analyze & design the software models using unified modeling language (UML).	K4	II
CO4	Implement quality management techniques & different types of metrics in software development.	K5	III
CO5	Schedule projects and manage risks using risk management strategies.	K5	IV
CO6	Apply project management concepts and techniques to an IT project.	K6	V

### 2. A. SYLLABUS

#### Unit 1: Software, Software Engineering & The Software Process

**Introduction to Software:** The nature of Software – The changing nature of Software. **Software Engineering:** Defining the discipline – The software process – Software Engineering practice – Software development myths. **Agile development:** What is Agility? – Agility and the cost of change – What is an Agile process? – Extreme programming – Other Agile process models.

#### Unit 2: Modeling

**Understanding requirements:** Requirements Engineering – Establishing the groundwork – Eliciting requirements – Developing Use Cases – Building the analysis model – Negotiating requirements. **Requirements modelling for Scenario-based methods:** Requirements analysis – Scenario-based modelling – UML models that support the Use Case.

#### Unit 3: Quality Management

**Quality concepts:** What is Quality? – Software Quality – The software quality dilemma – Achieving software quality. **Review techniques:** Cost impact of software defects – Review metrics and their use – Reviews: A formality spectrum – Informal reviews – Formal technical reviews – Post-Mortem evaluations. **Software Quality Assurance:** Elements of Software Quality Assurance – SQA Tasks, Goals and Metrics – Statistical Software Quality Assurance – Software reliability – The ISO 9000 Quality standards – The SQA plan.

#### Unit 4: Managing Software Projects – I

**Project Management concepts:** The Management spectrum – People – The Product – The Process – The Project – The W<sup>5</sup>HH principle. **Process and Project Metrics:** Metrics in the process and project domains – Software measurement – Metrics for software quality – Metrics for small organizations **Estimation for software projects:** Observations on estimation – The Project planning process – Software scope and feasibility – Resources – Software Project Estimation – Decomposition techniques – The Make/Buy decision.

#### Unit 5: Managing Software Projects – II

**Project Scheduling:** Basic concepts – Project scheduling – Defining a task set for the software project – Defining a task network – Scheduling – Earned Value Analysis. **Risk Management:** Reactive versus Proactive Risk Strategies – Software Risks – Risk Identification – Risk Projection – Risk Refinement – Risk Mitigation, Monitoring and Management – The RMMM plan.

## B. TOPIC FOR SELF STUDY

- Selenium
- Selenium Web Driver
- Manual testing
- Automated Testing using Selenium  
(Web Reference: <https://freevideolectures.com/course/3625/testing-with-selenium>)

## C. TEXT BOOK(S)

1. Roger S. Pressman, Bruce R. Maxim, *“Software Engineering, A practitioner’s Approach”*, Eighth edition, McGraw Hill, 2015.

## D. REFERENCE BOOK(S)

1. Tsui and Karam (T&K), *“Essentials of Software Engineering”*, Third Edition, Jones and Barrlet Publishing, 2013.

## E. WEB LINKS

- [https://www.tutorialspoint.com/software\\_engineering/index.htm](https://www.tutorialspoint.com/software_engineering/index.htm)
- <https://builtin.com/software-engineering-perspectives/how-to-become-a-software-engineer>
- <https://www.geeksforgeeks.org/software-engineering/>
- <https://www.udemy.com/courses/development/software-engineering>

## 3. SPECIFIC LEARNING OUTCOMES

Unit	Course Content	Learning Outcomes	Level
<b>I</b>	<b>Software, Software Engineering &amp; The Software Process</b>		
1.1	The nature of Software, The changing nature of Software	Understand the nature of Software	K2
1.2	Defining the discipline	Define software engineering	K3
1.3	The software process	Explain the software development process	K5
1.4	Software Engineering practice –	Apply engineering practices to software development, and typically handle the overall system design of the software application	K3
1.5	Software development myths.	Challenge Software development myths in the name of improving business efficiency.	K4
1.6	What is Agility?	Define agility	K2
1.7	Agility and the cost of change	Examine the Agile Cost of Change Curve	K4
1.8	What is an Agile process?	Use agile process to reduce the cost of change	K3
1.9	Extreme programming	Explain extreme programming framework to produce higher quality software.	K3
1.10	Other Agile process models	Adopt Agile process models like Adaptive Software Development, Dynamic Systems Development Method, Scrum, and Crystal	K4
<b>II</b>	<b>Modeling</b>		
2.1	Requirements Engineering - Establishing the groundwork, Eliciting requirements	Perform groundwork with what the customer desires, analyse the need, and assess feasibility, negotiate a reasonable solution, specify the solution clearly, validate the specifications and manage the requirements.	K5
2.2	Developing Use Cases.	Develop use cases during system analysis to identify, clarify, and categorize system requirements.	K4
2.3	Building the analysis model	Build the analysis model to define information, behaviour and functions of the system.	K4

2.4	Negotiating requirements	Manage the stakeholders of the software project who disagrees on the requirements, by using requirements negotiation methods to avoid rework and extra costs in the software development.	K5
2.5	Requirements analysis	Focus on the tasks that determine the needs or conditions to meet the project, taking account of the possibly conflicting requirements of the various stakeholders, analyze, document, validate and manage software requirements.	K5
2.6	Scenario-based modelling	Identify the possible use cases for the system and produce the use case diagrams, to which all the other stages of requirements modeling refer.	K4
2.7	UML models that support the Use Case	Visualize the design of the system by UML diagrams.	K4
<b>III</b>	<b>Quality Management</b>		
3.1	What is Quality?	Define quality in terms of software.	K2
3.2	Software Quality.	Measure how well software is designed (quality of design), and how well the software conforms to that design (quality of conformance)	K5
3.3	The software quality dilemma	Understand software quality dilemma	K2
3.4	Achieving software quality	Implement success factors such as Software Engineering Methods, Project Management Techniques, Quality Control, Quality Assurance to achieve software quality.	K5
	Cost impact of software defects	Implement the elements of software quality assurance to avoid cost impact of software defects.	K4
3.5	Review metrics and their use	Make a technical assessment of the work product created during the software engineering process.	K5
3.6	Reviews: A formality spectrum	Conduct a meeting by technical people for technical people for software quality assurance.	K5
3.7	Informal reviews, Formal technical reviews	Examine the work product by Informal reviews, and Formal technical reviews.	K4
3.8	Post-Mortem evaluations	Perform post-mortem evaluations at the conclusion of a project, to determine and analyse elements of the project that were successful or unsuccessful.	K5
3.9	<b>Software Quality Assurance: Elements of Software Quality Assurance</b>	Explain the elements of Software Quality Assurance	K2
3.10	SQA Tasks, Goals and Metrics	Undertake SQA Tasks, Goals and Metrics to achieve software quality.	K3
3.11	Statistical Software Quality Assurance	Collect information on all defects, find the causes of the defects, Move to provide fixes for the process.	K4
3.12	Software reliability	Calculate mean-time-to-failure, mean-time-to-repair, mean-time-between-failure and Software availability to assure reliability.	K4
3.13	The ISO 9000 Quality standards	Familiar with The ISO 9000 Quality standards.	K2
3.15	The SQA plan	Create SQA plan for the developing software.	K6

<b>IV Managing Software Projects – I</b>			
4.1	Project Management concepts	Explain Project Management concepts such as planning of project, deciding scope of software product, estimation of cost in various terms, scheduling of tasks and events, and resource management	K5
4.2	The Management spectrum	Describe the management of a software project and how to make a project successful	K2
4.3	People	Apply People Management Capability Maturity Model (PM-CMM), to undertake increasingly complex applications by helping to attract, grow, motivate, deploy, and retain the talent needed to improve the software development capability.	K3
4.4	The Product	Identify the product objectives and scope that should be established, alternative solutions that should be considered, and also technical and management constraints.	K4
4.5	The Process	Create the framework from which a comprehensive plan for software development can be established.	K6
4.6	The Project	Undertake the managerial issues which include all and everything of the total development process and take steps to avoid project failure.	K3
4.7	The W <sup>5</sup> HH principle	Raise series of questions related to project such as why, what, where, when, who, how and how much, to help project managers more efficiently manage software projects.	K5
4.8	<b>Process and Project Metrics:</b> Metrics in the process and project domains	Recognize Metrics in the process and project domains	K3
4.9	Software measurement	Categorize the Software measurement metrics.	K3
4.10	Metrics for software quality	Explain the metrics for software quality and identify its categories.	K2
4.11	Metrics for small organizations	Choose simple metrics that provide value to the organization and don't require a lot of effort to collect for small organizations.	K5
4.12	<b>Estimation for software projects:</b> Observations on estimation	Explain the four basic steps in Software Project Estimation.	K2
4.12	The Project planning process	Produce a schedule, identify and assess software risks, and negotiate commitments.	K4
4.14	Software scope and feasibility	Find out the actual operations that are going to be carried out by the software and its plus points and limitations and estimate resources needed.	K4
4.15	Resources	Identify the Project resources which include people, capital, and/or material goods required for the successful execution and completion of a project.	K4
4.16	Software Project Estimation.	Estimate of the size of software and predict the effort and time which will be needed to build the project	K5

4.17	Decomposition techniques	Compute Size, Effort and Cost estimation in a stepwise manner by breaking down a Project into major Functions or related Software Engineering Activities.	K5
4.18	The Make/Buy decision	Make make-or-buy decisions based on the important values such as the volume, the fixed cost of making, per-unit direct cost when making and per-unit cost when buying.	K4
<b>V</b>	<b>Managing Software Projects – II</b>		
5.1	<b>Project Scheduling:</b> Basic concepts	Explain the basic concepts of project scheduling.	K2
5.2	Project scheduling	Schedule the Project with the mechanism to communicate what tasks need to get done and which organizational resources will be allocated to complete those tasks in what timeframe and so on.	K6
5.3	Defining a task set for the software project	Create a Task Set for the Software Project which includes collection of software engineering work tasks, milestones, and deliverables that must be accomplished to complete a particular project.	K6
5.4	Defining a task network	Create a graphic representation of the task flow for a project that depicts major software engineering tasks.	K6
5.5	Scheduling	Schedule the project that includes the planned start and finish date, duration, and resources assigned to each activity.	K6
5.6	Earned Value Analysis	Compute Earned Value Analysis (EVA) to measure the project's progress at any given point in time, forecast its completion date and final cost, and analyse variances in the schedule and budget as the project proceeds.	K5
5.7	<b>Risk Management:</b> Reactive versus Proactive Risk Strategies.	Discriminate risk strategies.	K3
5.8	Software	Define software	K2
5.9	Risks – Risk Identification	Identify the potential risks that could prevent the program, enterprise, or investment from achieving its objectives.	K4
5.10	Risk Projection	Estimate the impact of the risk on the project and the product.	K4
5.11	Risk Refinement	Conduct the process of restating the risks as a set of more detailed risks that will be easier to mitigate, monitor, and manage	K5
5.12	Risk Mitigation,	Accomplish effectiveness throughout the project by Risk mitigation planning, Risk mitigation implementation and Risk progress monitoring.	K5
5.13	Monitoring	Monitor to track, review, and regulate the progress and performance of the project.	K4
5.14	Management	Ensure that software products and software engineering services are delivered efficiently, effectively, and to the benefit of stakeholders	K4
5.15	The RMMM plan	Analyse the risk which is related to the project and prepare RMMM plan.	K4

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS1:!	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H		L		L								
CO2	H	M	M	M	H	H							
CO3	H	H	H	H	M	L	M		H	M	H	L	
CO4	H	H	M	L	H			H	M	H	M	M	H
CO5	H			H	H		H	H	H	H	H	M	H
CO6	H		H	H	H		H	H	H	H	H	H	H

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Prof. C. Sathish Kumar**

**P18CS1:!**

## CORE PRACTICAL I: DATA AND VISUAL ANALYTICS LAB

**SEMESTER: I**  
**CREDITS: 3**

**CODE: P18CS1P1**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level
CO1	Experiment with the basic Python commands	K3
CO2	Develop array operations using NumPy and pandas data structures	K3
CO3	Discover data loading operations in Python	K4
CO4	Evaluate data wrangling methods in Python	K5
CO5	Construct Plotting, Visualization, Data Aggregation and Group operations	K6
CO6	Create applications in Time Series and Financial analysis	K6

### 2. SYLLABUS

- 1a). Practice using the Python interpreter / Jupyter Notebook as a calculator:
  - i. The volume of a sphere with radius  $r$  is  $\frac{4}{3}\pi r^3$ . What is the volume of a sphere with radius 5?
  - ii. Suppose cover price of a book is INR 24.95, but a bookstore offers a 40% discount. Shipping costs INR 3.00 for the first copy and 75 Paise for each additional copy. What is the total wholesale cost for 60 copies?
  - iii. If I leave my house at 6:52 am and run 1 km at an easy pace (8:15 per km), then 3 km at tempo (7:12 per km) and 1 km at easy pace again, what time do I get home for breakfast?
- 1b). Develop an application in Python that repeatedly reads numbers until the user enters “done”. Once “done” is entered, print out the total, count, and average of the numbers. If the user enters anything other than a number, detect their mistake using try and except and print an error message and skip to the next number.
- 2a). Develop a Python function front\_x(). Given a list of strings, return a list with the strings in sorted order, except group all the strings that begin with 'x' first. Eg. ['mix', 'xyz', 'apple', 'xanadu', 'aardvark'] yields ['xanadu', 'xyz', 'aardvark', 'apple', 'mix']. Hint: this can be done by making 2 lists and sorting each of them before combining them.
- 2b). Develop a Python function sort\_last(). Given a list of non-empty tuples, return a list sorted in increasing order by the last element in each tuple. E.g. [(1, 7), (1, 3), (3, 4, 5), (2, 2)] yields [(2, 2), (1, 3), (3, 4, 5), (1, 7)]. Hint: use a custom key= function to extract the last element from each tuple.
- 2c). Develop a Python function remove\_adjacent(). Given a list of numbers, return a list where all adjacent same elements have been reduced to a single element, so [1, 2, 2, 3] returns [1, 2, 3]. List [2, 2, 3, 3, 3] returns [2, 3]. List [ ] returns [ ]. You may create a new list or modify the passed in list.
- 3a). Develop an application in Python to open the file (say, romeo.txt) and read it line by line. For each line, split the line into words using the split function. For each word, check to see if the word is already in a list. If the word is not in the list, add it to the list. When the program completes, sort and print the resulting words in alphabetical order.
- 3b). Develop an application in Python to read through the email data and when you find line that starts with “From”, you will split the line into words using the split function. We are interested in who sent the message, which is the second word on the From line: From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008. You will parse the From line and print out the second word for each From line, then you will also count the number of From (not From:) lines and print out a count at the end.
- 4a). [NumPy]: Read a CSV file with 10 numbers in each row (5 rows), and store them in numpy array, print the values and maximum and minimum value of the array. Also save the same array in another file in TSV format
- 4b). [NumPy]: Create a small dataset of floating point numbers with 10 rows and 5 columns in ARFF format with proper header values. Read the files and store the numbers in numpy array. Reshape the array to 5 rows and 10 columns using numpy. Print the following properties of the array for



both before and after reshaping. Print number of dimensions, shape of the array, size of the array, data type of the array and item size of the array.

- 5a). [NumPy]: Create a 3\*3 matrix A [1 1 1, 2 2 2, 3 3 3] and B [4 4 4, 5 5 5, 6 6 6]. Print the following values. 1. Add A and B, 2. Subtract A from B, 3. Element wise multiplication A and B, 4. Divide B by A. 5. Square root of B, 6. Square of A.
- 5b). [NumPy]: Create a 4\*4 matrix A [1 1 1 1, 2 2 2 2, 3 3 3 3, 4 4 4 4] in numpy. Print the following matrix operations using built-in numpy functions. 1. Determinant of the matrix, 2. Inverse of a matrix, 3. Transpose of the matrix A, 4. Scalar multiplication with number, 5. Matrix multiplication with matrix B [2 2 2 2], 6. Dot product between rows of A and matrix B [2 2 2 2]. 7. Determinant of the matrix A.
- 6a). [NumPy]: Create a 3\*3 matrix A [ 4 5 6, 1 2 3, 7 8 9]. Flat the matrix into an array and print the sorted array in ascending and descending order using numpy functions. Print the mean, standard deviation and variance of the sorted array.
- 6b). [Pandas]: Create an array of 10 records of cities and their population and write them to a CSV file using pandas. Read the same CSV and store it in pandas dataframe. Print the values inside the dataframe and print information about the pandas dataframe variable using pandas builtin function. Print the first 3 and last 4 records using pandas functions. Print the indices of the cities with maximum and minimum population.
- 7a). [Pandas]: Create an array of 10 records of people names and their ages and write them to a TXT file using pandas. Read the same TXT file and store it in pandas variable. Give the column names as "Name" and "Age" for pandas variable. Print the description of the Name and Age using pandas functions. Sort and print the records in ascending order based on "Name". Sort and print the records in descending order based on "Age".
- 7b). [Pandas]: Read the data using pandas. Transpose the dataframe and save it to another file in JSON format. Read the JSON file and print the transposed dataframe values.
- 8a). [Pandas]: Read the text "You cannot end a sentence with because because because is a conjunction" from a text file. Find the unique words and their frequency from the text and store it in pandas variable with 2 columns "Words" and "Frequency". Do the following using pandas builtin functions, 1). Number of rows, 2). Sum of "Frequency", 3). Mean "Frequency", 4). standard deviation of "Frequency", 5). Upper case of "Words", 6). Lower case of "Words".
- 8b). [Pandas]: Generate a dataframe in pandas with two columns "Name", "Mark 1". Insert 5 records to the dataframe. Print the dataframe values. Insert one more column "Mark 2" with randomly generated integer numbers between range 50 to 100. Print the dataframe values after insertion. Compute the total of Mark 1 and Mark 2 and insert to dataframe as "Total" and print the dataframe. Compute average from "Total" and insert it as "Avg" and remove "Total" from dataframe. Print the dataframe values after deletion.
- 9a). [Matplotlib]: Create array of 20 numbers representing sin function using numpy, similarly arrays for cos function and tan function. Plot the sin and cos functions as green and red colored lines using matplotlib. Give the labels to the lines and the axes in the plot.
- 9b). [Matplotlib]: Plot a histogram plot with bars in red color. Present the the mean and standard deviation of the values in the graph.
- 10a). [Matplotlib]: Populate Pandas Dataframe with two columns "Date" and "Temperature". Generate dates 01.01.2017 to 31.01.2017 and generate random temperature from 20 to 40 degrees for each day. Plot the data using matplotlib and mark the maximum and minimum temperature of the week in the line graph. Give proper data labels and legend titles.
- 10b). [Matplotlib]: Create a dataset of 20 records with 4 columns for persons' "Name", "Age", "Height", "Weight". The height and weight can be linearly increasing as the age increases. Plot the dataset in Scatterplot using matplotlib with x axis for "age", y-axis for "height" and the size of the datapoints representing the "weight" of each person. Give proper labels to the axes in the plot.
- 10c). [Matplotlib]: Generate a dataset of 5 rows representing students, each row with 10 columns representing marks in 10 exams. Compute the standard deviation of each student's marks and plot the individual students in box plot using matplotlib representing the range of marks and standard deviation.

