Course and Examination Scheme
of NEP 2020 Curriculum
B.Tech. CSE Third Year (V Semester & VI Semester)

Bachelor of Technology in
Computer Science & Engineering
(Faculty of Science and Technology)

GONDWANA UNIVERSITY, Gadchiroli
MIDC Road Complex, Gadchiroli
PIN-442 605, (M.S.)

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SEMESTER– V																	
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme									Credit
				Hours per week				Theory Marks						Practical Marks			
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Computer Science and Engineering	STMDMCSE501	Multi-disciplinary Minor-III	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
OE	Computer Science and Engineering	STOECSE502	Open Elective- III	2	-	-	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Computer Science and Engineering	STPCCCSE503	Design and Analysis of Algorithms	3	-	-	3	3	10	10	80	100	40	--	--	--	--	4
PCC	Computer Science and Engineering	STPCCCSE504	Database Management Systems	3	-	-	3	3	10	10	80	100	40	--	--	--	--	4
PCC	Computer Science and Engineering	STPCCCSE505	Object Oriented Programming	3	-	-	3	3	10	10	80	100	40	--	--	--	--	4
PEC	Computer Science and Engineering	STPECCSE506	PEC-I	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE507	Design and Analysis of Algorithms Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Computer Science and Engineering	STPCCCSE508	Database Management Systems Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Computer Science and Engineering	STPCCCSE509	Object Oriented Programming Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
AEC	Computer Science and Engineering	STAECCSE510	Seminar/Mini-Project	-	-	4	4	--	--	--	--	--	--	25	25	50	25	1
Total				**17**	**-**	**10**	**27**	**--**	**55**	**55**	**440**	**550**	**--**	**100**	**100**	**200**	**--**	**24**
Marks Grand Total				**750**														

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SEMESTER–V						
LIST OF OPEN ELECTIVE - III COURSE			**LIST OF PROGRAM ELECTIVES - I**		**LIST OF PROGRAM ELECTIVES – I LAB**	
Sr.	**Course Code**	**Name of the course**	**Course Code**	**Name of the course**	**Course Code**	**Name of the course**
A	STOEMEC502	Operations Research Techniques	STPECCSE506A	Data Mining and Warehousing		
B	STOEETC502	Automotive Electronics	STPECCSE506B	Distributed Systems		
C	STOECSE502	Software Project Management	STPECCSE506C	Social Network Analytics		
D	STOEINS502	Unit Operation and Power Plant Instrumentation				
E	STOECEC502	Remote Sensing and GIS				
F	STOEELE502	Introduction to Smart Grid				

Note:

1. An open elective and Program elective course will be offered if at least 15 students opt for it.
2. If a student opts for Program Elective – I (Serial No. A), they will be eligible only for the corresponding Program Elective – I Lab (Serial No. A); the same applies for serial no. B

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SEMESTER– VI																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Computer Science and Engineering	STMDMCSEC601	Multi-disciplinary Minor-IV	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE602	Computer Networks	3	1	-	4	3	10	10	80	100	40	--	--	--	--	4
PCC	Computer Science and Engineering	STPCCCSE603	Compiler Design	3	-	-	3	2	10	10	80	100	40	--	--	--	--	3
PEC	Computer Science and Engineering	STPECCSE604	PEC-2	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PEC	Computer Science and Engineering	STPECCSE605	PEC-3	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
EMC	Computer Science and Engineering	STEMCCSE606	Enterprise Resource Planning	2	-	-	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Computer Science and Engineering	STPCCCSE607	Computer Networks Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
PEC	Computer Science and Engineering	STPECCSE608	PEC-2 Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
VSEC	Computer Science and Engineering	STVSECCSE609	Soft Skills	-	1	2	3	--	--	--	--	--	--	25	25	50	25	
Total				**17**	**2**	**6**	**25**	**--**	**55**	**55**	**440**	**550**	**--**	**75**	**75**	**150**	**--**	**20**
Marks Grand Total				**750**														

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SEMESTER–VI			
LIST OF PROGRAM ELECTIVES - II		**LIST OF PROGRAM ELECTIVES – II LAB**	
Course Code	**Name of the course**	**Course Code**	**Name of the course**
STPECCSE604A	**Deep Learning**	**STPECCSE608A**	**Deep Learning**
STPECCSE604B	**Real Time Operating System**	**STPECCSE608B**	**Real Time Operating System**
STPECCSE604C	**Digital Forensics**	**STPECCSE608C**	**Digital Forensics**

LIST OF PROGRAM ELECTIVES - III		**LIST OF PROGRAM ELECTIVES – III LAB**	
Course Code	**Name of the course**	**Course Code**	**Name of the course**
STPECCSE605A	**Natural Language Processing**		
STPECCSE605B	**Big Data Analytics**		
STPECCSE605C	**Information Retrieval**		

Note:

1. A Program elective course will be offered if at least 15 students opt for it.
2. If a student opts for Program Elective – II or III (Serial No. A), they will be eligible only for the corresponding Program Elective – II or III Lab (Serial No. A); the same applies for serial no. B

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EXIT CRITERIA FOR BACHELOR DEGREE IN VOCATION (AFTER THIRD YEAR)																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
PCC	Computer Science & Engineering	STEXCSE412	Certified Network Engineer (CISCO, CCNA)	--	--	16	16	--	--	--	--	--	--	200	--	200	100	8
OR																		
PCC	Computer Science & Engineering	STEXCSE413	Certified Cloud Engineer (AWS, AZURE)	--	--	16	16	--	--	--	--	--	--	200	--	200	100	8
Total				**--**	**--**	**16**	**16**	--	--	--	--	--	--	**200**	**--**	**200**	**--**	**8**
Marks Grand Total				**200**														

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	OPEN ELECTIVE -III
A	STOEMEC502 Operations Research Techniques
B	STOEETC502 Automotive Electronics
C	STOECSE502 Software Project Management
D	STOEINS502 Unit Operation and Power Plant Instrumentation
E	STOECEC502 Remote Sensing and GIS
F	STOEELE502 Introduction to Smart Grid

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LIST OF MULTI DICIPLINARY MINOR COURSES (MDM BASKET)

Name of Minor Course	Computer Science and Engineering
	TRACK-I Data Science
Multi-disciplinary Minor -I	STMDMCSE301 Introduction to Data Science
Multi-disciplinary Minor -II	STMDMCSE401 Tools for Data Science
Multi-disciplinary Minor -III	STMDMCSE501 Data Visualisation and Data Analytics
Multi-disciplinary Minor -IV	STMDMCSE601 Machine Learning
Multi-disciplinary Minor -V	STMDCSEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to vertical column
Multi-disciplinary Minor -VI	STMDMCSE801 Data Science in Practice

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STMDMCSE501

Title of Course: **MDM-III- Data Visualization and Data Analytics**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Learning Objective: This course is designed to introduce the students to real-world data analysis problems, the use of statistics to get a deterministic view of data, and interpreting results in the field of exploratory data science using Python.

Course Outcomes:

At the end of course, students will learn to:

CO1. Apply descriptive statistics to obtain a deterministic view of data.
CO2. Perform data handling using Numpy arrays. Load, clean, transform, merge, and reshape data using Pandas
CO3. To familiarize students with the principles and techniques of data visualization and enable them to design effective visual representations for communicating insights from data.
CO4. Visualize data using Pandas and matplot libraries.
CO5. To equip with the skills to create interactive dashboards, visualize business metrics, apply BI Reporting techniques, and communicate data-driven insights through effective storytelling and domain-specific visualization solutions.

Unit	Content	Hours
1	Introduction to basic statistics and analysis: Fundamentals of Data Analysis, Statistical foundations for Data Analysis, Types of data, Descriptive Statistics, Correlation and covariance, Linear Regression, Statistical Hypothesis Generation and Testing, Python Libraries: NumPy, Pandas, Matplotlib.	9
2	Array manipulation using Numpy: Numpy array: Creating Numpy arrays; various data types of Numpy arrays, indexing and slicing, swapping axes, transposing arrays, data processing using Numpy arrays. Data Manipulation using Pandas: Data Structures in Pandas: Series, DataFrame, Index objects, Loading data into Pandas data frame, Working with DataFrames: Arithmetics, Statistics, Binning, Indexing, Reindexing, Filtering, Handling missing data, Hierarchical indexing, Data wrangling: Data cleaning, transforming, merging and reshaping	9
3	Fundamentals of Data Visualization: Introduction to Data Visualization, Importance and Objectives of Visualization, Visualization Process, Visual Perception, Design Principles, Data Types and Visual Encoding, Choosing Appropriate Charts and Graphs, Storytelling with Data.	9
4	Plotting and Visualization: Using Matplotlib to plot data: figures, subplots, markings, color and line styles, labels and legends, plotting functions in Pandas: Line, bar, Scatter plots, histograms, stacked bars, Heatmap	9