### 3. SPECIFIC LEARNING OUTCOMES

S.No.	Exercise List	Level
1a)	Practice using the Python interpreter / Jupyter Notebook as a calculator:	
	i). The volume of a sphere with radius $r$ is $\frac{4}{3}\pi r^3$ . What is the volume of a sphere with radius 5?	K1
	ii). Suppose cover price of a book is INR 24.95, but a bookstore offers a 40% discount. Shipping costs INR 3.00 for the first copy and 75 Paise for each additional copy. What is the total wholesale cost for 60 copies?	K1
	iii). If I leave my house at 6:52 am and run 1 km at an easy pace (8:15 per km), then 3 km at tempo (7:12 per km) and 1 km at easy pace again, what time do I get home for breakfast?	K1
1b)	Develop an application in Python that repeatedly reads numbers until the user enters “done”. Once “done” is entered, print out the total, count, and average of the numbers. If the user enters anything other than a number, detect their mistake using try and except and print an error message and skip to the next number	K3
2a)	Develop a Python function front_x(). Given a list of strings, return a list with the strings in sorted order, except group all the strings that begin with 'x' first. Eg. ['mix', 'xyz', 'apple', 'xanadu', 'aardvark'] yields ['xanadu', 'xyz', 'aardvark', 'apple', 'mix']. Hint: this can be done by making 2 lists and sorting each of them before combining them	K3
2b)	Develop a Python function sort_last(). Given a list of non-empty tuples, return a list sorted in increasing order by the last element in each tuple. E.g. [(1, 7), (1, 3), (3, 4, 5), (2, 2)] yields [(2, 2), (1, 3), (3, 4, 5), (1, 7)]. Hint: use a custom key= function to extract the last element form each tuple	K3
2c)	Develop a Python function remove_adjacent(). Given a list of numbers, return a list where all adjacent same elements have been reduced to a single element, so [1, 2, 2, 3] returns [1, 2, 3]. List [2, 2, 3, 3, 3] returns [2, 3]. List [ ] returns [ ]. You may create a new list or modify the passed in list	K3
3a)	Develop an application in Python to open the file (say, romeo.txt) and read it line by line. For each line, split the line into words using the split function. For each word, check to see if the word is already in a list. If the word is not in the list, add it to the list. When the program completes, sort and print the resulting words in alphabetical order	K6
3b)	Develop an application in Python to read through the email data and when you find line that starts with “From”, you will split the line into words using the split function. We are interested in who sent the message, which is the second word on the From line: From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008. You will parse the From line and print out the second word for each From line, then you will also count the number of From (not From:) lines and print out a count at the end	K6
4a)	[NumPy]: Read a CSV file with 10 numbers in each row (5 rows), and store them in numpy array, print the values and maximum and minimum value of the array. Also save the same array in another file in TSV format	K2
4b)	[NumPy]: Create a small dataset of floating point numbers with 10 rows and 5 columns in ARFF format with proper header values. Read the files and store the numbers in numpy array. Reshape the array to 5 rows and 10 columns using numpy. Print the following properties of the array for both before and after reshaping. Print number of dimensions, shape of the array, size of the array, data type of the array and item size of the array	K6
5a)	[NumPy]: Create a 3*3 matrix A [1 1 1, 2 2 2, 3 3 3] and B [4 4 4, 5 5 5, 6 6 6] Print the following values. 1. Add A and B, 2. Subtract A from B, 3. Element wise multiplication A and B, 4. Divide B by A, 5. Square root of B, 6. Square of A	K3
5b)	[NumPy]: Create a 4*4 matrix A [1 1 1 1, 2 2 2 2, 3 3 3 3, 4 4 4 4] in numpy. Print the following matrix operations using built-in numpy functions. 1. Determinant of the matrix, 2. Inverse of a matrix, 3. Transpose of the matrix A, 4. Scalar multiplication	K3

	with number, 5. Matrix multiplication with matrix B [2 2 2 2], 6. Dot product between rows of A and matrix B [2 2 2 2]. 7. Determinant of the matrix A	
6a)	[NumPy]: Create a 3*3 matrix A [ 4 5 6, 1 2 3, 7 8 9]. Flat the matrix into an array and print the sorted array in ascending and descending order using numpy functions. Print the mean, standard deviation and variance of the sorted array	K3
6b)	[Pandas]: Create an array of 10 records of cities and their population and write them to a CSV file using pandas. Read the same CSV and store it in pandas dataframe. Print the values inside the dataframe and print information about the pandas dataframe variable using pandas builtin function. Print the first 3 and last 4 records using pandas functions. Print the indices of the cities with maximum and minimum population	K6
7a)	[Pandas]: Create an array of 10 records of people names and their ages and write them to a TXT file using pandas. Read the same TXT file and store it in pandas variable. Give the column names as “Name” and “Age” for pandas variable. Print the description of the Name and Age using pandas functions. Sort and print the records in ascending order based on “Name”. Sort and print the records in descending order based on “Age”	K6
7b)	[Pandas]: Read the data using pandas. Transpose the dataframe and save it to another file in JSON format. Read the JSON file and print the transposed dataframe values	K2
8a)	[Pandas]: Read the text “You cannot end a sentence with because because because is a conjunction” from a text file. Find the unique words and their frequency from the text and store it in pandas variable with 2 columns “Words” and “Frequency”. Do the following using pandas built-in functions, 1). Number of rows, 2). Sum of “Frequency”, 3). Mean “Frequency”, 4). standard deviation of “Frequency”, 5). Upper case of “Words”, 6). Lower case of “Words”	K4
8b)	[Pandas]: Generate a dataframe in pandas with two columns “Name”, “Mark 1”. Insert 5 records to the dataframe. Print the dataframe values. Insert one more column “Mark 2” with randomly generated integer numbers between range 50 to 100. Print the dataframe values after insertion. Compute the total of Mark 1 and Mark 2 and insert to dataframe as “Total” and print the dataframe. Compute average from “Total” and insert it as “Avg” and remove “Total” from dataframe. Print the dataframe values after deletion	K6
9a)	[Matplotlib]: Create array of 20 numbers representing sin function using numpy, similarly arrays for cos function and tan function. Plot the sin and cos functions as green and red colored lines using matplotlib. Give the labels to the lines and the axes in the plot	K6
9b)	[Matplotlib]: Plot a histogram plot with bars in red color. Present the the mean and standard deviation of the values in the graph	K3
10a)	[Matplotlib]: Populate Pandas Dataframe with two columns “Date” and “Temperature”. Generate dates 01.01.2017 to 31.01.2017 and generate random temperature from 20 to 40 degrees for each day. Plot the data using matplotlib and mark the maximum and minimum temperature of the week in the line graph. Give proper data labels and legend titles	K3, K6
10b)	[Matplotlib]: Create a dataset of 20 records with 4 columns for persons’ “Name”, “Age”, “Height”, “Weight”. The height and weight can be linearly increasing as the age increases. Plot the dataset in Scatterplot using matplotlib with x axis for “age”, y-axis for “height” and the size of the datapoints representing the “weight” of each person. Give proper labels to the axes in the plo	K3, K6
10c)	[Matplotlib]: Generate a dataset of 5 rows representing students, each row with 10 columns representing marks in 10 exams. Compute the standard deviation of each student’s marks and plot the individual students in box plot using matplotlib representing the range of marks and standard deviation	K4, K6

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS1P1	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L		L								
CO2	H	M	M	M	H	H							
CO3	H	H	H	H	M	L	M		H	M	H	L	
CO4	H	H	M	L	H	H		H	M	H	M	M	H
CO5	H	H		H	H		H	H	H	H	H	M	H
CO6	H		H	H	H		H	H	H	H	H	H	H

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. Ramah Sivakumar**

## MOBILE APPLICATION DEVELOPMENT LAB

**SEMESTER: I**  
**HOURS/WEEK : 5**

**CODE: P18CS1P2**  
**CREDITS : 3**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Ex. No.
CO1	Design the Mobile app for general purposes with preliminary concepts	K6	1
CO2	Design the Mobile App with Database connectivity	K6	2-6
CO3	Develop the app with Graphical Primitives	K5	7
CO4	Develop the app with multithread concepts	K5	8
CO5	Create the app GUI components	K6	9-10
CO6	Create the Mobile apps with Background designs	K6	9-10

### 2. SYLLABUS

1. Develop a native calculator mobile app for arithmetic operations
2. Develop an application that makes use of student database for end semester mark list
3. Design a mobile app for hotel menu card using list view activity
4. Develop a mobile app for expense tracker monitoring system of monthly budget
5. Implement a mobile app for digital diary for creating alert message for our day to day activity
6. Develop a mobile app for bus ticket reservation system
7. Develop an application that draws basic graphical primitives ( Line, Circle, Rectangle, ellipse) on the screen
8. Implement an application to change the back ground activity using multi threading
9. Develop an application that writes data to the SD card
10. Design a mobile app for marriage Invitation that uses GUI components, Font and colors

### 3. SPECIFIC LEARNING OUTCOMES

S.No.	Exercise List	Level
1	Develop a native calculator mobile app for arithmetic operations	K6
2	Develop an application that makes use of student database for end semester mark list	K6
3	Design a mobile app for hotel menu card using list view activity	K6
4	Develop a mobile app for expense tracker monitoring system of monthly budget	K6
5	Implement a mobile app for digital diary for creating alert message for our day to day activity	K6
6	Develop a mobile app for bus ticket reservation system	K6
7	Develop an application that draws basic graphical primitives ( Line, Circle, Rectangle, ellipse) on the screen	K6
8	Implement an application to change the back ground activity using multi threading	K6
9	Develop an application that writes data to the SD card	K6
10	Design a mobile app for marriage Invitation that uses GUI components, Font and colors	K6

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS1P2	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H		H					H		M	
CO2	H	M	M	M	H	H							
CO3	H	H	H	H	M	L	M		H	M	H	L	
CO4	H	H	M	L	H	H		H	M	H	M	M	H
CO5	H	H		H	H		H	H	H	H	H	M	H
CO6	H		H	H	H		H	H	H	H	H	H	H

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. B. Karthikeyan**

## CORE IV: MACHINE LEARNING

**SEMESTER: II**  
**CREDITS: 4**

**CODE: P18CS204**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Elaborate the basics of building machine learning systems, to implement the perceptron learning model and the convergence.	K6	I
CO2	Demonstrate the sci-kit learning method and SVM for solving linear and non-linear problems.	K4	II
CO3	Apply the Dimensionality Reduction and model evaluation for different data set	K5	III
CO4	Compare the different cluster analysis algorithm	K4	IV
CO5	Develop the neural network for the various dataset to classify them	K6	IV
CO6	Design the web application using Scikit FLASH	K6	V

### 2. A. SYLLABUS

#### UNIT – 1 Machine Learning Algorithm - Training

Three different types of Machine Learning Algorithms-Predictions with supervised learning-Predicting with Class labels-Regression for predicting continuous outcomes-Introduction to basic terminology and notations used in Machine Learning

**Building Machine Learning Systems:** Preprocessing, Training, Selection and Evaluation Of Model-Installing Python Package, Artificial Neurons: A glimpse into the early history of Machine Learning-Implementation of Perceptron learning algorithm in Python-Adaptive linear neurons and the Convergence of Learning-Implementation of Adaptive linear neuron in Python.

#### UNIT – 2 Machine Learning Classifier

Training a perceptron via Scikit-Learn-Modeling class probabilities through logistic regression-Support vector machine for maximum margin classification-Solving Non-Linear problems using a kernel SVM

**Learning Decision Tree-**A Lazy learning Algorithms – K-Nearest Neighbors -Data Preprocessing: Dealing with missed and Categorical data-Data Preprocessing: Dealing with Data set Testing and Training-Selection of Meaningful features-Selection of meaningful sparse solutions with L1 regularization

#### UNIT – 3 Dimensionality Reduction and Model Evaluation

Unsupervised Dimensionality reduction using P.C.A [Principal Component Analysis]-Supervised data compression via Linear Discriminant analysis-Using Kernel principal component analysis for N-L-M-Streamlining workflows with pipeline-Using K-Fold cross-validation to assess model performance

**Debugging algorithms with learning and validation-**Different performance evaluation metrics-Implementing simple majority vote classifier-Tuning the ensemble classifier-Weak Learners Vs Adaptive Boosting.

#### UNIT – 4 Cluster Analysis

Grouping objects by similarity using K-Means-Organizing Clusters as a hierarchical tree. -Training Artificial Neural Network for image recognition-Modeling Complex functions with Artificial Neural Network-Classifying Hand Written Digits

Training an Artificial Neural Network-Developing initiation for Back Propagation-Debugging Neural Network with Gradient Checking-Convergence in Neural Network-Architecture of Neural Network

#### UNIT – 5 Embedding a Machine Learning Model into a Web Application

Serializing fitted Scikit-learn estimators-Setting up SQL-LITE database for data storage- Developing a Web application with FLASK-First FLASK Web application-Form Validation and Rendering-Turning the movie classifier into a web application-Deploying the web application to a public server- Updating the movie review Classifier

## B. TOPICS FOR SELF STUDY

- Data Input and Preprocessing with Tensorflow
- Machine Learning Model Building
- Prediction with Tensorflow
- Monitoring and evaluating models using Tensorboard

## C. TEXT BOOKS

1. Sebastian Raschka, Python Machine Learning, First Edition, [PACKT] , 2015.
2. Luis Pedro Coelho, Willi Richert, Building Machine Learning System with Python, Second Edition [PACKT], 2015
3. Gavin Hakeking, Mastering Machine Learning with Sci-kit Learn, Second Edition [PACKT], 2017

## D. REFERENCE BOOKS

1. Joel Grus, Data Science from Scratch, First Edition, O'Reilly, 2015
2. Gavin Hakeking, Mastering machine learning with scikit-learn, First Edition, [PACKT] , 2014

## E. WEB LINKS

- <https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs44/>
- <https://www.coursera.org/learn/machine-learning>
- <https://developers.google.com/machine-learning/crash-course>
- <https://www.udemy.com/topic/machine-learning/>

## 3. SPECIFIC LEARNING OUTCOMES

Unit	Course Content	Learning Outcomes	Level
<b>I</b>	<b>Machine Learning Algorithm – Training</b>		
1.1	Types of Machine Learning Algorithms	Description of basic types of Machine learning algorithms.	K1
1.2	Making Predictions with supervised learning	Demonstrate the Supervised learning method to make predictions.	K2
1.3	Predictions of Class Labels	Apply the principles of Predicting Class labels and their meanings.	K3
1.4	Continuous outcome prediction using Regression Learning	Experiment with the outcome of Regression Learning method.	K3
1.5	Terminologies and Notations used in Machine Learning	Label the basic symbols and terms used in Machine Learning	K1
1.6	Building Machine Learning Systems	Categorize the Machine Learning system	K4
1.7	Installation of Python Package	Apply the installation tasks of a Python Package.	K3
1.8	Implementing Perceptron model in Python	Building Perceptron Model using Python.	K6
1.9	Convergence of Learning	Formulate the Convergence process in Learning	K6
1.10	Implementation of Adaptive linear neuron in Python	Interpret the implementation of Adaptive Linear neuron in Python	K5
<b>II</b>	<b>Machine Learning Classifier</b>		
2.1	Training a perceptron via Scikit-Learn	Make use of Scikit-Learn in training of a Perceptron	K3



2.2	Probabilistic Modeling through Logistic Regression	Evaluate Probabilistic Modeling through Logistic Regression	K5
2.3	Support vector machine for maximum margin classification	Analysis of margin classification using Support Vector Machine	K4
2.4	Solving Non-Linear problems using a kernel SVM	Experiment the problem of solving Non-Linear Problems using SVM.	K3
2.5	Learning Decision Tree	Classification of Learning of Decision Tree	K2
2.6	K-Nearest Neighbor – A Lazy learning Algorithms	Examine the functions of KNN Algorithm	K4
2.7	Data Pre processing: Dealing with missed and Categorical data	Organize the ways to handling missed and Categorical data	K3
2.8	Data Preprocessing: Dealing with Data set Testing and Training	Contrast training and testing the datasets	K4
2.9	Selection of Meaningful features	Interpret the selection of Features	K5
2.10	Selection of meaningful sparse solutions with L1 regularization	Identify L1 regularization in sparse solutions.	K3
<b>III</b>	<b>Dimensionality Reduction and Model Evaluation</b>		
3.1	Unsupervised Dimensionality reduction using Principal Component Analysis	Applying Unsupervised Dimensionality reduction using PCA	K3
3.2	Supervised data compression via Linear Discriminant analysis	Compare and contrast LDA and Supervised data Compression	K4
3.3	Using Kernel principal component analysis for N-L-M	Define the effects of Kernel PCA over N-L-M	K1
3.4	Stream Lining workflows with pipeline	Demonstrate the Stream lining with the pipeline.	K2
3.5	Using K-Fold cross-validation to assess model performance	Modeling performance using K-Fold Validation	K3
3.6	Debugging algorithms with learning and validation	Extend debugging in learning and validation	K2
3.7	Different performance evaluation metrics	List the performance evaluation metrics	K1
3.8	Implementing simple majority vote classifier	Compile the working principle of simple majority vote classifier	K6
3.9	Tuning the ensemble classifier	Measure classifier tuning method	K5
3.10	Weak Learners Vs Adaptive Boosting	Compare and contrast Weak learners and Adaptive Boosting	K5
<b>IV</b>	<b>Cluster Analysis</b>		
4.1	Grouping objects by similarity using K-Means	Relate the grouping of objects by K-Means	K1
4.2	Organizing Clusters as a hierarchical tree.	Relating the organization of clusters as a hierarchical tree.	K4
4.3	Training Artificial Neural Network for image recognition	Experiment with Neural network to recognize an image	K3
4.4	Modeling Complex functions with Artificial Neural Network	Demonstrate the complex function modelling with ANN	K2
4.5	Classifying Hand Written Digits	Organize the Handwritten symbols using classification	K3
4.6	Training an Artificial Neural Network	Recall on training ANN	K1
4.7	Developing initiation for Back Propagation	Categorize the initiation process in Back propagation	K4

4.8	Debugging Neural Network with Gradient Checking	Utilize Gradient check in NN for debugging.	K3
4.9	Convergence in Neural Network	Spell the convergence process in NN	K1
4.10	Architecture of Neural Network	Define the Architecture of NN	K1
V	<b>Embedding a Machine Learning Model into a Web Application</b>		
5.1	Serializing fitted Scikit-learn estimators	Organizing the Scikit-learn estimators	K3
5.2	Setting up SQL-LITE database for data storage	Illustrate the SQL-LITE database storage set up	K2
5.3	Developing a Web application with FLASK	Build an Web application with FLASK	K3
5.4	First FLASK Web application	Development of First FLASK Application	K3
5.5	Form Validation and Rendering	Demonstrate the process of Validation and Rendering in Forms	K2
5.6	Turning the movie classifier into a web application	Experiment with the movie classifier in web application	K2
5.7	Deploying the web application to a public server	Justify the web application deployment	K5
5.8	Updating the movie review Classifier	Examine the updation in movie review classifier	K4

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS204	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	M	M
CO3	H	H	H	M	M		M		H	M	M	H	M
CO4	H	H	H	M	M		M		H	H	M	H	M
CO5	H	H	M	H	M		M		H	L	M	H	M
CO6	H	M	H	H	H	M	H	M	H	H	M	M	M

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. B. Satheesh Kumar**

## CORE IV: REAL TIME WEB APP DEVELOPMENT

**SEMESTER: II**  
**CREDITS: 4**

**CODE: P18CS205**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Design and Develop the Web Applications using Node.js.	K5	I
CO2	Construct Web Applications using Express.js	K4	II
CO3	Understand MongoDB and its applicability.	K2	III
CO4	Illustrate the features of MongooseDB.	K4	IV
CO5	Build Web Applications using AngularJS.	K6	V
CO6	Develop various server side web applications using tools, middleware technologies and use them to develop web applications	K5	V

### 2. A. SYLLABUS

#### Unit I : Web App Development using Node.js

Three-tier web application development – Introducing NPM: Using NPM – Introduction to Node.js : JavaScript event-driven programming, Node.js event-driven programming – JavaScript closures – Node modules : CommonJS modules , Node.js core modules – Node modules : Node.js third-party modules, Node.js File modules, Node.js folder modules – Developing Node.js web applications: Meet the Connect module – Developing Node.js web applications: Connect middleware – Developing Node.js web applications: Understanding the order of Connect middleware – Developing Node.js web applications: Mounting Connect middleware.

#### Unit II : Built Web App using Express.js and MongoDB

Introduction to Express, Creating your First Express application – The application, request, and response objects, External middleware – Implementing the MVC pattern: Application folder structure, Horizontal folder structure, Vertical folder structure, File-naming conventions, Implementing the horizontal folder structure – Configuring an Express application: Environment configuration files – Rendering views: Configuring the view system, Rendering EJS views, Serving static files, Configuring sessions – MongoDB: Introduction to NoSQL, Introducing MongoDB – Key features of MongoDB: The BSON format, MongoDB ad hoc queries, MongoDB indexing, MongoDB replica set, MongoDB sharding – MongoDB shell, MongoDB databases, MongoDB collections – MongoDB CRUD operations: Creating a new document, Creating a document using insert(), Creating a document using update(), Creating a document using save(), Reading documents, Finding all the collection documents, Using an equality statement – MongoDB CRUD operations: Using query operators, Building AND/OR queries, Updating existing documents, Updating documents using update(), Updating documents using save(), Deleting documents, Deleting all documents.

#### Unit III : Understand the features of Mongoose

Introducing Mongoose: Connecting to MongoDB – Understanding Mongoose schemas: Creating the user schema and model, Registering the User model – Understanding Mongoose schemas: Creating new users using save(), Finding multiple user Documents using Find(), Advanced querying using Find(), Reading a single user document using FindOne()– Understanding Mongoose schemas: Updating an existing user document, Deleting an existing user document – Extending your Mongoose schema: Defining default values, Using schema modifiers – Extending your Mongoose schema: Predefined modifiers, Custom setter modifiers, Custom getter modifiers – Extending your Mongoose schema: Adding virtual attributes, Optimizing queries using indexes – Defining custom model methods: Defining custom static methods, Defining custom instance methods – Model validation: Predefined validators, Custom validators – Using Mongoose middleware: Using pre middleware, Using post middleware, Using Mongoose DBRef:

## Unit IV : Key concepts of AngularJS

Introducing AngularJS – Key concepts of AngularJS: The core module of AngularJS, The angular global object – AngularJS modules: Application modules, External modules, Third-party modules – Two-way data binding, Dependency injection: Dependency injection in AngularJS – AngularJS directives: Core directives, Custom directives – Bootstrapping an AngularJS application: Automatic bootstrap, Manual bootstrap – Structuring an AngularJS application, Bootstrapping your AngularJS application, AngularJS MVC entities: AngularJS views, AngularJS controllers and scopes – AngularJS routing: Installing the ngRoute module, Configuring the URL scheme, AngularJS application routes – AngularJS services: AngularJS prebundled services, Creating AngularJS services, Using AngularJS services – Managing AngularJS authentication: Rendering the user object, Adding the Authentication service, Using the Authentication service.

## Unit V : Creating a MEAN CRUD Module

Introducing CRUD modules, Setting up the Express components: Creating the Mongoose model, Setting up the Express controller – Setting up the Express components: The error handling method of the Express controller, The create() method of the Express controller, The list() method of the Express controller, The read() middleware of the Express controller – Setting up the Express components: The update() method of the Express controller, The delete method of the Express controller – Setting up the Express components: Implementing an authentication middleware, Implementing an authorization middleware – Setting up the Express components: Wiring the Express routes, Configuring the Express application – Introducing the ngResource module: Installing the ngResource module, Using the \$resource service – Implementing the AngularJS MVC module: Creating the AngularJS module service, Setting up the AngularJS module controller – Implementing the AngularJS MVC module: The create() method of the AngularJS controller, The Find() and FindOne() methods of the AngularJS controller – Implementing the AngularJS MVC module: The update() method of the AngularJS controller, The delete() method of the AngularJS controller, Implementing the AngularJS module views, The create-article view, The view-article view, The edit-article view, – Implementing the AngularJS MVC module: The list-articles view, Wiring the AngularJS module routes – Finalizing your module implementation.

### B. TOPICS FOR SELF STUDY

- ReactJS – ReactJS Properties
- Class Components & Life Cycle of Methods
- State in ReactJS
- User Inputs, Forms and Events in ReactJS

### C. TEXT BOOK(S)

1. Amos Q Vaviv, “*MEAN Web Development*”, Packt Publishing Ltd, Sep 2014.

### D. REFERENCES BOOK(S)

1. Shane A Stillwell. “*Mastering MEAN web app development*”: Expert fullstack Javascript, PACKT Publishers, 2016. ISBN 9781785882159

### E. WEB LINKS

- <https://www.udemy.com/course/react-learn-react-js-from-scratch-with-hands-on-projects/>
- <https://www.coursera.org/courses?query=angularjs>
- <https://www.codecademy.com/learn/learn-angularjs>

## 3. SPECIFIC LEARNING OUTCOMES

Unit	Topics	Unit Learning Outcomes	Level
I	<b>Web App Development using Node.js</b>		
1.1	Three-tier web application development	Describing three-tier web application architecture	K2
1.2	Introducing NPM	Annotating NPM and its applications.	K2
1.3	Using NPM		

1.4	Introduction to Node.js	Develop JavaScript and Node.js along with event driven programming.	K6
1.5	JavaScript event-driven programming		
1.6	Node.js event-driven programming		
1.7	JavaScript closures		
1.8	CommonJS modules	Illustrating different types of JS modules	K4
1.9	Node.js core modules		
1.10	Node.js third-party modules		
1.11	Node.js File modules		
1.12	Node.js folder modules		
1.13	Developing Node.js web applications	Creating Node.js code to connect module .	K6
1.14	Meet the Connect module		
1.15	Connect middleware	Construct Node.js web application program to link middleware	K4
1.16	Understanding the order of Connect middleware	Execute Node.js web applications to understanding the order and mounting for connect the middleware.	K6
1.17	Mounting Connect middleware		
<b>II</b>	<b>Built Web App using Express.js and MongoDB</b>		
2.1	Introduction to Express	Recalling Express.js	K2
2.2	Creating your First Express application	Executing simple Express.js application.	K3
2.3	The application, request, and response objects		
2.4	External middleware	Describe the external middleware.	K2
2.5	Implementing the MVC pattern	Demonstrating the MVC pattern using three tier architecture	K3
2.6	Application folder structure	Distinguish different folder structures in express.js	K2
2.7	Horizontal folder structure		
2.8	Vertical folder structure		
2.9	File	Converting file name in express.js application.	K2
2.10	naming conventions		
2.11	Implementing the horizontal folder structure	Applying the horizontal folder structure in express.js.	K3
2.12	Configuring an Express application	Develop an express application and configuration.	K6
2.13	Environment configuration files		
2.14	Rendering views	Illustrating the various views in the express js	K4
2.15	Configuring the view system		
2.16	Rendering EJS views		
2.17	Serving static files	Accessing static files in express.js	K5
2.18	Configuring sessions	Identifying session in express.js application.	K5
2.19	Introduction to NoSQL	Describing NoSQL database.	K2
2.20	Introducing MongoDB	Explaining MangoDB.	K2
2.21	Key features of MongoDB	Expressing the various MangoDB features of BSON format, indexing, replica set, shell.	K5
2.22	The BSON format		
2.23	MongoDB ad hoc queries		
2.24	MongoDB indexing		
2.25	MongoDB replica set		
2.26	MongoDB sharding		
2.27	MongoDB shell		
2.28	MongoDB databases		
2.29	MongoDB collections		
2.30	MongoDB CRUD operations		
2.31	Creating a document using save()	Making data modification in MangoDB involve creating, updating or deleting data.	K6
2.32	Reading documents		

2.33	Finding all the collection documents		
2.34	Using an equality statement	Justifying specific condition in MangoDB using query operator such as AND and OR .	K5
2.35	MongoDB CRUD operations		
2.36	Using query operators		
2.37	Building AND/OR queries		
2.38	Updating existing documents	Examine the update(),save(),and delete() documents using MangoDB	K3
2.39	Updating documents using update()		
2.40	Updating documents using save()		
2.41	Deleting documents		
2.42	Deleting all documents		
<b>III</b>	<b>Understand the features of Mongoose</b>		
3.1	Introducing Mongoose	Recallthe basic concept of Mongoose .	K2
3.2	Connecting to MongoDB	Building a MongoDB connection	K6
3.3	Understanding Mongoose schemas	Identifying the structure of schema in Mongoose	K2
3.4	Creating the user schema and model	Developing the model based on user specific schema	K6
3.5	Registering the User model	Extending the user model with registration	K2
3.6	Creating new users using save()	Execute save() by creating authorised user	K3
3.7	Finding multiple user Documents using Find()	Apply find() in query to select multiple user documents in Mongoose	K3
3.8	Advanced querying using Find()		
3.9	Reading a single user document using FindOne()	Using FindOne() , to read a single user document	K3
3.10	Updating an existing user document	Examineupdated and deleted documents in Mongoose	K3
3.11	Deleting an existing user document		
3.12	Extending your Mongoose schema	Apply default values in Mongoose schema level.	K3
3.13	Defining default values		
3.14	Using schema modifiers	Computing Mongoose predefined getter and setter modifier	K3
3.15	Predefined modifiers		
3.16	Custom setter modifiers		
3.17	Custom getter modifiers		
3.18	Extending your Mongoose schema	Createvirtual attributes to extendMongooseDB.	K6
3.19	Adding virtual attributes		
3.20	Optimizing queries using indexes	Executequery with index	K3
3.21	Defining custom model methods	Explaining custom model, static and instance methods .	K2
3.22	Defining custom static methods		
3.23	Defining custom instance methods		
3.24	Model validation	Differentiate model validation with predefined and custom built-in validators .	K2
3.25	Predefined validators		
3.26	Custom validators		
3.27	Using Mongoose middleware	IllustratingMongoose and pre middleware	K4
3.28	Using pre middleware		
<b>IV</b>	<b>Key concepts of AngularJS</b>		
4.1	Introducing AngularJS	Describing AngularJS concept	K2
4.2	Key concepts of AngularJS	Explaining the basic concepts of AngularJS and its modules, global object.	K2
4.3	The core module of AngularJS		
4.4	The angular global object		
4.5	AngularJS modules	Classifying various modules of AngularJS .	K4
4.6	Application modules		
4.7	External modules		

4.8	Third-party modules		
4.9	Two-way data binding		
4.10	Dependency injection	Discussing dependency injection in	K2
4.11	Dependency injection in AngularJS	AngularJS	
4.12	AngularJSdirectives	Exemplifying built-in directives in	K2
4.13	Core directives	AngularJS.	
4.14	Custom directives	Creating a custom directive	K6
4.15	Bootstrapping an AngularJS application	Developing an AngularJS application by bootstrapping.	K6
4.16	Automatic bootstrap	Distinguish Automatic bootstrap with	K2
4.17	Manual bootstrap	manual bootstrap in AngularJS	
4.18	Structuring an AngularJS application	Constructing an AngularJS application	K3
4.19	AngularJS MVC entities	Explaining MVC framework.	K4
4.20	AngularJS views	Illustrating the views of MVC framework.	K4
4.21	AngularJS controllers and scopes	Describing AngularJS controllers and it understand scopes.	K2
4.22	AngularJS routing	Explain routing in AngularJS.	K2
4.23	Installing the ngRoute module	Preparing ngRoute module	K3
4.24	Configuring the URL scheme	Constructing the URL scheme in AngularJS application.	K3
4.25	AngularJS application routes	Create single page application using routes in AngularJS .	K6
4.26	AngularJS services	Demonstrate theprebundled services in	K2
4.27	AngularJSprebundled services	AngularJS.	
4.28	Creating AngularJS services	Develop a code for AngularJS services	K6
4.29	Using AngularJS services	Applying AngularJS services	K3
4.30	Managing AngularJS authentication	Adapting AngularJS authentication.	K6
4.31	Rendering the user object		
4.32	Adding the Authentication service	Managing theAuthentication services in	K6
4.33	Using the Authentication service.	AngularJS authentication.	
V	<b>Creating a MEAN CRUD Module</b>		
5.1	Introducing CRUD modules	Describe the basic building blocks of CRUD modules	K2
5.2	Setting up the Express components	Linkthe Express components for CRUD modules.	K4
5.3	Creating the Mongoose model	Develop the Mongoose model using CRUD modules.	K6
5.4	Setting up the Express controller	Recommend the Express controller set-up in the CRUD modules.	K4
5.5	The error handling method of the Express controller	Prioritize the error handling methods of theExpress controller.	K4
5.6	The create() method of the Express controller	Apply create(), list(), read(), update(), delete() methods of the Express controller in AngularJS.	K3
5.7	The list() method of the Express controller		
5.8	The read() middleware of the Express controller		
5.1	The update() method of the Express controller		
5.2	The delete method of the Express controller		
5.3	Implementing an authentication middleware		
5.4	Implementing an authorization middleware		

5.5	Wiring the Express routes	Examine the Express routes.	K3
5.6	Configuring the Express application	Organize the Express application.	K4
5.7	Introducing the ngResource module	Describe ngResource module	K2
5.8	Installing the ngResource module	Order the steps in ngResource module.	K4
5.9	Using the \$resource service	Create a RESTfulAPI using \$resource service	K6
5.10	Implementing the AngularJS MVC module	Applying the AngularJS MVC module	K3
5.11	Creating the AngularJS module service	Develop a module as a service AngularJS	K6
5.12	Setting up the AngularJS module controller	Prepare an AngularJS module controller set up.	K3
5.13	Implementing the AngularJS MVC module	Running the AngularJS MVC module	K3
5.14	The create() method of the AngularJS controller	Apply create(), find (), findone(), update(), delete() methods in the AngularJS controller.	K6
5.15	The Find() and FindOne() methods of the AngularJS controller		
5.16	The update() method of the AngularJS controller		
5.17	The delete() method of the AngularJS controller		
5.18	Implementing the AngularJS module views	Examine multiple views in the AngularJS module.	K3
5.19	The create-article view	Choosing appropriate views in the AngularJS MVC module	K3
5.20	The view-article view		
5.21	The edit-article view		
5.22	The list-articles view		
5.23	Wiring the AngularJS module routes	Develop a code using AngularJS module routes.	K6
5.24	Finalizing your module implementation	Concluded the AngularJS module implementation procedure.	K5

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS205	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	L	H	H	M	L	M	-	M	H	M	M	M
CO2	M	L	H	M	M	-	H	M	H	H	H	M	H
CO3	H	M	M	L	L	L	-	-	-	M	L	-	-
CO4	H	M	L	L	-	-	-	-	-	L	L	M	L
CO5	M	M	H	H	H	H	H	M	H	M	H	M	H
CO6	M	H	H	H	M	M	M	H	H	H	H	M	H

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. M. P. Anuradha**



## CORE VI: CLOUD AND BIG DATA COMPUTING

**SEMESTER: II**  
**CREDITS: 4**

**CODE: P18CS206**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Analyze the need, value, cost, and merits of cloud for the given problem	K4	I
CO2	Understand and apply cloud architecture and services	K2	II
CO3	Apply load balancing and virtualization techniques	K3	III
CO4	Explain characteristics and use cases and applications of Big Data	K2	IV
CO5	Develop MapReduce operation using Hadoop	K6	V
CO6	Design the applications in Hadoop	K6	V

### 2. A. SYLLABUS

#### Unit I : Cloud Computing Fundamentals

CLOUD COMPUTING: Definition, Types. – Cloud Deployment models – Service Delivery Models – Characteristics of Cloud Computing: Basic characteristics. – Characteristics of Cloud – Computing: Essential characteristics – Benefits of cloud computing. – Disadvantages of cloud computing. – Measuring the cloud value: Measuring cloud computing cost. – Measuring the cloud value: Computing the total cost of ownership. – Specifying Service Level Agreements (SLA).

#### Unit II : Cloud Architecture and Services

CLOUD COMPUTING STACK: Composability, Infrastructure – CLOUD COMPUTING STACK: Platform, Virtual Appliances – CLOUD COMPUTING STACK: Communication Protocols and Applications. – Defining Infrastructure as a Service (IaaS) – Defining Platform as a Service (PaaS) – Defining Software as a Service (SaaS) and its characteristics. – Open SaaS and Service Oriented Architecture (SOA) – Defining Identity as a Service (IDaaS), – IDaaS interoperability – Defining Compliance as a Service (CaaS).

#### Unit III : Abstraction and Virtualization

Using virtualization technologies. – Load Balancing and Virtualization. –Advanced Load Balancing. – Understanding Hypervisors. – Virtual machine types. – Using Amazon Web Services: Understanding Amazon Web Services. – Amazon Web Service Components and Services – Working with the Elastic Compute Cloud (EC2): Creating an account and instance on EC2. – Working with Amazon Storage Systems: Amazon Simple Storage System (S3). – Working with Amazon Storage Systems: Amazon Elastic Block Store (EBS) and Cloud front.

#### Unit IV : Big Data: Characteristics, use cases and applications

Big Data: From the Business Perspective. – Defining Big Data. – Characteristics of Big Data: The Volume and Variety of Data. – Characteristics of Big Data: The Velocity and Veracity of Data. – Data in Warehouse and Data in Hadoop. Why is Big Data Important – Considering Big Data Solutions. – Big Data Use Cases: Patterns for Big Data Deployment. – Big Data Use Cases: IT for IT Log Analytics, The Fraud Detection Pattern. – Risk: Patterns for Modeling and Management. – Big Data and the Energy Sector.

#### Unit V : Big Data: From the Technology Perspective

The History of Hadoop – Components of Hadoop – The Hadoop Distributed File System – The Basics of MapReduce – Hadoop Common Components – Application Development in Hadoop: Pig and PigLatin – Application Development in Hadoop: Hive – Getting Data into Hadoop – Other Hadoop Components: ZooKeeper, HBase and Oozie. – Other Hadoop Components: Lucene and AVRO.