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5.	Dashboard Design and Business Visualization: Dashboard Concepts, KPI Visualization, Dashboard Design Principles, Interactive Dashboards, Business Intelligence and Reporting, Data Storytelling Techniques, Visualization Case Studies in Healthcare, Finance, Marketing and Sales Analytics.	9
	Total	**45**

Textbook

1. McKinney W. Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython, 2nd edition, O'Reilly Media, 2018.
2. Molin S. Hands-On Data Analysis with Pandas, Packt Publishing, 2019.
3.Wes McKinney – Python for Data Analysis.
4.Cole Nussbaumer Knaflic – Storytelling with Data.

Reference Books

1. Chen D. Y. Pandas for Everyone: Python Data Analysis, First edition, Pearson Education, 2018.
2. Miller J.D. Statistics for Data Science, Packt Publishing Limited, 2017.

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: **STOECSE502**
Title of the Course: **Open Elective -III- Software Project Management**

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Period/Week	Credit	Duration in Hours	MSE	IE	ESE	Total
02	00	--	00	02	02	05	05	40	50

Course Objectives/Outcomes: - At the end of this course, students will be able:
CO1 - To understand software project management concepts.
CO2 - To understand Software Processes, Project planning and Project Estimation Techniques.
CO3 - To know the Evaluation of Project and programme management.
CO4 - To know the project monitoring, risk management and control.

Unit	Content	Hrs
I	**Introduction to Software Project Management: -**	8
	What is a Project? Types of Software Projects, Software Project Management Activities, Plans, Methods and Methodology, Project Charter, Stakeholders, Setting Objectives, W5HH Principles, What is Management? Why is Software Project Management important? Contract Management and Technical Project Management, Management Control, Project Management Life Cycle, Project Management Processes, Project Management Standards, Project Success Versus Failure, The Business Case, Traditional Versus Modern Project Management Practices.	
II	**Project Planning: -**	7
	Step wise Project Planning, Selection of an Appropriate Project Approach, Choosing Methodologies and Technologies, Software Processes and Process Models, Structure Versus Speed of Delivery, Agile Methods, Extreme Programming, Scrum, Lean Software Development, Selecting the Most Appropriate Process Model. Software Measurement and Metrics, Project Estimation Techniques.	
III	**Project Evaluation and Programme Management: -**	8
	The Business Case, Feasibility Study, Project Portfolio Management, Evaluation of Individual Projects, Cost-Benefits Evaluation Techniques, Risk Evaluation, Programme Management, Resource Allocation within Programme, Reservations about Programme Management, Benefits Management.	
IV	**Risk Management, Monitoring and Control: -**	7
	Risk, Categories of Risk, Risk Management Approaches, Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Boehm's Top 10 Risks and Counter Measures, Monte Carlo Simulation, Creating the Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Change Control, Software Configuration Management.	
	Total	30

Text/Reference Books:

1. Software Project Management (7th Edition)- Bob Hughes, Mike Cotterell and Rajib Mall, Mc Graw Hill Education.
2. Introduction to Software Project Management, Adolfo Villafiorita, CRC Press
3. Essentials of Projects and Systems Engineering Management - Howard Eisner, Wiley

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE503

Title of Course: Design and Analysis of Algorithm

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	4	3	10	10	80	100

Course Outcomes:

After completing the course, the students will be able;

CO1	Identify various Time and Space complexities of various algorithms
CO2	Understand Tree Traversal method and Greedy Algorithms
CO3	Apply Dynamic Programming concept to solve various problems
CO4	Apply Backtracking, Branch and Bound concept to solve various problems
CO5	Implement different performance analysis methods for non deterministic algorithms