### B. TOPICS FOR SELF STUDY

- Big Data with Spark
- Hbase & Kafka
- Big Data Machine Learning
- Big Data Predictive Analysis

### C. TEXT BOOK(S)

1. “*Cloud Computing Bible*”. Barrie Sosinsky, Wiley Publishing, 2011.
2. “*Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*”. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis and Paul Zikopoulos. McGrawHill Publishing, 2012

### D. REFERENCES BOOK(S):

1. “*Distributed and Cloud Computing*”. Kai Hwang. Elsevier India Pvt Ltd, 1ed, 2012. ISBN 978-9381269237.
2. “*Cloud Computing: Concepts, Technology & Architecture*”. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood. Prentice Hall, 2013

### E. WEB LINKS

- <https://nptel.ac.in/courses/106/104/106104189/>
- <https://www.coursera.org/specializations/big-data>
- <https://cognitiveclass.ai/courses/what-is-big-data/>
- <https://www.edx.org/learn/big-data>

### 3. SPECIFIC LEARNING OUTCOMES

UNIT	Course Content	Learning Outcomes	Level
<b>I</b>	<b>Cloud Computing Fundamentals</b>		
1.1	<b>Cloud Computing</b>	1. Define a Cloud Computing 2. Explain Deployment and development models	[K2]
1.2	<b>Characteristics of Cloud Computing</b>	1. Recall Cloud Computing models 2. Classify different types of Characteristics 3. Compare Cloud Computing with other computing technologies 4. Evaluate advantages and disadvantages of the Cloud Computing	[K5]
1.3	<b>Measuring the cloud value</b>	1. Illustrate different measuring parameters(e.g. computing cost, total cost for ownership)	[K2]
1.4	<b>SLA</b>	1. Explain Specifying Service Level Agreements	[K2]
<b>II</b>	<b>Cloud Architecture and Services</b>		
2.1	<b>Cloud computing stack</b>	1. Define Compos-ability, Infrastructure, Platform, Virtual Appliances in cloud computing Stack 2. Explain Communication Protocols and Applications	[K2]
2.2	<b>IaaS</b>	1. Define Infrastructure as a Service	[K1]
2.3	<b>SaaS</b>	1. Define Software as a Service	[K1]
2.4	<b>PaaS</b>	1. Define Platform as a Service	[K1]
2.5	<b>SOA</b>	1. Recall SaaS 2. Explain Open SaaS and Service Oriented Architecture 3. Compare SOA with SaaS	[K5]
2.6	<b>IDaaS</b>	1. Define Identity as a Service 2. illustrate interoperability in IDaaS	[K2]
2.7	<b>CaaS</b>	1. Define Defining Compliance as a Service	[K1]
<b>III</b>	<b>Abstraction and Virtualization</b>		
3.1	<b>Using virtualization technologies</b>	1. Define Virtualization 2. Classify Different types of Virtualization technologies 3. Examine Virtualization technologies	[K4]
3.2	<b>Virtual machine types</b>	1. Recall Virtualization 2. Classify virtual machine types	[K4]
3.3	<b>Amazon Web Services</b>	1. Recall Amazon Web Services 2. illustrate Amazon Web Service Components and Services 3. Explain Elastic Compute Cloud (EC2) 4. Create an account and instance on EC2	[K5]
<b>IV</b>	<b>Big Data: Characteristics, use cases and applications</b>		

4.1	<b>Big Data</b>	1. Define Big Data 2. Explain Characteristics of Big Data	[K2]
4.2	<b>Data in Warehouse and Data in Hadoop</b>	1. Recall Characteristics of Big data 2. Evaluate Importance of Big data	[K4]
4.3	<b>Big Data Use Cases</b>	1. Explain Patterns for Big Data Deployment, IT for IT Log Analytics, The Fraud Detection Pattern	[K2]
4.4	<b>Risk</b>	1. Define risk factors in Big Data 2. Examine Patterns for Modelling and Management, Big Data and the Energy Sector.	[K4]
<b>V</b>	<b>Big Data: From the Technology Perspective</b>		
5.1	<b>The History of Hadoop</b>	1. Define Hadoop 2. Explain History of Hadoop 3. Evaluate the use of Hadoop	[K5]
5.2	<b>Components of Hadoop</b>	1. Summarize components of Hadoop 2. Classify different types of components	[K4]
5.3	<b>Application Development in Hadoop</b>	1. Recall Components of Hadoop 2. Create an application using Hadoop components	[K6]

#### 4. MAPPING SCHEME (CO, PO & PSO)

<b>P18CS206</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	L	H	H	M	L	M	-	M	H	M	M	M
CO2	M	L	H	M	M	-	H	M	H	H	H	M	H
CO3	H	M	M	L	L	L	-	-	-	M	L	-	-
CO4	H	M	L	L	-	-	-	-	-	L	L	M	L
CO5	M	M	H	H	H	H	H	M	H	M	H	M	H
CO6	M	H	H	H	M	M	M	H	H	H	H	M	H

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. R. Jemima Priyadharsini**

## ELECTIVE 2 A: NETWORK MANAGEMENT

**SEMESTER: II**  
**CREDITS: 4**

**CODE: P18CS2:1**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Interpret the communication protocols and standards	K4	I
CO2	Elaborate various aspects of network management	K5	II
CO3	Adapt different technologies for networking	K4	III
CO4	Analyze transmission technologies and management models	K5	IV
CO5	Illustrate the model of Simple Network Management Protocol	K5	V
CO6	Discover and apply Network Management Tools, System, and Engineering	K6	V

### 2. A. SYLLABUS

#### **Unit I :Introduction to Data Communication and Network Management**

Analogy of Telephone Network management, Data (Computer) and Telecommunication Network - Distributed Computing Environment - TCP Based Network - Communication Protocols and Standard : Communication Architecture, Protocol Layer Services - Network Management: Goals, Organization and function : Goal of Network Management, Network Provisioning, Network Operation and NOC, Network Installation and Maintenance - Network Management Architecture and Organization - Network Management Perspective.

#### **Unit II :Network and Technology**

Network Technology - Local Area Network : Ethernet, Fast Ethernet, Gigabit Ethernet, Full-Duplex Ethernet, Virtual LAN, Token ring, FDDI, Wireless LAN - Network Interconnecting Device : Hubs, Bridges, Remote Bridges, Transparent Bridges, Source-Routing Bridges, Routers, Gateways and Protocols Converter, Multiprotocol and Tunneling, Half Bridge Configuration of Router, Edge Router, Switches.

#### **Unit III :Transmission Technology & Basic foundations of Network Management :**

Standards, Models and Languages. Wide Area Network, Transmission Technology: Wired Transmission - Transmission Technology : Wireless Transmission - Transmission Model - Network Management Standards - Network Management Models, Organization Model - Information Model - Communication Model - Abstract Syntax Notation One ANS.1 – Macros - Functional Model.

#### **Unit IV : SNMPv1 Network Management**

Managed Network - History of SNMP Management, Internet Organization and Standards - SNMP Model - SNMP Model : Organization Model - Information Model : Structure of Management Information, Information Model, Management of Information Base.

#### **Unit V :SNMP Communication and Functional Models & Network Management Tools, System, and Engineering**

SNMP Communication Model: SNMP Architecture , Administrative Model, SNMP Protocol Specification , SNMP Operation,SNMP MIB Group. Functional Model - **Network Management Tools, System, and Engineering** System Utilities for Management : Basic Tools , SNMP Tools, Protocol Analyzer, Network Statistics -Measurement System: Traffic Load Monitoring - Network Statistics Measurement System : Protocol Statistics , Data and Error Statistics, Using MRTG to collect Traffic Statistics - MIB Engineering : General Principles and Limitations of SMI, Object-Oriented Approach t MIB Engineering, SMI Tables, SMI Actions, SMI Transactions - NMS Design - Network Management System.

## B. TOPICS FOR SELF STUDY

- Centralized management and monitoring of Cisco network infrastructure
- Configure standard network monitoring protocols: SNMP, Syslog, NTP
- Configure standard network monitoring protocols: SNMP, Syslog, NTP
- Out-Of-Band (Oob) Management For Back Door Access

## C. TEXT BOOK(S)

1. Mani Subramanian; Timothy A. Gonsalves; N. Usha Rani, *“Network Management: Principles and Practice”*, Pearson Education India, 2010

## D. REFERENCES BOOK(S)

1. James F Kurose and Keith W. Ross, *“Computer Networking”* – A Top-Down Approach, Sixth Edition, 2013, Pearson Publication.

## E. Web Links

- <https://www.udemy.com/course/managing-cisco-network-devices-netops/>
- <https://mcc.iavalley.edu/academic/computer-science-information-technologies/computer-network-mgmt/>
- <https://www.edx.org/learn/computer-networking>

## 3. LEARNING OUTCOMES

Unit	Topics	Unit Learning Outcomes	Level
I	<b>Introduction to Data Communication and Network Management</b>		
1.1	Analogy of Telephone Network management, Data (Computer) and Telecommunication Network	Categorize the different features of networks	K4
1.2	Distributed Computing Environment	Elaborate the distributed environment	K6
1.3	TCP Based Network	Discuss the transmission control protocol	K6
1.4	Communication Protocols and Standard : Communication Architecture, Protocol Layer Services	Compare the services offered by layers and architectures	K4
1.5	Network Management: Goals, Organization and function : Goal of Network Management	Analyze the goal of network management	K4
1.6	Network Provisioning, Network Operation and NOC	Build the network based on provisions	K6
1.7	Network Installation and Maintenance	Construct the network and maintain it	K3
1.8	Network Management Architecture and Organization	Discuss the organization of network and apply it for any network	K6
1.9	Network Management Perspective	Perceive management perspective	K5
II	<b>Network and Technology</b>		
2.1	Network Technology - Local Area Network	Identify the various technology of network	K3
2.2	Ethernet, Fast Ethernet, Gigabit Ethernet, Full-Duplex Ethernet, Virtual LAN, Token ring, FDDI, Wireless LAN	Compare the different Ethernets and its usages	K5
2.3	Network Interconnecting Device	Elaborate the devices used for interconnection	K6
2.4	Hubs, Bridges, Remote Bridges, Transparent Bridges, Source-Routing Bridges, Routers, Gateways and Protocols Converter, Multiprotocol and Tunneling, Half Bridge Configuration of Router, Edge Router, Switches	Compare various routing hardware and its features	K5
III	<b>Transmission Technology &amp; Basic foundations of Network Management</b>		
3.1	Standards, Models and Languages	Analyze the different standards, models and languages available for networking	K4

3.2	Wide Area Network	Construct a WAN through different technologies	K6
3.3	Transmission Technology: Wired Transmission	Elaborate the features of wired transmission	K6
3.4	Wireless Transmission	Elaborate the features of wireless transmission	K6
3.5	Transmission Model	Analyze various models of transmission	K4
3.6	Network Management Standards	Agree with the right standard for establishing network	K5
3.7	Network Management Models, Organization Model	Discuss the model of organization level	K6
3.8	Information Model	Discuss the model of information	K6
3.9	Communication Model	Discuss the model of communication	K6
3.10	Abstract Syntax Notation One ANS.1	Build a notation for networking	K6
3.11	Macros - Functional Model	Inference the function model	
<b>IV</b>	<b>SNMPv1 Network Management</b>		
4.1	Managed Network	Discuss on the managed network	K6
4.2	History of SNMP Management, Internet Organization and Standards	Perceive the history and the standards	K5
4.3	SNMP Model	Model the protocol called SNMP	K3
4.4	Organization Model	Discuss the model of organization	K6
4.5	Information Model: Structure of Management Information	Elaborate the structure of MI	K6
4.6	Management of Information Base	Discuss the information base	K6
<b>V</b>	<b>SNMP Communication and Functional Models &amp; Network Management Tools, System, and Engineering</b>		
5.1	SNMP Communication Model	Model and apply the SNMP for networking	K3
5.2	SNMP Architecture	Examine the architecture of SNMP for networking	K4
5.3	Administrative Model	Adapt the model for administration	K6
5.4	SNMP Protocol Specification	Make use of the SNMP protocol specification for any network for communication	K3
5.5	SNMP Operation, SNMP MIB Group	Function the operations of SNMP and distinguish the MIB group	K4
5.6	Functional Model	Analyze the functional model of SNMP	K4
5.7	Network Management Tools, System, and Engineering System Utilities for Management	Make use of various things like tools etc for management	K3
5.8	Basic Tools , SNMP Tools, Protocol Analyzer, Network Statistics	Adapt the tools like analyzer for networking	K6
5.9	Measurement System: Traffic Load Monitoring	Experiment with various measurement system for performance tuning of any network	K3
5.10	Network Statistics, Protocol Statistics , Data and Error Statistics, Using MRTG to collect Traffic Statistics	Compile various statistical methods for networking	K6
5.11	MIB Engineering : General Principles and Limitations of SMI, Object-Oriented Approach t MIB Engineering, SMI Tables, SMI Actions, SMI Transactions	Discuss various aspects of MIB and SMI	K6
	NMS Design - Network Management System	Discuss NMS with various networks as examples	K6

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS2:1	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	L	H	H	M	L	M	-	M	H	M	M	M
CO2	M	L	H	M	M	-	H	M	H	H	H	M	H
CO3	H	M	M	L	L	L	-	-	-	M	L	-	-
CO4	H	M	L	L	-	-	-	-	-	L	L	M	L
CO5	M	M	H	H	H	H	H	M	H	M	H	M	H
CO6	M	H	H	H	M	M	M	H	H	H	H	M	H

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. M. Jayakkumar**

## CORE PRACTICAL III: REAL TIME WEB APP DEVELOPMENT LAB

**SEMESTER: II**  
**CREDITS: 4**

**CODE: P18CS2P3**  
**HOURS/WEEK: 3**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level
CO1	Develop web application in angular JS, by understand the steps in designing a web page	K5
CO2	Design a webpage using server controls and manages the properties of server controls	K5
CO3	Develop an .js code to create basic controls and model view controls	K5
CO4	Examine the properties of ng model and ng controller	K6
CO5	Understand and implement the CRUD operations	K6
CO6	Perform database operation using MongoDB and Mongoose	K6

### 2. SYLLABUS

1. Create students web application for welcoming the user using Node.js
2. Create students profile using Node.js
3. Implement the MVC pattern
4. Develop Hello world Express.js application
5. Build a registration form using Express.js
6. Develop a web application for Library that can perform the CRUD operations.
7. Build single page Coffee shop application using Angular JS.
8. Make a Shopping list using Angular JS which can add and delete items
9. Create a Angular JS application to implement the ngModel and ngController features.
10. Develop a web application for restaurant that can perform the CRUD operations using MEAN.

### 3. SPECIFIC LEARNING OUTCOMES

S.NO	EXERCISE	LEARNING OUTCOME	LEVEL
1	Create students web application for welcoming the user using Node.js	<ul style="list-style-type: none"><li>• To build the code in node.js</li><li>• To execute the code in command prompt.</li><li>• To view the student web application form in the browser</li></ul>	K5
2	Create students profile using Node.js	<ul style="list-style-type: none"><li>• To develop the student profile program with specific operations and save the file with the extension .js.</li><li>• To execute the node.js program in the command prompt and display the student profile in the browser.</li></ul>	K5
3	Implement the MVC pattern	<ul style="list-style-type: none"><li>• To recall element access with access specifications.</li><li>• To create the code with specific functionality</li><li>• To implement the Model View Controller to develop various controls</li><li>• To execute the program in the browser</li></ul>	K5
4	Develop Hello world Express.js application	<ul style="list-style-type: none"><li>• To recall the steps to develop the program</li><li>• To classify the modules in a program.</li><li>• To develop Hello world program in Express.js and save it in the .js extension.</li><li>• To execute the program in command prompt and visualize the result in the browser.</li></ul>	K6
5	Build a registration form using Express.js	<ul style="list-style-type: none"><li>• To define and initialize variables.</li><li>• To demonstrate element access</li><li>• To inspect the operation of methods.</li></ul>	K6



		<ul style="list-style-type: none"> <li>To develop the registration program with appropriate controls in Express.js.</li> <li>To execute the program in command prompt and view the registration form in the browser.</li> </ul>	
6	Develop a web application for Library that can perform the CRUD operations.	<ul style="list-style-type: none"> <li>To construct the Program for Library management</li> <li>To classify the various types of mangoose db operations.</li> <li>To experiment with specific, CREATE, READ, UPDATE and DELETE operations</li> <li>To make use these operations and visualize the result in the browser.</li> </ul>	K6
7	Build single page Coffee shop application using Angular JS.	<ul style="list-style-type: none"> <li>To define a Code.</li> <li>To illustrate the operation of Angular Js.</li> <li>To construct the program for coffee shop application using various controls.</li> <li>To examine the code in command prompt.</li> <li>To evaluate the result in web browser</li> </ul>	K6
8	Make a Shopping list using Angular JS which can add and delete items	<ul style="list-style-type: none"> <li>To develop the code for shopping list using Angular Js</li> <li>To construct a code for adding and deleting an item</li> <li>To examine the code and evaluate the result</li> </ul>	K6
9	Create a Angular JS application to implement the ngModel and ngController features.	<ul style="list-style-type: none"> <li>To create a construct an Angular Js application</li> <li>To apply ngModel and ngController features.</li> <li>To examine the code and evaluate the result</li> </ul>	K6
10	Develop a web application for restaurant that can perform the CRUD operations using MEAN.	<ul style="list-style-type: none"> <li>To construct the Program for Restaurant management</li> <li>To classify the various types of mangoose db operations.</li> <li>To experiment with specific CREATE, READ, UPDATE and DELETE operations using MEAN</li> <li>To make use these operations and visualize the result in the browser.</li> </ul>	K6

#### Web links:

- [https://www.w3schools.com/nodejs/nodejs\\_mongodb\\_create\\_db.asp](https://www.w3schools.com/nodejs/nodejs_mongodb_create_db.asp)
- <https://angularjs.org>
- <https://github.com/gothinkster/node-express-realworld-example-app>
- <https://github.com/gothinkster/angularjs-realworld-example-app>

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS2P3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H	H	M	L	H	-	H	H	M	M	H
CO2	M	M	H	M	M	-	H	M	H	H	H	M	H
CO3	H	M	M	M	M	L	H	-	H	H	M	M	H
CO4	H	M	L	L	-	-	-	-	M	H	M	M	L
CO5	M	M	H	H	H	M	M	M	H	M	H	M	H
CO6	M	M	H	H	M	M	M	H	H	H	H	M	H

## **5. ASSESSMENT METHODS**

### **DIRECT**

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

### **INDIRECT**

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. M. P. Anuradha**

# MACHINE LEARNING LAB

**SEMESTER: II**

**Code: P18CS2P3**

**CREDITS : 3**

**HOURS/WEEK : 5**

## 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Ex. No.
CO1	Apply the Pre-processing on the given dataset	K5	1
CO2	Develop and evaluate the regression model using Datasets	K6	2,3,4,
CO3	Develop and evaluate the Support Vector Machine using Datasets	K6	5
CO4	Develop and evaluate the Decision Tree Classifier and Regressor using Datasets	K6	6,7
CO5	Develop and evaluate the Clustering model using Datasets	K6	8, 9
CO6	Develop and evaluate the Neural Network and Perceptron model using Datasets	K6	10

## 2. SYLLABUS

1. [Data preprocessing]: Create dataset in CSV file with 10 rows and 5 columns (name, age, height, eight, BP). Load the CSV file and do the following preprocessing to the data. Apply data range normalization, predict the missing value (if any) and select the useful features automatically. Finally print the preprocessed data.
2. [Linear Regression]: Generate random numbers for input features and target. Divide the data into training and testing set. Print the training and testing data. Create a linear regression model for the dataset and run the model for 100 iterations. Print the evaluation results and learned model weights.
3. [Multiple Linear Regression]: Load the boston house price prediction dataset. Divide the data into training and testing set. Print the training and testing data. Create a multiple linear regression model for the dataset and run the model for 500 iterations. Print the evaluation results and learned model weights.
4. [Logistic Regression]: Load the Iris classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a logistic regression model for the dataset and run the model for 500 iterations. Print the evaluation results and learned model weights.
5. [Support Vector Machine]: Load the Digits classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a Linear SVM model for the dataset and run the model for 500 iterations. Apply logistic regression to the dataset and print the results. Print the evaluation results and learned model weights. Compare the results with results of logistcs regression in terms of speed and accuracy.
6. [Decision Tree Classifier]: Lox1ad the Wine classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a Decision Tree model for the dataset and run the model for 500 iterations. Print the evaluation results and learned model weights. Apply SVM to the dataset and print the results. Compare the results with results of Support Vector machines in terms of speed and accuracy.
7. [Decision Tree Regressor]: Load the Diabetes prediction dataset. Divide the data into training and testing set. Print the training and testing data. Create a Decision Tree Regression model for the dataset and run the model for 500 iterations. Apply Linear Regression to the dataset and print the results. Print the evaluation results and learned model weights. Compare the results with results of Linear regression in terms of speed and accuracy.

8. [K-Means Clustering]: Populate clustering dataset with 2 features using sklearn built-in functions. Divide the data into training and testing set. Print the training and testing data. Apply K-Means for the dataset and run the model for 500 iterations. Visualize the clustering results using 2D plots.
9. [Spectral Clustering]: Populate clustering dataset with 2 features using sklearn built-in functions. Divide the data into training and testing set. Print the training and testing data. Apply spectral clustering for the dataset and run the model for 500 iterations. Visualize the clustering results using 2D plots. Visually compare the results with plots of the K-means in terms of speed and clustering validity.
10. [Simple Neural Networks]: Load the Digits classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a Neural Network with 2 layers and 100 nodes each for the dataset and run the model for 500 iterations. Apply logistic regression, SVM, decision tree to the dataset and print the results. Print the evaluation results and learned model weights. Compare the results in terms of speed and accuracy.

### 3. SPECIFIC LEARNING OUTCOMES

S.No.	Exercise List	Level
1	Apply the pre-processing on data set	K6
2	Develop a linear regression model for user-built data set	K6
3	Design a multiple regression model for Boston House Price Data set	K6
4	Develop a logistic regression model for Iris Dataset	K6
5	Design a Support Vector Machine for Digit Dataset	K6
6	Develop a Decision Tree Classifier for Wine Dataset	K6
7	Construct a Decision tree regressor for Diabetics Dataset	K6
8	Design a K-means clustering for dataset	K6
9	Develop a Spectral Clustering for given Dataset	K6
10	Design a Neural Network for Digit Dataset	K6

### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS2P3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H		H					H		M	
CO2	H	M	M	M	H	H							
CO3	H	H	H	H	M	L	M		H	M	H	L	
CO4	H	H	M	L	H	H		H	M	H	M	M	H
CO5	H	H		H	H		H	H	H	H	H	M	H
CO6	H		H	H	H		H	H	H	H	H	H	H

### 5. ASSESSMENT METHODS

#### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

#### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. B. Satheesh Kumar**

## CORE VII: COMPUTER VISION

**SEMESTER: III**  
**CREDITS: 4**

**CODE: P18CS307**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Apply the concepts of Image Transformation, Enhancement, segmentation, compression on the Monochrome and color images.	K3	I
CO2	Develop the algorithms for Image Enhancement, Segmentation, Compression, Video restoration, video enhancement and video motion estimation in MATLAB	K5	II
CO3	Develop a feature extraction algorithms for different types of images	K5	III
CO4	Develop the algorithms for Image Enhancement, Segmentation for Colour Images	K5	IV
CO5	Examine the video restoration, enhancement and motion estimation of videos	K5	V
CO6	Formulate the research problems on Computer Vision	K6	V

### 2. A. SYLLABUS

#### Unit I : Basics of Image Processing

Introduction and motivation to computer vision – Digital image representation and file formats – Basic image processing operations – Basics of MATLAB – Scripts, functions, graphics & visualization – Basic Image operations using image processing toolbox – Image manipulation using image processing toolbox – Light, Color, and Electromagnetic Spectrum – Image Acquisition – Image Digitization.

#### Unit II : Image Operations, Transformations and Histograms

Arithmetic Operations: Fundamentals and Applications – Logic Operations: Fundamentals and Applications – Mapping and Affine Transformations – Geometric Operations Using MATLAB – Other Geometric Operations and Applications – Gray-level (Point) Transformations – Other Linear and Non-linear Point Transformations – Computing and interpreting Image Histograms- Histogram Equalization – Histogram Modification Techniques.

#### Unit III : Image Filtering, Edge Detection and Image Segmentation

Convolution and Correlation – Image Smoothing (Low-pass Filters) – Image Sharpening (High-pass Filters) – Fourier Transform: the Mathematical Foundation – Low-pass Filtering – High-pass Filtering – First-order and Second-order Derivative Edge Detection – Canny Edge Detector, Edge Linking and Boundary Detection Intensity-based Segmentation – Region-based Segmentation and Watershed Segmentation.

#### Unit IV : Color Images, Compression and Feature Extraction, Representation

Color Models – Pseudocolor Image Processing – Full-color Image Processing – Basic Concepts of Image Compression – Lossless and Lossy Compression Techniques – Image Compression Standards and Quality Measures – Feature Vectors and Vector Spaces – Binary Object Features- Boundary Descriptors – Histogram-based (Statistical) and Texture Features.

#### Unit V : Video Processing: sampling and motion estimation

Monochrome Analog Video and Color Video – Digital Video Basics – Digital Video Formats and Standards – Video Processing in MATLAB – Video Sampling and Basics - Standards Conversion – Fundamentals of Motion Estimation and Motion Compensation – General Methodologies in Motion Estimation – Motion Estimation Algorithms – Video Enhancement and Noise Reduction.

### B. TOPICS FOR SELF STUDY

- Computer Vision using Machine Learning
- Computer Vision using Deep Learning
- Image Classification Model using OpenCV
- Image Classification using Watson

### C. TEXT BOOKS

1. Oge Marques, *“Practical Image and Video Processing Using MATLAB”*, Wiley Publications, 2011.

### D. REFERENCES

1. Mark S. Nixon and Alberto S. Aguado, *“Feature Extraction & Image Processing for Computer Vision”*, 3ed, Academic Press, 2012.
2. Gonzalez, R.C. Woods, *“Digital Image Processing”*, 4<sup>th</sup> Edition, PHI publications, 2015.

### E. WEB LINKS

- <https://www.udacity.com/course/introduction-to-computer-vision--ud810>
- <https://www.coursera.org/professional-certificates/applied-artificial-intelligence-ibm-watson-ai>
- [https://onlinecourses.nptel.ac.in/noc20\\_cs88/preview](https://onlinecourses.nptel.ac.in/noc20_cs88/preview)
- <https://cloudxlab.com/course/99/computer-vision>

### 3. SPECIFIC LEARNING OUTCOMES

Unit	Topic	Topic Learning Outcomes	Level
	By the end of each topic of a unit, students will be able to		
I	<b>Basics of Image Processing</b>		
1.1	Introduction and motivation to computer vision	Explain the components of Human Vision Systems	K2
		Demonstrate the basic concepts of Computer vision	K2
1.2	Digital image representation and file formats	Categorize the different types for Digital Image Representation	K4
1.3	Basic image processing operations	Explain the different types of Image Processing operations	K5
1.4	Basics of MATLAB – Scripts, functions, graphics & visualization	Design the Matlab programming for different types of problems	K6
1.5	Basic Image operations and Image manipulation using image processing toolbox (IPT)	Develop the programs for Image processing algorithms using IPT	K6
1.6	Light, Color, and Electromagnetic Spectrum	Summarize the basic concepts of Optics	K2
1.7	Image Acquisition and Image Digitization	Examine the different types sensors for acquisition of images	K4
		Explain the concepts of Image Digitization	K5
II	<b>Image Operations, Transformations and Histograms</b>		
2.1	Arithmetic Operations: Fundamentals and Applications	Identify the type of arithmetic operations on images	K2
		Develop the program for logical operations using Matlab functions	K6

2.2	<b>Logic Operations:</b> Fundamentals and Applications	Categorize the logical Operations	K3
		Develop the program for logical operations using Matlab functions	K6
2.3	<b>Geometric Operations:</b> – Mapping and Affine Transformations	Explain the different types of mapping (Transformations)	K5
2.4	Geometric Operations Using MATLAB	List the matlab functions of Geometric Operations	K4
		Design the Matlab application for Geometric Operations	K6
2.5	Other Geometric Operations and Applications	Discuss about the features of wrapping and other non-linear transformations	K6
2.6	<b>Gray-level (Point) Transformations</b> – Other Linear and Non-linear Point Transformations	Demonstrate the Point Transformation on grayscale images	K2
		Assess the performance of the Linear transformations on different images	K5
		Compare the non-linear transformations over linear transformations.	K4
2.7	<b>Histogram Processing:</b> Computing and interpreting Image Histograms	Construct the histogram for the different images	K6
		Interpret the histograms of different images	K5
2.8	Histogram Equalization	Elaborate the steps involved in the Histogram Equalization	K6
2.9	Histogram Modification Techniques	Explain the procedure of Direct histogram specifications	K5
		List the other histogram modification techniques	K5
III	<b>Image Filtering, Edge Detection and Image Segmentation</b>		
3.1	<b>Neighbourhood Processing:</b> Convolution and Correlation – Image Smoothing (Low-pass Filters) – Image Sharpening (High-pass Filters)	Formulate the convolution and correlation operations for filter design	K6
		Design the Low-pass filters for the images	K6
		Design the High-pass filters for the images	K6
		Examine the filtering techniques on different images	K5
3.2	<b>Frequency Domain Filtering:</b> Fourier Transform: Mathematical Foundation – Low-pass Filtering – High-pass Filtering	Determine the Fourier Transforms for images	K5
		Develop the Low-pass filters for the images	K6
		Develop the High-pass filters for the images	K6
		Construct the filtering techniques using matlab	K6
3.3	<b>Edge Detection:</b> First-order and Second-order Derivative Edge Detection	Distinguish the First-order and Second-order Derivative Edge Detection	K5
		List the Matlab functions for the edge detection methods	K4
		Compare the different types of Edge Detection methods	K5
3.4	Canny Edge Detector	Explain the working flow of Canny Edge Detector	K5
3.5	Edge Linking and Boundary Detection	Examine the Edge Linking and Boundary Detection methods for different images	K5

3.6	<b>Image Segmentation:</b> Intensity-based Segmentation	Demonstrate the concepts of Image segmentation	K2
		Categorize the methods of Intensity based segmentations	K4
3.7	Region-based Segmentation	Discuss the features of Region-based Segmentation methods	K6
3.8	Watershed Segmentation	Compare the Watershed Segmentation with other methods	K5
<b>IV</b>	<b>Color Images, Compression and Feature Extraction, Representation</b>		
4.1	<b>Color Image Processing:</b> Color Models	Discuss the concepts of colour models	K6
		List the matlab functions for colour image processing	K4
4.2	Pseudocolor Image Processing	Explain the characteristics of pseudocolor processing	K5
4.3	Full-color Image Processing	Compare the full color image processing over pseudocolor processing	K5
4.4.	<b>Image Compression :</b> Basic Concepts of Image Compression	Outline concepts of Image Compressions	K2
4.5	Lossless and Lossy Compression Techniques	Analyse the different methods of Lossless Compression	K4
		Classify the different methods of Lossy Compression	K4
4.6	Image Compression Standards and Quality Measures	Estimate the compression methods using Quality Measures	K5
4.7	<b>Feature Extraction:</b> Feature Vectors and Vector Spaces	Summarize the concepts of feature extraction	K2
		Illustrate the feature extraction using Matlab functions	K2
4.8	Binary Object Features	Compile the binary object features	K6
4.9	Boundary Descriptors	Construct the Boundary descriptors for the images	K6
4.10	Histogram-based (Statistical) and Texture Features	Compare the Histogram-based (Statistical) and Texture Features	K5
<b>V</b>	<b>Video Processing: sampling and motion estimation</b>		
5.1	<b>Video Fundamentals:</b> Monochrome Analog Video and Color Video	Outline the concepts of Video fundamentals	K2
		Distinguish the Monochrome and colour video	K4
5.2	Digital Video Formats and Standards	Analyse the different types of video formats and standards	K4
5.3	Digital Video Basics	Explain how the analog video converted to digital video	K5
5.4	Video Processing in MATLAB	Develop the matlab program for video processing	K6
5.5	<b>Video Sampling Rate &amp; Standards Conversion:</b> Video Sampling and Basics	Examine the sampling rate conversion	K5
5.6	Standards Conversion	Elaborate the main practical aspects involved in converting a video sequence from one format to another.	K6
		Analyze steps are involved in PAL to NTSC (and vice versa) standard conversion	K4



5.7	Fundamentals of Motion Estimation and Motion Compensation – General Methodologies in Motion Estimation – Motion Estimation Algorithms	Demonstrate the motion estimation (ME) and its properties Design techniques and algorithms can be used to estimate motion within a video sequence	K2 K6
5.8	Video Enhancement and Noise Reduction.	Develop the techniques can be used to filter a video sequence Formulate the research problems related to Video processing List the matlab functions to be used for video processing	K6 K6 K2

#### 4. MAPPING SCHEME (CO, PO & PSO)

<b>P18CS307</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	L

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. P. S. Eliahim Jeevaraj**

## CORE VIII: TEXT AND WEB MINING

**SEMESTER: III**  
**CREDITS: 4**

**CODE: P18CS308**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Demonstrate the use of representing the vector space.	K2	I
CO2	Analyze the usage of the metrics for evaluating the Information Retrieval systems.	K4	II
CO3	Extend the need for analyzing through the query expansion techniques.	K2	III
CO4	Make use of the different forms of ranking for studying the link structure.	K3	IV
CO5	Categorize the crawlers and follow the ethics.	K4	V
CO6	Build a user-based recommender system.	K6	V

### 2. A. SYLLABUS

#### Unit I : Information Retrieval Part-I

Information Retrieval Terminologies: Definition, Unstructured document, General IR system architecture – Boolean retrieval model: Term-Document Incident Matrix for Document representation, Boolean queries, Relevance of a document, Precision and Recall – Inverted Index Construction – Processing Boolean queries using inverted index – Determining vocabulary terms: tokenization, Stop words removal, Normalization, Stemming, Lemmatization. – Term frequency and weighting: Bag of words, term frequency, document frequency and inverse document frequency, tf-idf weighting, Overlap score measure. – Vector space model: Dot product, Queries as vectors, Computing vector scores. – Other tf-idf functions – Evaluation of IR systems: Precision, Recall, F-measure, Precision-Recall graph – Evaluation of IR systems: Interpolated precision, Mean average precision, Precision @ k, R-precision.

#### Unit II : Information Retrieval Part-II

Evaluation of IR systems: ROC curve, Sensitivity, Specificity, Cumulative gain – Evaluation of IR systems: Normalized Discounted Cumulative Gain, Dice coefficient, Kappa statistic – Relevance Feedback (RF): Rocchio algorithm – Probabilistic RF, Pseudo RF, Indirect RF, Query expansion – Probabilistic retrieval: Binary independence model – Okapi BM25: Non binary model. Example – Language model: Query likelihood model – Naïve Bayes text classification: Multinomial model – Naïve Bayes text classification: Bernoulli model – Feature selection: Mutual information.

#### Unit III : Social Network Analysis

Centrality and Prestige – Co-citation and Bibliographic coupling – PageRank algorithm Part-I – PageRank algorithm Part-II – HITS algorithm – Strengths and weaknesses of PageRank and HITS – Community discovery: Bipartite core based algorithm – Community discovery: Maximum flow based algorithm – Betweenness measure to discover email communities – Heuristic approach to discover overlapping communities.

#### Unit IV : Web Crawling

Basic sequential crawler – Basic sequential crawler: Implementation issues – Universal Crawler – Focused Crawler – Context Focused Crawler – Topical crawlers: Topical locality and cues – Topical crawlers: Best N First crawler – Topical crawlers: InfoSpider crawler – Crawler evaluation – Crawler ethics and conflicts.

#### Unit V : Opinion Mining and Recommender Systems

Opinion mining: Problem definition – Aspect based opinion summary – Document Sentiment Classification: supervised and unsupervised – Sentence level sentiment classification – Aspect based opinion mining – Opinion spam detection – Content based recommendation – Collaborative filtering based recommendation: kNN – Collaborative filtering based recommendation: Association rules – Collaborative filtering based recommendation: Matrix factorization.

## B. TOPICS FOR SELF STUDY

- Link Analysis
- Cascading Behaviour
- Rich Get Richer Phenomenon
- Small World Effect

## C. TEXT BOOK(S)

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze. “*Introduction to Information Retrieval*”, Cambridge University Press, 2009. (<http://nlp.stanford.edu/IR-book/>)
2. Bing Liu. “*Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data*”, 2nd Edition, Springer July 2011. (<http://www.cs.uic.edu/~liub/WebMiningBook.html>)

## D. REFERENCES BOOK(S)

1. Soumen Chakrabarti. “*Mining the Web: Discovering knowledge from unstructured data*”, Morgan Kaufmann Publishers, 2003.