Unit	Content	Hours
I	INTRODUCTION: Algorithm, pseudo code for expressing algorithms, performance analysis-space complexity, time complexity, asymptotic notation- big (O) notation, omega notation, theta notation, recurrences, time complexity, iterative sorting and searching algorithm.	9
II	DIVIDE AND CONQUER: General method, applications-analysis of binary search, quick sort, merge sort. GREEDY METHOD: General method, Applications-job sequencing with deadlines, Fractional knapsack problem, minimum cost spanning trees, Single source shortest path problem, huffman code.	9
III	DYNAMIC PROGRAMMING: General method, applications – LCS, matrix chain multiplication, optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.	9
IV	BACKTRACKING: General method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles. BRANCH AND BOUND: General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.	9
V	NP-HARD AND NP-COMPLETE PROBLEMS: Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes, Cook‘s theorem.	9
	Total	45

Text Books:

1. Ellis Horowitz, Satraj Sahni, Rajasekharam (2007), Fundamentals of Computer Algorithms, 2nd edition, University Press, New Delhi.

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Reference Books:

1. R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.
2. Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson education, New Delhi.
3. Aho, Ullman, Hopcroft (2009), Design and Analysis of algorithms, 2nd edition, Pearson education, New Delhi.

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE504

Title of Course: **Database Management System**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Design conceptual and logical database models using ER and relational models.
CO2	Apply relational algebra and SQL for database query formulation
CO3	Analyze and normalize database schemas using functional dependencies.
CO4	Evaluate transaction management, concurrency control, and recovery mechanisms.
CO5	Apply indexing, query optimization and advanced database concepts to solve real-world problem.

Unit	Content	Hours
I	Introduction to Database Systems and Data Modeling: Introduction to DBMS, File System vs Database System, Database Users and DBA, Three-Schema Architecture Data Independence, Data Models: Hierarchical, Network, Relational, Entity-Relationship (ER) Model Enhanced ER Model, ER-to-Relational Mapping, Keys and Constraints	9
II	Relational Model, Relational Algebra and SQL: Relational Model Concepts, Relational Constraints, Keys: Super, Candidate, Primary, Alternate, Foreign, Relational Algebra: Selection, Projection, Union, Intersection,Difference, Cartesian Product,Join Operations ,Structured Query Language (SQL): DDL, DML, DCL, TCL,Joins and Nested Queries,Views and Indexes	8
III	Database Design and Normalization: Functional Dependencies, Closure of Attributes, Armstrong's Axioms, Canonical (Minimal) Cover,Candidate Keys,Schema Refinement, Normalization: 1NF, 2NF, 3NF, BCNF, Multivalued Dependencies, 4NF and 5NF (Introduction), Lossless Join and Dependency Preservation	9
IV	Transaction Processing, Concurrency Control and Recovery: Transaction Concepts, ACID Properties, Transaction States, Schedules and Serializability, Conflict and View Serializability, Concurrency Control, Lock-Based Protocols, Two-Phase Locking (2PL), Deadlock Handling, Recovery Techniques: Log-Based Recovery, Checkpointing, Shadow Paging	10
V	Storage Structures and Advanced Database Concepts: File Organization Techniques, Indexing Concepts, B+ Tree Indexing, Hashing Techniques, Query Processing and Query Optimization Basics, Distributed Database Concepts, NoSQL Databases – Introduction and Types, Data Warehousing and OLAP, Database Security and Authorization	9
	Total	45

Text Books:

1. Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-

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Hill.
2. Fundamentals of Database Systems by Ramez Elmasri, Shamkant B. Navathe, Pearson

Reference books :

1. Database Management Systems by Raghu Ramakrishnan, Johannes Gehrke ,McGraw-Hill
2. Database Management Systems by P. K. Yadav, S. K. Kataria & Sons
3. Database Management System by V. K. Jain, Khanna Publishers

V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE505

Title of Course: Object Oriented Programming

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Apply object-oriented principles using C++ and Java.
CO2	Design software using inheritance, polymorphism, and abstraction.
CO3	Implement exception handling and file processing techniques.
CO4	Develop multithreaded and collection-based Java applications.
CO5	Create modular and reusable software components using OOP concepts.