## E. WEB LINKS

- [https://www.tutorialspoint.com/natural\\_language\\_processing](https://www.tutorialspoint.com/natural_language_processing)
- <https://www.javatpoint.com/data-mining-world-wide-web>
- <https://nptel.ac.in/courses/106/106/106106169/>

## 3. SPECIFIC LEARNING OUTCOMES

Unit	Contents	Learning Outcomes	Level
<b>I</b>	<b>Information Retrieval - I</b>		
1.1	Terminologies	Recall the different Information Retrieval terminologies	[K1]
1.2	Boolean retrieval model	Summarize the Boolean retrieval model	[K2]
1.3	Term frequency and weighting	Apply the document frequency and inverse document frequency	[K3]
1.4	Vector space model	Interpret the vector scores	[K2]
1.5	Evaluation of IR systems	Apply the Precision, Recall, F-measure and the Precision-Recall graph	[K3]
<b>II</b>	<b>Information Retrieval - II</b>		
2.1	Evaluation of IR systems	Apply ROC curve, Sensitivity, Specificity, Cumulative gain, Normalized Discounted Cumulative Gain, Dice coefficient, Kappa statistic	[K3]
2.2	Query expansion	Illustrate the need for analyzing through the query expansion techniques.	[K2]
2.3	Models for text classification and feature selection	Classify the models and analyze their suitability for text classification and feature selection	[K4]
<b>III</b>	<b>Social Network Analysis</b>		
3.1	PageRank algorithm and HITS algorithm	Make use of the algorithms to decide the relevance of the pages.	[K3]
3.2	Community discovery	Classifying and identifying the most appropriate algorithm for discovering the Web communities	[K4]
<b>IV</b>	<b>Web Crawler</b>		
4.1	Basic sequential crawler	Make use of the algorithms download new and updated Web pages.	[K3]
4.2	Topical crawlers	Make use of the algorithms to distribute the crawling process across users, queries, or even client computers.	[K3]

V	Opinion Mining and Recommender Systems		
5.1	Classification	Distinguish the levels of classification	[K4]
5.2	Opinion spam detection	Apply the principles to detect spam	[K3]
5.3	Recommender System	Build a user-based recommender system	[K6]

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS308	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	L

#### 5. ASSESSMENT METHODS

##### DIRECT

5. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
6. Open Book Test.
7. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
8. Pre-Semester & End Semester Theory Examination

##### INDIRECT

2. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. B. Satheesh Kumar**

## CORE IX: HUMAN COMPUTER INTERACTION DESIGN

**SEMESTER: III**  
**CREDITS: 4**

**CODE: P18CS309**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Elaborate the concepts of understanding problem space, conceptual models, transition from conceptual design to physical design	K6	I
CO2	Explain about cognition, conceptual frameworks for cognition, Informing design, social mechanisms used in communication and collaboration	K5	II
CO3	Elucidate the fundamentals of ethnographic studies of collaboration and communication and conceptual frameworks	K4	III
CO4	Describe the life cycle models of interaction design, Evaluation paradigms and techniques and framework to guide evaluation	K3	IV
CO5	Impart the knowledge on design prototyping and construction, Data gathering techniques, Data gathering guidelines, Data interpretation and analysis	K4	V
CO6	substantiate the concepts of analyzing, interpreting and presenting data, qualitative and quantitative data analysis, feeding the findings back to design	K6	V

### 2. A. SYLLABUS

#### **Unit I : Understanding and conceptualizing interaction**

Interaction design, Good and Bad design – Process and goals of Interaction Design: Usability goals, User experience goals – Design and usability principles: Heuristics and usability principles – Understanding the problem space – Conceptual Models: Based on activities – Conceptual Models: Based on objects – Case of mix and match – Interface metaphors – Interaction Paradigms – Transition from conceptual model to physical design.

#### **Unit II : Designing for collaboration and communication**

Understanding cognition – Applying knowledge from physical world to the digital world – Conceptual frameworks for cognition: Mental models – Conceptual frameworks for cognition: Information processing, External cognition – Informing design : from theory to practice – Social mechanisms used in communication and collaboration: conversational mechanisms, designing collaborative technologies to support conversation – Social mechanisms used in communication and collaboration: co-ordination mechanisms, designing collaborative technologies to support co-ordination – Awareness mechanisms, Designing collaborative technologies to support awareness – Ethnographic studies of collaboration and communication – Conceptual framework: Language /action framework, distributed cognition

#### **Unit III : Human centered software evaluation**

Affective aspects, Expressive interfaces – Virtual characters: Agents, Kinds of agents, General design concerns – Introduction, Four basic activities of Interaction design – Key characteristics of Interaction design process – Lifecycle models: Simple lifecycle model for interaction design – Lifecycle models: Lifecycle model in s/w engineering, lifecycle model in HCI – Evaluation introduction, What, Why and When to evaluate – Evaluation Paradigms and techniques – DECIDE: Framework to guide evaluation – Determine, Explore, Choose, Identify, Decide, Evaluate.

#### **Unit IV : Design prototyping and construction**

Introduction, Kinds of requirements – Data gathering: Techniques, Choosing between techniques, Data gathering guidelines – Data interpretation and analysis – Task description – Hierarchical task analysis – Prototyping: Introduction, Low fidelity and High fidelity and compromises in prototyping – Conceptual design: Perspectives for developing conceptual model, Expanding conceptual model – Scenarios and prototypes in conceptual design – Physical design : Guidelines, Kinds of widget – Tool support.

## Unit V : Human centered software design

Degrees of involvement, User centered approach – Applying ethnography in design-Coherence , contextual design – Participatory design: PICTIVE, CARD – Goals, questions and paradigms for observation – To observe : In controlled environments, In field, Participant observation and Ethnography – Data collection – Indirect observation : Diaries, Interaction logging – Analyzing, Interpreting and presenting data: Qualitative Analysis – Analyzing, Interpreting and presenting data: Quantitative data analysis – Feeding the findings back to design

### B. TOPICS FOR SELF STUDY

- Model based Design and Evaluation
- Task Modelling and Analysis
- Dialog Design
- Cognitive Architecture

### C. TEXT BOOK(S)

1. Preece, J., Rogers, Y., & Sharp, H. (2015). *“Interaction design: Beyond human-computer interaction”* (4th ed.) John Wiley & Sons Ltd.

### D. REFERENCES BOOK(S)

1. Dix, A., Finlay, J., Abowd, G.D., & Beale, R. (2004). *“Human computer interaction”* (3<sup>rd</sup> ed.). Prentice Hall.

### E. WEB LINKS

- <https://nptel.ac.in/courses/106/103/106103115/>
- <https://www.interaction-design.org/courses/human-computer-interaction>
- <https://www.udacity.com/course/human-computer-interaction--ud400>

## 3. SPECIFIC LEARNING OUTCOMES

Unit	Topics	Unit Learning Outcomes	Level
<b>I</b>	<b>Understanding and Conceptualizing Interaction</b>		
1.1	Interaction Design	Describe interaction design, and Good and Bad design	K3
1.2	Process and Goal of Interaction Design	Explain about process and goals of interaction design	K5
1.3	Design and Usability Principles	Analyse user experienced principles and usability principles of interaction design	K4
1.4	Conceptual Model	Elaborate the conceptual model of interaction design of a particular system	K6
1.5	Interface Metaphors	Discuss the evolution of interface. Create new interface for interaction design	K6
1.6	Interaction Paradigms	Categorize the interaction paradigms	K4
<b>II</b>	<b>Designing for Collaboration and Communication</b>		
2.1	Basic Concepts of Cognition	Apply the basic concepts of cognition	K3
2.2	Conceptual Frameworks for Cognition	Elaborate the mental models	K6
2.3	Information Design	Interpret the theory to practice of information design	K5
2.4	Social Mechanism used in Communication and Collaboration	Evaluate the conversational mechanisms in communication and collaboration	K5
2.5	Designing Collaborative Technologies to Support Co-ordination	Design the collaborative technologies to support co-ordination	K6
<b>III</b>	<b>Human Centered Software Evaluation</b>		
3.1	Affective Aspects and Expressive Interfaces	Identify the affective aspects and expressive interfaces	K3
3.2	Virtual Characters	Discover the virtual characters	K4

3.3	Key Characteristics of Interaction Design Process	Determine the key characteristics of interaction design process	K5
3.4	Life Cycle Models	Elaborate the life cycle models of interaction design process	K6
3.5	Evaluation Paradigms and Techniques	Importance of evaluation paradigms and techniques in human centered software evaluation	K5
<b>IV</b>	<b>Design Prototyping and Construction</b>		
4.1	Types of Requirements	Examine the types of requirements for design prototyping and construction	K4
4.2	Data Gathering Techniques	List the data gathering techniques	K4
4.3	Prototyping	Compare low fidelity and high fidelity	K5
4.4	Conceptual Design	Elaborate the conceptual model	K6
4.5	Physical Design	Develop physical design from the conceptual design	K6
<b>V</b>	<b>Human Centered Software Design</b>		
5.1	User Centered Approach	Apply user centered approach in human centered software design	K3
5.2	Participatory Design	Explain about participatory design	K5
5.3	Indirect Observation	Evaluate indirect observation	K5
5.4	Analysing, Interpreting and Presenting Data	Analyse, interpret and present the data	K4

#### 4. MAPPING SCHEME (CO, PO & PSO)

<b>P18CS309</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	L

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. S. Annal Ezhil Selvi**

## ELECTIVE 4a: DESIGN AND IMPLEMENTATION OF DATA WAREHOUSE

SEMESTER: III  
CREDITS: 4

CODE: P18CS4:1  
HOURS/WEEK: 5

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Explain the fundamental concepts of data warehouse	K2	I
CO2	Illustrate the model of data warehouse architecture	K4	II
CO3	Impart the concepts of analytical processing operation	K4	III
CO4	Determine data warehouse design concepts	K3	IV
CO5	Create queries to get the desired results from data warehouse	K5	V
CO6	Evaluate Extraction, Transformation and Loading techniques in order to get information from the internal and external sources	K6	V

### 2. A. SYLLABUS

#### Unit I : Data warehouse fundamental concepts

Hierarchies – Measures – OLAP operations – Data warehouses – Data warehouse architecture: Back-End tier, Data Warehouse tier – OLAP tier, Front-end tier – Variations of the architectures – Data warehouse Design – Microsoft SQL Server Tools – Pentaho Business Analytics.

#### Unit II : Conceptual Data warehouse design

Conceptual modeling of data warehouses – Balanced Hierarchies and Unbalanced hierarchies – Generalized Hierarchies – Parallel hierarchies – Alternative – hierarchies – Parallel hierarchies – Non strict hierarchies – Facts with Multiple – granularities – Many to many dimensions – Querying the Northwind Cube Using the OLAP Operations.

#### Unit III : Logical Data warehouse Design

Logical Modeling of data warehouses – Relational data warehouse design – Relational implementation of the conceptual model – Time Dimensions – Logical representation of hierarchies – Advanced modeling aspects – Slowly changing dimensions – SQL/OLAP operations : Data Cube – Rollup, Cube and Grouping sets – Window Functions.

#### Unit IV : Querying Data warehouses

Tuples and Data sets, Basic Queries – Slicing, Navigation – Cross join, Sub-queries – Calculated Members and Named sets – Relative Navigation – Time Series Functions – Filtering – Sorting – Top and Bottom analysis – Aggregation functions.

#### Unit V : Physical Data warehouse design and Extraction, Transformation and Loading

Physical modeling of data warehouses – Materialized views – Data Cube Maintenance – PipeSort Algorithms – Cube Size Estimation – Evaluation of Star queries – Data warehouse partitioning – Business Process Modeling Notation – Conceptual ETL Design using BPMN – Conceptual design of the Northwind ETL Process.

### B. TOPICS FOR SELF STUDY

- Design and Build a Data Warehouse for Business Intelligence Implementation
- Data integration workflows and analytical queries
- Materialized views, Dashboards and Visualizations
- BI tools

### C. TEXT BOOK

1. Alejandro Vaisman, Esteban Zimanyi, “*Data Warehouse Systems*”, Springer – 2014, ISBN 978-3-642-54654-9

### D. REFERENCE BOOK

1. William H. Inmon, “*Building the Data Warehouse*”, Wiley Publishing Inc, 2005, 4<sup>th</sup> Edition, ISBN-13: 978-0-7645-9944-6



## E. WEB LINKS

- <https://www.coursera.org/learn/data-warehouse-bi-building>
- <https://www.coursera.org/specializations/data-warehousing>
- <https://www.edx.org/learn/data-warehouse>

## 3. SPECIFIC LEARNING OUTCOMES

Unit	Topics	Learning Outcomes	Level
<b>I</b>	<b>Data warehouse fundamental concepts</b>		
1.1	Hierarchies	Recognizing the data warehouse Hierarchies	K1
1.2	Measures	Identifying the specific measures Of Data warehouse Concepts	K1
1.3	OLAP operations	Classifying the various OLAP Operations	K2
1.4	Data warehouses	Summarizing the Data warehouse Concepts	K2
1.5	Data warehouse architecture	Demonstrating the Data warehouse Architecture	K2
1.6	Back-End tier	Categorizing the Data warehouse Tiers	K2
1.7	OLAP tier		
1.8	Data Warehouse tier		
1.9	Front-end tier		
1.10	Variations of the architectures	Relating the variations of the architecture	K2
1.11	Data warehouse Design	Explain the Data warehouse Design	K2
1.12	Parallel hierarchies	Discuss the various tools of MS-SQL Server	K2
1.13	Pentaho Business Analytics	Extend the Business Analytics with Pentaho Model	K2
<b>II</b>	<b>Conceptual Data warehouse design</b>		
2.1	Conceptual modelling of data	Describing the conceptual modelling of data	K1
2.2	Balanced Hierarchies and Unbalanced hierarchies	Contrasting Balanced hierarchies with Unbalanced hierarchies	K2
2.3	Generalized Hierarchies	Relating the types of Hierarchies	K2
2.4	Alternative hierarchies		
2.5	Parallel hierarchies		
2.6	Non strict hierarchies		
2.7	Facts with Multiple granularities	Determining the facts with multiple granularities	K3
2.8	Many to many dimensions	Discussing many to many Dimensions	K2
2.9	Querying the North wind Cube Using the OLAP Operations	Applying the queries using OLAP Operations	K3
<b>III</b>	<b>Logical Data warehouse Design</b>		
3.1	Logical Modelling of data warehouses	Extend the Logical Model in Data warehouse	K2
3.2	Relational data warehouse design	Constructing Relational data warehouse design	K3
3.3	Relational implementation of the conceptual model	Structuring the conceptual model in relational database design	K4
3.4	Time Dimensions	Correlating the time dimensions	K4
3.5	Logical representation of hierarchies	Prioritizing the hierarchies based on the logical representation	K4
3.6	Advanced modelling aspects	Illustrating the Advanced Modelling Aspects	K4

3.7	Slowly changing dimensions	Accessing the Slowly Changing Dimensions	K5
3.8	SQL/OLAP operations	Validating SQL/OLAP Operations	K5
3.9	Data Cube	Designing the Data Cube	K4
3.10	Rollup, Cube and Grouping sets	Estimating Rollup, Cube and Grouping Sets	K4
3.11	Window Functions	Contrasting the various Window Functions	K4
<b>IV</b>	<b>Querying Data warehouses</b>		
4.1	Tuples and Data sets, Basic Queries	Defining the tuples datasets and basic queries	K1
4.2	Slicing, Navigation	Indicating Slicing and Navigation concept	K2
4.3	Cross join, Sub-queries	Examine the cross join and sub queries	K3
4.4	Calculated Members and Named sets	Operating Calculated Members and Named sets	K3
4.5	Relative Navigation	Executing Relative navigational Function	K3
4.6	Time Series Functions	Classifying the various time series Functions	K4
4.7	Filtering	Compare Filtering with Sorting	K4
4.8	Sorting		
4.9	Top and Bottom analysis	Construct the top and bottom analysis	K3
4.10	Aggregation functions	Integrate the aggregate Functions	K4
<b>V</b>	<b>Physical Data warehouse design and Extraction, Transformation and Loading</b>		
5.1	Physical modelling of data warehouses	Describing Physical modelling of data warehouse	K2
5.2	Materialized views	Computing the materialized views	K3
5.3	Data Cube Maintenance	Summarizing the concept of data cube maintenance	K2
5.4	Pipe Sort Algorithms	Determine the pipe sort algorithms	K3
5.5	Cube Size Estimation	Estimating the cube size	K4
5.6	Evaluation of Star queries	Checking the evaluation of queries	K5
5.7	Data warehouse partitioning	Composing the partition of data warehouse	K6
5.8	Business Process Modelling Notation	Simulating the Business Process Modelling Notation	K6
5.9	Conceptual ETL Design using BPMN	Formulating Conceptual ETL Design using BPMN	K6
5.10	Conceptual design of the Northwind ETL Process.	Adapting the conceptual design with ETL Process	K6

#### 4. MAPPING SCHEME (CO, PO & PSO)

<b>P18CS4:1</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	M	L	-	-	-	-	-	H	-	L	-
CO2	H	L	H	L	-	-	-	-	M	-	H	-	-
CO3	M	M	M	H	M	L	H	M	L	H	H	M	H
CO4	M	H	M	L	M	-	-	-	-	H	M	-	L
CO5	H	M	H	M	H	H	M	L	M	M	H	M	L
CO6	M	L	L	M	L	M	H	H	H	H	H	H	M

## **5. ASSESSMENT METHODS**

### **DIRECT**

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

### **INDIRECT**

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. M. P. Anuradha**

## CORE PRACTICAL VI: COMPUTER VISION LAB

SEMESTER: III  
CREDITS: 3

CODE: P18CS3P5  
HOURS/WEEK: 5

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level
CO1	Practice fundamental concepts of images and image Transformation	K4
CO2	Analyze the transformation, filtering, segmentation and edge detection methods	K5
CO3	Construct the Matlab applications for image compression techniques	K6
CO4	Develop the matlab programs for motions and objects from videos	K5
CO5	Design the applications for colour image processing operations	K6
CO6	Formulate the research problems on Computer Vision	K6

### 2. SYLLABUS

1. Develop an application for Image Transformation
2. Develop an application for Image Enhancement
3. Develop an application for Image Restoration
4. Develop an application for Edge Detection
5. Develop an application for Image Segmentation
6. Develop an application for Image Compression
7. Develop an application for Color Image Processing
8. Develop an application for Video enhancement
9. Develop an application for Video Restoration
10. Develop an application for Motion detection and Segmentation in videos

### 3. SPECIFIC LEARNING OUTCOMES

Topic	Topic Learning Outcomes	Level
Image Transformation	Apply the image transformation on grayscale images	K4
Image Enhancement	Design the applications for image enhancement techniques	K6
Image Restoration	Develop the algorithms for Image filters	K6
Edge Detection	Construct the edge detection techniques for color and grayscale images	K6
Image Segmentation	Design the applications for image segmentation methods	K6
Image Compression	Develop the algorithms for Image compression	K6
Color Image Processing	Construct the methods for colour image processing operations	K6
Video enhancement	Design the applications for Video enhancement techniques	K6
Video Restoration	Develop the algorithms for Video filters	K6
Motion detection and Segmentation in videos	Construct the Motion detection techniques for Videos	K6

### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS3P5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	L

## **5. ASSESSMENT METHODS**

### **DIRECT**

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

### **INDIRECT**

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. P. S. Eliahim Jeevaraj**

## TEXT AND WEB MINING LAB

**SEMESTER: III**

**Code: P18CS3P6**

**HOURS/WEEK : 5**

**CREDITS : 3**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Ex. No.
CO1	Apply NLP preprocessing methods to text and web data	K5	1,2,3
CO2	Implement IR models including Vector space mode	K6	4,5
CO3	Evaluate the effectiveness of IR systems using Precision, recall	K6	6
CO4	Develop text classification system using ML methods	K6	7
CO5	Develop a sentiment analysis systems for real world use cases	K6	8
CO6	Develop a recommender systems for real world use cases	K6	9, 10

### 2. SYLLABUS

1. [NLP Preprocessing]: Read a text file from local directory. Tokenize the text, remove all the special character then apply Stemming, Lemmatization. Write result to an output file.
2. [Word Features]: Read a text file from local directory. Apply all text processing methods. Identify the features such as Unigrams, Bigrams, Trigrams and Ngram and further plot their frequency distribution.
3. [TFIDF]: Read a text file from local directory. Consider each line in the text file as a document. Apply all text processing methods. For each document (i.e. each line) compute the TFIDF vector and print to a file.
4. [Boolean Model]: Read a text file from local directory. Consider each line in the text file as a document. Apply all text processing methods. Build a Boolean model for the documents (i.e. each line). For a query text rank each document in the file using similarity measures such as dot product, cosine similarity etc. Print the top ranked documents as result.
5. [Vector Space Model]: Read a text file from local directory. Consider each line in the text file as a document. Apply all text processing methods. Build TFIDF matrix for the documents (i.e. each line). For a query text rank each document in the file using similarity measures such as dot product, cosine similarity etc. Print the top ranked documents as result.
6. [Evaluation]: For a given query text, compute relevant set of documents with ranking (either using W5 or manually given ranks and documents). Compute the following evaluation measures for the retrieval task. Accuracy, Precision, Recall, F-Measure, Confusion Matrix.
7. [Naïve Bayes Text Classification for Ham vs Spam detection]: Populate documents for Ham and Spam. Construct TFIDF vector for documents of documents of Ham vs Spam. Train a Naïve Bayes classification model for the Ham vs Spam detection.
8. [Sentiment analysis of Movie Reviews]: Populate documents for positive and negative reviews of a movie. Classify sentiment using dictionary based approach and also Naïve Bayes classification model for review classification.
9. [Content based recommender system for Library]: Create a user profile with user preferred keywords related to books. Create descriptions about books with different tags. Recommend new books to the user based on content based filtering.
10. [Collaborative Filtering using kNN for Music Recommendation]: Create an incident matrix with users and their ratings for music they listened to. Build a collaborative filtering using KNN for recommending music to new/existing users.

### 3. SPECIFIC LEARNING OUTCOMES

S.No.	Exercise List	Level
1	Apply the NLP pre-processing on data set	K6
2	Develop a program for extracting the Word Feature	K6
3	Design a model to compute the TFIDF	K6
4	Develop a Boolean Model for Text Mining	K6
5	Design a Vector Spaces Model for Text Mining	K6
6	Evaluate the models using Retrieval metrics	K6
7	Construct a Naïve Bayes Text Classification for Ham vs Spam detection	K6
8	Design a Sentiment analysis of Movie Reviews	K6
9	Develop a Content based recommender system for Library	K6
10	Design a Collaborative Filtering using kNN for Music Recommendation	K6

### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS3P6	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H		H					H		M	
CO2	H	M	M	M	H	H							
CO3	H	H	H	H	M	L	M		H	M	H	L	
CO4	H	H	M	L	H	H		H	M	H	M	M	H
CO5	H	H		H	H		H	H	H	H	H	M	H
CO6	H		H	H	H		H	H	H	H	H	H	H

### 5. ASSESSMENT METHODS

#### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

#### INDIRECT

1. Course end survey (Feedback)

Name of the Course Coordinator: **Dr. B. Satheesh Kumar**

## ELECTIVE 3a: BLOCK CHAIN AND CRYPTO-CURRENCIES

**SEMESTER: II**  
**CREDITS: 4**

**CODE: P18CS2:3**  
**HOURS/WEEK: 4**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
1	Perceive the role cryptography plays in securing block chain based cryptocurrencies	K5	I
2	Analyze transactions and operations on block chains and smart contracts required to plan more robust financial systems	K4	II
3	Discuss how emerging block chain and cryptocurrencies ecosystems are set to impact economies, finance, government and regulation	K5	III
4	Examine the technologies behind block chain and explore their application in the business context	K4	IV
5	Design, build and deploy smart contracts and distributed applications	K5	V
6	Elaborate the intrinsic value of leading cryptocurrencies, Bitcoin and Ethereum	K6	V

### 2. A. SYLLABUS

#### Unit-1

Introduction to Cryptocurrencies: Cryptographic hash functions – Hash pointers and data structures: Block chain, Merkle trees, Proof of membership and nonmembership – Digital signatures: ECDSA algorithm - Public keys and identities – Simple cryptocurrencies. Decentralization in Bitcoin: Centralization vs decentralization – Distributed consensus algorithm – Implicit consensus algorithm – Incentive mechanisms: Block reward, transaction fee – Mining and proof of work

#### Unit-2

Mechanics of Bitcoin: Transactions – Scripts – Applications of Bitcoin scripts – Bitcoin blocks – Bitcoin network – Limitations of Bitcoin protocol. Storing Bitcoins: Local storage – Hot and cold storage – Splitting and sharing keys – Online wallets and exchanges – Payment services – Transaction fees – Trading Bitcoins

#### Unit-3

Bitcoin Mining: Tasks of Bitcoin miners – CPU mining – GPU mining – Mining incentives and strategies. Bitcoin Anonymity: Anonymity basics – Deanonimize Bitcoins – Mixing – Decentralized mixing – Zerocoin and Zerocash. Bitcoin Community, Politics and Regulation: Consensus in Bitcoin – Stakeholders – Governments interaction with Bitcoin – Anti money laundering – Regulations

#### Unit-4

Bitcoin as a Platform: Bitcoin as append only log – Bitcoin as smart property – Secure multiparty lotteries – Generating random numbers using Bitcoin – Implementing prediction markets using cryptocurrencies.

#### Unit-5

Altcoins: Launching Altcoin and Initial allocation – Few Altcoins – Relationship with Bitcoin – Altcoin infanticide an merge mining – Atomic cross swap chain protocol – Ethereum and smart contracts - Future of Bitcoin

### B. TOPICS FOR SELF STUDY

- Bitcoin and Anonymity
- Alternative Mining Puzzles
- Altcoins and the Cryptocurrency Ecosystem
- Future of Bitcoins



### C. TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Cryptocurrency Technologies. Princeton University Press, 2016. ISBN 978-0691171692

### D. REFERENCES

1. Andreas Antonopoulos. Mastering Bitcoin: Programming the open block chain. Oreilly Publishers, 2017. ISBN 978-9352135745

### E. Web Links

- <https://www.coursera.org/learn/cryptocurrency>
- <https://www.edx.org/learn/blockchain>
- <https://online.stanford.edu/courses/soe-xcs0001-blockchain-and-cryptocurrency-what-you-need-know>

### 3. SPECIFIC LEARNING OUTCOMES

Unit	Contents	Learning Outcomes	Level
<b>I</b>	<b>Introduction to Cryptocurrencies</b>		
1.1	Cryptographic hash functions	Explain the three properties, namely collision resistant, hiding and puzzle friendliness	K5
		Compare message digest and SHA-256	
1.2	Hash pointers and data structures: Block chain and Merkle trees	Demonstrate the structure of a block chain and why it is better than a simple distributed database	K2
		Construct the Merkle trees and verify proofs using JavaScript	K3
		Evaluate the setting where a block chain based structure may be applied, its potential and its limitations	K5
1.3	Proof of membership and nonmembership	Distinguish between proof of membership and nonmembership	K4
	Digital signatures: ECDSA algorithm	Explain digital signatures and how does a digital signature work?	K5
		Explain how does the block chain make use of digital signatures?	K5
		Compare ECDSA algorithm with MD5 algorithm	K5
1.4	Public keys and identities	Demonstrate how public keys are used as identities	K2
		Explain the decentralized identity management	
1.5	Simple cryptocurrencies	Distinguish between Goofycoin and Scroogecoin	K4
<b>Decentralization in Bitcoin</b>			
1.6	Centralization vs decentralization	Compare and contrast centralization vs decentralization	K2
1.7	Distributed consensus algorithm – Implicit consensus algorithm	Explain Bitcoin’s consensus mechanism	K5
		Compare distributed consensus and implicit consensus algorithms	K5
1.8	Incentive mechanisms: Block reward, transaction fee	Analyze the incentive mechanisms in a block chain-based system and critically assess its functions, benefits and vulnerabilities	K4
		Distinguish between block reward and transaction fee	K5

1.9	Mining and proof of work	Outline the differences between proof of work and proof of stake consensus	K2
<b>II Mechanics of Bitcoin</b>			
2.1	Transactions – Scripts – Applications of Bitcoin scripts	Analyze how the individual components of the Bitcoin protocol make the whole system works: transaction, scripts and peer-to-peer network	K4
		Use the applications of Bitcoin scripts in real world scenarios	K3
		Apply the commonly used script instructions in transactions	K3
2.2	Bitcoin blocks	Explain in detail about Bitcoin blocks	K5
2.3	Bitcoin network	Analyze the size of the Bitcoin network and storage requirements	K4
		Explain the function of a lightweight node within a block chain network	K5
2.4	Limitations of Bitcoin protocol	Summarize the limitations of the Bitcoin protocol	K2
<b>Storing Bitcoins</b>			
2.5	Local storage – Hot and cold storage	Examine the different ways of storing Bitcoin keys	K4
		Compare hot storage with cold storage	K5
2.6	Splitting and sharing keys	Identify how the secret sharing method works?	K3
2.7	Online wallets and exchanges	Distinguish online wallets from Bitcoin exchanges	K4
		Explain the three types of risks involved	K5
2.8	Payment services	Elaborate the steps involved in the payment process	K6
		Examine the security issues that may occur during the payment process	K4
2.9	Transaction fees	Discuss the practical details of how transaction fees are set in Bitcoin today	K6
2.10	Trading Bitcoins	Analyze security measures and various types of services that allow people to trade and transact with bitcoins	K4
<b>III Bitcoin Mining</b>			
3.1	Tasks of Bitcoin miners	Summarize the tasks of Bitcoin miners	K2
		Analyze how Bitcoin transactions are validated by miners	K4
		Explain the business model for miners and what impact do they have on the environment?	K5
3.2	CPU mining – GPU mining	Compare CPU mining with GPU mining	K2
3.3	Mining incentives and strategies	Interpret how block chain is incentivized without any central controlling or trusted agency	K5
		Examine the various strategies that miners apply in order to gain more profit	K4
<b>Bitcoin Anonymity</b>			
3.4	Anonymity basics	Explain the role of anonymity and privacy in Bitcoin ecosystem	K5
3.5	Deanonymize Bitcoins	Analyze whether it is possible to deanonymize bitcoins and trace transactions	K4
3.6	Mixing	Discuss how online wallets are used as mixes	K6
		Elaborate the set of guidelines for improving the way that mixes operate	K6
3.7	Decentralized mixing	Explain how decentralized mixing eliminates mixing services and replaces them with a peer-to-peer protocol	K5

3.8	Zerocoin and Zerocash	Distinguish between zerocoin and zerocash	K4
		Explain minting of zerocoins	K2
<b>Bitcoin Community, Politics and Regulation</b>			
3.9	Consensus in Bitcoin	Discuss the three kinds of consensus in order for Bitcoin to be successful	K6
3.10	Stakeholders	Examine who are all the stakeholders and who is in charge of Bitcoin	K4
3.11	Governments interaction with Bitcoin	Elaborate the lessons learned from Silk Road	K6
3.12	Anti-money laundering	Outline the goal of anti-money laundering rules	K2
		Summarize the laws regarding “know your customer”	K2
3.13	Regulations	Predict the role regulations play in Bitcoin	K6
		Determine how to fix a lemons market	K5
<b>IV</b>	<b>Bitcoin as a Platform</b>		
4.1	Bitcoin as append only log	Explain about the secure timestamping and applications of timestamping in Bitcoin	K5
		Discuss the attacks on proof of clairvoyance and overlay currencies	K6
4.2	Bitcoin as smart property	Demonstrate the need of adding authenticated metadata to currency	K2
		Show in what ways colored coins differ from Bitcoins	K2
		Elaborate the uses of colored coins and smart property	K6
4.3	Secure multiparty lotteries	Solve the problem of coin flipping by making use of random numbers	K6
		Analyze how fairness property is applied in Bitcoin transaction	K4
4.4	Generating random numbers using Bitcoin	Examine how to generate randomness using Bitcoin	K4
4.5	Implementing prediction markets using cryptocurrencies	Explain what constitutes a “prediction market”, what are its legal implications and what it can and cannot do, now and in the near future	K5
		Discuss about how to build a decentralized prediction market	K6
		Examine how arbitration can be done in a decentralized way	K4
<b>V</b>	<b>Altcoins</b>		
5.1	Launching Altcoin and Initial allocation	Elaborate the reasons for launching Altcoins	K6
		Identify the process involved in the launching an altcoin	K3
		Determine the concept of Altcoins and the interaction between Bitcoin and Altcoins	K5
5.2	Few Altcoins	Compare Namecoin, Litecoin and Dogecoin	K5
5.3	Relationship with Bitcoin	Analyze the various metrics involved in order to calculate the impact of different altcoins	K4
		Interpret the Bitcoin-Altcoin interactions from economic point of view	K5
5.4	Altcoin infanticide and merge mining	Outline the concept of Altcoin infanticide	K2
		Design an altcoin so that it mines blocks both on the altcoin and on bitcoin at the same time?	K6
5.5	Atomic cross-chain swap protocol	Discuss whether there is any way to swap one type of coin for another	K6
		Examine how the atomic cross-chain swap protocol works	K4

5.6	Ethereum and smart contracts	Analyze to what extent smart and self-executing contracts can benefit automation, governance, transparency and the Internet of Things (IOT)	K4
		Determine how to attain awareness of the new challenges that exist in monetizing businesses around block chains and smart contracts	K5
		Explain the design principles of Bitcoin and Ethereum	K2
5.7	Future of Bitcoin	If decentralization is technically possible, discuss how it is financially sensible and beneficial to society	K6
		Elaborate how security is achieved and how do mediators become trustworthy?	K6

#### 4. MAPPING SCHEME (CO, PO & PSO)

P18CS2:3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	L

#### 5. ASSESSMENT METHODS

##### DIRECT:

5. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
6. Open Book Test.
7. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
8. Pre-Semester & End Semester Theory Examination

##### INDIRECT:

2. Course end survey (Feedback)

**Name of the Course Coordinator: Prof. V. Bhuvaneshwari**

## CORE X: NEURAL NETWORKS AND DEEP LEARNING

**SEMESTER: IV**  
**CREDITS: 4**

**CODE: P18CS410**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Develop a simple Neural Network for the given problem	K4	I
CO2	Perform training and evaluation using various metrics	K5	II
CO3	Design NEAT network	K4	III
CO4	Design and develop convolutional neural network	K5	IV
CO5	Develop the algorithms for pruning the CNN	K5	V
CO6	Design and develop recurrent neural network	K6	V

### 2. A. SYLLABUS

#### Unit I : Neural Network Part-I

Background: Typical NN, NN Structure, XOR example for NN input and output, Training, Car – Database example – Neurons and Layers – Types of Neurons – Activation Functions – Rectified Linear Units Activation Functions – Logic Programming with NN – Self Organizing Maps – Neighbourhood Functions – Hopfield Network – Training a Hopfield Network.

#### Unit II : Neural Network Part-II

Boltzmann Machine and Boltzmann Machine Probability – Boltzmann Machine for Traveling – Salesman Problem – Single Output Feed Forward NN – RBF Networks – Data Normalization – Training and Evaluation: Binary Classification, Sensitivity, Specificity, ROC curves – Multi-class Classification: Log loss, Multi class log loss, Means square error – Training with Simulated Annealing – Backpropagation Training: Gradients, Calculating output node delta and error functions.

#### Unit III : Neural Network Part-III

Backpropagation Training: Calculating interior node delta and derivatives of activation functions – Choices for Backpropagation: Batch, Online and Stochastic Gradient Descent Training – Resilient Propagation Training: Arguments and data structures – Resilient Propagation Training: Steps in the training process – Levenberg–Marquardt Training: Algorithm – Levenberg–Marquardt Training: Calculation of the Hessian – Levenberg–Marquardt Training: With multiple outputs and Overview of LMA process – NEAT Networks: Concepts – NEAT Networks: NEAT Mutation – NEAT Crossover.

#### Unit IV : Deep Learning Part-I

Deep Learning Features or Components – Deep Learning Tools – Comparison of NN and DBNN – Deep Belief Neural Networks architecture – Implementing DBNN with Restricted Boltzmann Machine – Training DBNN: Steps, Layer wise sampling, Computing positive and negative gradients, Updating weights and bias – Deep Belief Classification Example – Convolutional Neural Networks: LeNET-5, Convolutional layer – Convolutional Neural Networks: Max-Pool layer and Dense layer.

#### Unit V : Deep Learning Part-II

Pruning: connections, neurons, algorithm for pruning – Model Selection: Grid Search model selection – Model Selection: Random Search model selection, Other model selections – L1 Regularization – L2 Regularization – Dropout Regularization – Simple Recurrent Neural Networks: Context Neuron, Context Layer – Architecture of SRN: Elman SRN, Jordon SRN; – Training SRN: Backpropagation through time – Architecting Neural Network: Training parameters, Hyper Parameters.

### B. TOPIC FOR SELF STUDY

- GoogleNet
- ResNet, Optimisers: Momentum Optimiser
- Momentum and Nesterov Accelerated Gradient (NAG) Optimiser
- Adagrad Optimiser

### C. TEXT BOOK(S)

1. Jeff Heaton, “*Artificial Intelligence for Humans*”, Volume 3: Neural Networks and Deep Learning, Heaton Research Inc, 2015

### D. REFERENCES BOOK(S)

1. Kevin Gurney, “*An Introduction to Neural Networks*”, UCL Press, 1997
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016, (<http://www.deeplearningbook.org>)

### E. WEB LINKS

- <https://nptel.ac.in/courses/106/105/106105215/>)
- <https://www.coursera.org/learn/neural-networks-deep-learning>
- <https://www.deeplearning.ai/program/deep-learning-specialization/>

### 3. SPECIFIC LEARNING OUTCOMES

Unit	Topics	Learning Outcomes	Level
<b>I</b>	<b>Neural Networks -I</b>		
<b>1.1</b>	Typical NN, NN Structure, XOR example for NN input and output, Training, Car – Database example – Neurons and Layers	Defines the Typical Neural Networks with input and output examples along with Neurons and Layers	<b>K3</b>
<b>1.2</b>	Types of Neurons – Activation Functions – Rectified Linear Units Activation Functions – Logic Programming with NN	Explains the neuron types and the activation functions	<b>K3</b>
<b>1.3</b>	Self Organizing Maps – Neighbourhood Functions – Hopfield Network – Training a Hopfield Network.	Identifying the Neural maps and describes about the Hopfield Networks	<b>K4</b>
<b>II</b>	<b>Neural Networks -II</b>		
<b>2.1</b>	Boltzmann Machine and Boltzmann Machine Probability – Boltzmann Machine for Traveling – Salesman Problem – Single Output Feed Forward NN – RBF Networks – Data Normalization	i) Detailed explanation and the Applications of th Boltzmann machine and the travelling sales man problem  ii) Utilizing the Data Normalization and its various phases.	<b>K3</b>
<b>2.2</b>	Training and Evaluation: Binary Classification, Sensitivity, Specificity, ROC curves	Describes the evaluation and classification methods of NN	<b>K3</b>
<b>2.3</b>	Multi-class Classification: Log loss, Multi class log loss, Means square error – Training with Simulated Annealing	Dealing with the classification types especially log loss and the simulated annealing	<b>K3</b>
<b>2.4</b>	Backpropagation Training: Gradients ,Calculating output node delta and error functions.	Describes about the Back propagation method	<b>K3</b>
<b>III</b>	<b>Neural Networks -III</b>		
<b>3.1</b>	Backpropagation Training: Calculating interior node delta and derivatives of activation functions	Explains the activation functions through the back propagation training.	<b>K4</b>
<b>3.2</b>	Choices for Backpropagation: Batch, Online and Stochastic Gradient Descent Training	Defines the various types of Back propagation techniques	<b>K3</b>
<b>3.3</b>	Resilient Propagation Training: Arguments and data structures, Resilient Propagation Training: Steps in the training process	Illustrating the various Resilient propagation training methods	<b>K4</b>
<b>3.4</b>	Marquardt Training: Algorithm, Levenberg, Marquardt Training: Calculation of the Hessian, Levenberg, Marquardt Training: With multiple outputs and Overview of LMA process	Detailed description of the Marquardt training and the algorithm with various examples & Applications.	<b>K3</b>

3.5	NEAT Networks: Concepts – NEAT Networks: NEAT Mutation – NEAT Crossover	Various perspective of the NEAT method in detail.	<b>K3</b>
<b>IV</b>	<b>Deep Learning - I</b>		
4.1	Deep Learning Features or Components, Deep Learning Tools, Comparison of NN and DBNN, Deep Belief Neural Networks architecture, Implementing DBNN with Restricted Boltzmann Machine	Thorough look of Deep learning algorithm and the various levels, architecture of Deep Learning.	<b>K4</b>
4.2	Training DBNN: Steps, Layer wise sampling, Computing positive and negative gradients, Updating weights and bias, Deep Belief Classification Example	Next level of DBNN with classification examples	<b>K3</b>
4.3	Convolutional Neural Networks: LeNET-5, Convolutional layer, Convolutional Neural Networks: Max-Pool layer and Dense layer.	Describes the convolutional NN and its layer.	<b>K4</b>
<b>V</b>	<b>Deep Learning - II</b>		
5.1	Pruning: Connections, neurons, algorithm for pruning, Model Selection: Grid Search model selection	Detailed explanation of pruning and its methodologies	<b>K3</b>
5.2	Model Selection: Random Search model selection, Other model selections – L1 Regularization – L2 Regularization – Dropout Regularization	Evaluating the different kinds of Model selection	<b>K4</b>
5.3	Simple Recurrent Neural Networks: Context Neuron, Context Layer – Architecture of SRN: Elman SRN, Jordon SRN;	Explains the Architecture of Simple Recurrent Neural Networks.	<b>K4</b>
5.4	Training SRN: Back propagation through time – Architecting Neural Network: Training parameters, Hyper Parameters.	Details of the Simple Recurrent Neural Network training.	<b>K4</b>

#### 4. MAPPING SCHEME (CO, PO & PSO)

<b>P18CS410</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	L

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. M. Newbegin**

## CORE XI: COMPUTER AND NETWORK SECURITY

**SEMESTER: IV**  
**CREDITS: 4**

**CODE: P18CS411**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Classify various of attacks	K2	I
CO2	Examine a variety of algorithm	K4	II
CO3	Apply the concepts of Encryption and decryption messages using block chippers and sign.	K3	III
CO4	Create digital signature using various algorithms.	K6	IV
CO5	Classify web security, intruders, viruses and firewalls	K4	V
CO6	Analyze Various Security Services	K5	V

### 2. A. SYLLABUS

#### Unit I : Symmetric Ciphers

Introduction: Overview of security concepts - Overview of Symmetric cryptography - General model for Symmetric encryption -Examine a variety of algorithm[Monoalphabetic, Polyalphabetic] - Look briefly a different approach known as Steganography - Principles of modern Symmetric Cipher(DES) - DES example and strength - Overview of general structure of AES, Transformation function - AES key expansion,AES Example, Implementation - Analyse the security of encryption Scheme(Dpublic DES, Triple DES) - Compare the content ECB,CBC, CFB, OFB and counter Model of operation.

#### Unit II : Asymmetric Ciphers and Public key Crpteograh, Data Integrity

Key concept to Prime numbers, Fermat's Theorem - Euclers Theorem, Testing of primality Chinis Remainder Theorm - Overview of the basic principle of public key Cryptography - RSA algorithm - Diffie Hell Mon key exchange(PKCS) - Eligamal cryptograph y System - Application of nCryptographic HASH function(Message authentication, Digital Signature) - Two (b simple Hash function Bit by Bit XOR, SHA Hash function based Cipher block Chaning) - SHA

#### Unit III :Message Authentication and Digital Signature

Introduction to the requirement of Message authentication - Digital signature - HMAC,MAC based of Block cipher DAA, CMAC - Authentication Encryption CCM and GCM - Key wrapping and unwrapping algorithm - Pseudo Random number generation using Hash functions - PRNG on MAC function, PRNG based on Hash and MAC - Digital Signature requirements, Elgamal DS - Schnorr Digital Signature NIST Signature(DSA approach) - Elliptic Curve DSA - RSA-PSS Digital Signature algorithm.

#### Unit IV : Key management and Distribution user authentication

Symmetric Key Distribution using Encryption – Symmetric Key distribution using asymmetric key encryption – Distribution of Public Keys – X.509 certificates – PKI-PKIX management function, Protocols – Remote user authentication principle, Remote user authentication using symmetric encryption – Kerberos- version 4 – Kerberos version 5 – Federated Identity Management - Remote user authentication using asymmetric encryption, Personal Identity Verification.

#### Unit V : Network and Internet Security

Network access model, Extensible authentication Protocol - IEEE802.1X port based network access control - Cloud computing - Cloud secutiry,Risks and counter measures - Cloud security as a service - Transport level security-web security, SSL - TLS, HTTP - SSH , wireless security Electronic mail security, Pretty good privacy - IP security overview, policy.

### B. TOPICS FOR SELF STUDY

- Cryptoanalysis
- Memory Trade off Attack
- Differential Cryptoanalysis
- Linear Cryptoanalysis



### C. TEXT BOOK(S)

1. *“Cryptography and network security”*: William Stallings, Pearson Edition 6<sup>th</sup> Edition,2016.

### D. REFERENCE BOOK(S)

1. *“Cryptography-Made-Simple”*:Nigel.P. Smart.

### E. WEB LINKS

- <https://alison.com/courses/network-and-security>
- <https://www.coursera.org/courses?query=network%20security>
- <https://www.edx.org/learn/network-security>

### 3. SPECIFIC LEARNING OUTCOMES:

Unit	Contents	Learning Outcomes	Level
<b>1</b>	<b>Symmetric Ciphers</b>		
1.1	Overview of security concepts	Understand the concepts of security	[K1]
1.2	Examine a variety of algorithm	Examine the variety of algorithms like Monoalphabetic, Polyalphabetic	[K4]
1.3	Analyze the security of encryption Scheme	Analyze the security of encryption scheme such as Dpublic DES, Triple DES	[K4]
<b>2</b>	<b>Asymmetric Ciphers and Public key Cryptography, Data Integrity</b>		
2.1	Key concept to Prime numbers	Recall key concepts of Prime Numbers and Define Various thermos	[K1]
2.2	Overview of the basic principle of public key Cryptography	Categorize the public key cryptography algorithms based on their basic principles	[K4]
2.3	Application of Cryptographic HASH function	Evaluate the applications of cryptographic hash functions	[K5]
<b>3</b>	<b>Message Authentication and Digital Signature</b>		
3.1	Introduction to the requirement of Message authentication	Explain the requirements of Message authentication	[K5]
3.2	Key wrapping and unwrapping algorithm	Classify Key wrapping and unwrapping algorithms	[K2]
3.3	Digital Signature requirements	Elaborate the concepts of Digital Signature Requirements	[K6]
<b>4</b>	<b>Key management and Distribution user authentication</b>		
4.1	Symmetric Key Distribution	Explain Symmetric Key Distributions	[K5]
4.2	Distribution of Public Keys	Classify Distribution of public keys	[K3]
4.3	Remote User Authentication	Analyze Remote User Authentication using symmetric and asymmetric encryptions	[K4]
<b>5</b>	<b>Network and Internet Security</b>		
5.1	Network access model, Extensible authentication Protocol	Explain the Network access Model and Extensible authentication protocol	[K4]
5.2	Cloud computing	Evaluate Cloud security, Risks and counter measures	[K5]

<b>5.3</b>	Cloud security, Transport level security, web security, wireless security and IP security	Elaborate the concepts of Cloud security, Transport level security, web security, wireless security and IP security	[K6]
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#### 4. MAPPING SCHEME (CO, PO & PSO)

<b>P18CS411</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	M

#### 5. ASSESSMENT METHODS

##### DIRECT

1. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
2. Open Book Test.
3. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
4. Pre-Semester & End Semester Theory Examination

##### INDIRECT

1. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. G. Sobers Smiles David**

## ELECTIVE 5a: SUPPLY CHAIN MANAGEMENT

**SEMESTER: IV**  
**CREDITS: 4**

**CODE: P18CS5:1**  
**HOURS/WEEK: 5**

### 1. COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO #	Course Outcomes	Level	Unit Covered
CO1	Understand the importance of good supply chain design, planning and operation	K4	I
CO2	Apply strategic drivers and metrics of supply chain performance	K5	II
CO3	Design Supply Chain Network	K4	III
CO4	Plane and manage demand and supply and inventories	K5	IV
CO5	Design Transportation Networks	K5	V
CO6	Explore opportunities in Logistics and related industries	K6	V

### 2. A. SYLLABUS

#### Unit I : Building strategic framework

Supply chain: Definition, 3 streams of knowledge, objectives and importance - Decision phases and process views of a supply chain (SC) - Examples of supply chain - Competitive strategy and SC strategy - 3 steps of achieving strategic fit - Improving SC performance by expanding scope of strategic fit, challenges to achieving strategic fit - Financial measures and drivers of SC performance - Logistical drivers: Roles in SC and decision components - Cross functional drivers: Roles in SC and decision components - Role of infrastructure in SC performance.

#### Unit II : Designing SC network

Key factors influencing distribution network design - Design options for a distribution network - Impact of online sales on customer service and cost - Network design decisions: Influencing factors, framework - Capacitated plant location model for network optimization - Gravity location model for network design - Model for demand allocation and locating plants - Global supply chain: Dimensions to evaluate total cost, SC risks, tailored risk mitigation strategies - Discounted cash flow analysis to evaluate network design decision - Decision tree analysis: Basics, Evaluating flexibility at Trip Logistics.

#### Unit III : Planning and coordinating demand and supply

Demand forecasting: role, characteristics, components and methods - Static demand forecasting methods - Adaptive demand forecasting methods - Measures of demand forecasting error - Aggregate planning: role, identifying aggregate units, strategies - Aggregate planning using Linear programming - Managing supply and demand to improve synchronization in SC - Lack of SC coordination: Bullwhip effect, effect on performance - Obstacles to coordination in SC - Managerial levers to achieve coordination of demand and supply in SC.

#### Unit IV : Planning and managing inventories

Cycle inventory terminologies: Lot size, Average flow time, Inventory holding cost, Ordering cost - Computing optimal lot size for single product: Economic order quantity, for Production environment, with Capacity constraint - Lot size based discount schemes: All unit quantity discounts, Marginal unit quantity discount - Trade promotions: Goals, Forward buying, Impact on lot size and cycle inventory - Factors affecting the level of safety inventory - Evaluating required safety inventory: Given a replenishment policy, Desired cycle service level, Desired fill rate - Impact of desired product availability and uncertainty on safety inventory - Impact of supply uncertainty on safety inventory - Factors affecting optimal level of product availability - Managerial levers of inventory to improve SC profitability.

#### Unit V : Transportation and cross functional drivers

Modes of transportation in SC - Design options for a transportation network - Transportation and inventory cost trade off - Transportation cost and customer responsiveness trade off - Tailored transportation - Sourcing decisions: In house or Outsource - Sharing risk and reward in SC - Pricing and revenue management for multiple customer segments - Pricing and revenue management for perishable assets - Pricing and revenue management for seasonal demand.

### B. TOPICS FOR SELF STUDY

- Analytical Hierarchy Processing (AHP) Method
- Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) Method
- Forecasting Simple and Weighted Average Mean Square Error.
- Forecasting Trend Holt's and Winters Method

### C. TEXT BOOK(S)

1. Sunil Chopra, Peter Meindl and DV Karla. *“Supply Chain Management: Strategy, planning and operation”*, 6<sup>th</sup> edition, Pearson, 2016. ISBN 978-9332548237 (Excluding Excel Examples )

#### D. REFERENCES BOOK(S)

1. David Simchi-Levi and Philip Kaminsky. *“Designing and managing the supply chain: Concepts, strategies and case studies”*, 3<sup>rd</sup> edition, McGraw Hill, 2007.

#### E. WEB LINKS

- <https://nptel.ac.in/courses/110/105/110105141/>
- <https://www.coursera.org/courses?query=supply%20chain>
- <https://www.udemy.com/course/supply-chain-management-for-beginners/>

#### 3. SPECIFIC LEARNING OUTCOMES

Unit	Contents	Learning Outcomes	Level
<b>I</b>	<b>Building Strategic Framework</b>		
1.1	Supply chain: Definition, 3 streams of knowledge, objectives and importance - Decision phases and process views of a supply chain (SC) - Examples of supply chain	Define and Explain Supply Chain and its phases.	K2
1.2	Competitive strategy and SC strategy: 3 steps of achieving strategic fit - Improving SC performance by expanding scope of strategic fit, challenges to achieving strategic fit - Financial measures and drivers of SC performance	Explain SC Strategy and explain strategic fit.	K2
1.3	Logistical drivers: Roles in SC and decision components	Analyze the roles and decision components.	K4
1.4	Cross functional drivers: Roles in SC and decision components - Role of infrastructure in SC performance	Summarizing cross functional drivers.	K2
<b>II</b>	<b>Designing SC Network</b>		
2.1	Key factors influencing distribution network design: Design options for a distribution network - Impact of online sales on customer service and cost	Explain key factors influencing distribution network design.	K2
2.2	Network design decisions: Influencing factors, framework - Capacitated plant location model for network optimization - Gravity location model for network design - Model for demand allocation and locating plants	Analyse Network design decisions.	K4
2.3	Global supply chain: Dimensions to evaluate total cost, SC risks, tailored risk mitigation strategies - Discounted cash flow analysis to evaluate network design decision	Estimate Total cost. Analyse Global supply chain risk.	K6
2.4	Decision tree analysis: Basics, Evaluating flexibility at Trip Logistics		
<b>III</b>	<b>Planning and coordinating demand and supply</b>		
3.1	Demand forecasting: role, characteristics, components and methods - Static demand forecasting methods - Adaptive demand forecasting methods - Measures of demand forecasting error	Define and explain Demand forecasting	K2
3.2	Aggregate planning: role, identifying aggregate units, strategies - Aggregate planning using Linear programming -	Estimate Aggregate Planning	K6

	Managing supply and demand to improve synchronization in SC		
3.3	Lack of SC coordination: Bullwhip effect, effect on performance - Obstacles to coordination in SC	Explain Lack of SC coordination	K2
3.4	Managerial levers to achieve coordination of demand and supply in SC	Explain Managerial levers to achieve coordination of demand and supply in SC	K2
<b>IV</b>	<b>Planning and managing inventories</b>		
4.1	Cycle inventory terminologies: Lot size, Average flow time, Inventory holding cost, Ordering cost	Estimate Average flow time, Inventory holding cost and Ordering cost	K6
4.2	Computing optimal lot size for single product: Economic order quantity, for Production environment, with Capacity constraint	Measure economic order quantity.	K5
4.3	Lot size based discount schemes: All unit quantity discounts, Marginal unit quantity discount	Explain discount schemes	K2
4.4	Trade promotions: Goals, Forward buying, Impact on lot size and cycle inventory - Factors affecting the level of safety inventory	Analyse the factors affecting the levels of safety inventory	K4
4.5	Evaluating required safety inventory: Given a replenishment policy, Desired cycle service level, Desired fill rate - Impact of desired product availability and uncertainty on safety inventory - Impact of supply uncertainty on safety inventory - Factors affecting optimal level of product availability	Explain how to evaluate safety inventory.	K2
4.6	Managerial levers of inventory to improve SC profitability	Explain Managerial levers of inventory	K2
<b>V</b>	<b>Transportation and cross functional drivers</b>		
5.1	Modes of transportation in SC - Design options for a transportation network - Transportation and inventory cost trade off - Transportation cost and customer responsiveness trade off - Tailored transportation	Estimate transportation cost in SC	K5
5.2	Sourcing decisions: In house or Outsource - Sharing risk and reward in SC	Explain Sourcing decisions	K2
5.3	Pricing and revenue management for multiple customer segments - Pricing and revenue management for perishable assets - Pricing and revenue management for seasonal demand	Explain Pricing and Revenue Management.	K2

#### 4. MAPPING SCHEME (CO, PO & PSO)

<b>P18CS5:1</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H		M		H	H	H	H	
CO2	H	H	H	H	M		M		H	H	M	H	M
CO3	H	H	H	H	M		M		H	H	M	H	M
CO4	H	H	H	H	M		M		H	H	M	H	M
CO5	H	H	H	H	M		M		H	H	M	H	M
CO6	H	H	H	H	H	M	H	M	H	H	M	H	M

## **5. ASSESSMENT METHODS**

### **DIRECT**

2. Continuous Assessment Test: T1, T2 (Theory & Practical Components): Closed Book
3. Open Book Test.
4. Cooperative Learning Report, Assignment, Group Presentation, Group Discussion, project Report, Field Visit Report, Poster Presentation, Seminar, Quiz (written).
5. Pre-Semester & End Semester Theory Examination

### **INDIRECT**

5. Course end survey (Feedback)

**Name of the Course Coordinator: Dr. J. Persis Jessintha**

## PROJECT

**SEMESTER: IV**  
**Code: P18CS4PJ**

**HOURS/WEEK : ---**  
**CREDITS : 6**

### **COURSE OUTCOMES**

Upon completion of this course, students should be able to:

- Identify and define the problem statement
- Define and justify scope of the proposed problem
- Gather and analyze system requirements
- Propose an optimized solution among the existing solutions
- Practice software analysis and design techniques
- Develop a functional application based on the software design
- Apply coding, debugging and testing tools to enhance the quality of the software
- Construct new software system based on the theory and practice gained
- Prepare proper documentation of software project following the standard guidelines
- Develop technical reporting and oral presentation skills

### **Text Book(s):**

1. Lynn E. Miner & Jeremy T. Miner, *"Proposal Planning and Writing"*, Third Edition, Greenwood Publishing Group, 2003.

### **References Book(s):**

1. William Navidi, *"Statistics for Engineers and Scientists"*, 2nd Edition, McGraw-Hill, 2007.