Unit	Content	Hours
I	**Fundamentals of Object-Oriented Programming and C++:** Evolution of Programming Paradigms: Procedure-Oriented Programming, Object-Oriented Programming, Features of OOP. Introduction to C++: Structure of a C++ Program, Tokens, Keywords, Identifiers, Data Types and Variables, Operators and Expressions, Input/Output Streams. Classes and Objects: Class Definition, Data Members and Member Functions, Access Specifiers, Object Creation and Memory Allocation. Constructors and Destructors: Default Constructor, Parameterized Constructor, Constructor Overloading, Destructor.	9
II	**Advanced Object-Oriented Concepts in C++:** Function Overloading, Operator Overloading, Friend Functions and Friend Classes, Inheritance: Single, Multilevel, Multiple, Hierarchical, Hybrid. Polymorphism: Compile-Time Polymorphism, Run-Time Polymorphism, Virtual Functions. Abstract Classes and Pure Virtual Functions	9
III	**Exception Handling and File Processing in C++:** Exception Handling: try, throw, catch, Multiple Catch Blocks, Nested try Blocks, User-Defined Exceptions. Templates: Function Templates, Class Templates. Standard Template Library (STL): Vector, List, Map, Iterators. File Handling: File Streams, Text Files, Binary Files, Reading and Writing Operations.	9
IV	**Introduction to Java and Core OOP Concepts: Overview of Java:** Features of Java, JVM, JRE, JDK, Java Program Structure, Data Types, Variables and Operators. Classes and Objects in Java: Constructors, Methods, this Keyword, Static Members. Inheritance and Polymorphism: Method Overriding, Dynamic Method Dispatch. Packages and Access Modifiers	9
V	**Advanced Java Programming**: Exception Handling in Java: try, catch, finally, throw and throws, Custom Exceptions. Interfaces and Abstract Classes. Multithreading: Thread Life Cycle, Thread Creation, Synchronization. Collection Framework: ArrayList, LinkedList, HashSet, HashMap. File Handling and Basic GUI: File I/O Streams, Introduction to Swing, Event Handling Basics.	9
	Total	45

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Text Books:

1. OOP with C++,E Balgurusamy, Publisher McGraw Hill Education.
2. Herbert Schildt, Java: The Complete Reference, McGraw Hill Education.

Reference Books:

1. OOP in C++, Robert Lafore, Publisher: Pearson Education
2. The C++ Programming Language, Bjarne Stroustrup, Publisher : Addison Wesley.
3. C++ Primer (5th Edition),Stanley B. Lippman, Josee Lajoie, Barbara E. Moo , Publisher: Addison Wesley.
4. E. Balgurusamy, Programming with Java, McGraw Hill Education.
5. Bruce Eckel, Thinking in Java , Prentice Hall.

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE506A

Title of Course: **Data Mining and Ware Housing**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able:

CO1	Design multidimensional data models and implement OLAP operations within a data warehouse framework.
CO2	Evaluate and apply data preprocessing pipelines to clean and transform messy, real-world data.
CO3	Implement association rule mining algorithms to extract hidden patterns from transactional datasets.
CO4	Differentiate between types of machine learning paradigms (supervised, unsupervised, reinforcement) and map them to real-world problems.
CO5	Build, tune, and evaluate foundational machine learning models for classification, regression, and clustering.

Unit	Content	Hours
I	**Data Warehouse Foundations:** Operational Database Systems (OLTP) vs. Data Warehouses (OLAP); Multidimensional features of data warehouses. **Data Warehouse Architecture**: Three-tier architecture, ETL (Extraction, Transformation, Loading) framework, Metadata repository. **Multidimensional Data Modeling:** Star schema, Snowflake schema, Fact Constellation schema; Fact and Dimension tables. **OLAP Operations:** Roll-up, Drill-down, Slice, Dice, and Pivot operations.	9
II	**Data Mining Fundamentals:** KDD (Knowledge Discovery in Databases) process pipeline; Core functionalities and types of data mined. **Data Preprocessing: * Data Cleaning:** Handling missing values and noisy data. **Data Integration:** Metadata, correlation analysis, handling data redundancy. **Data Reduction:** Dimensionality reduction, numerosity reduction. **Data Transformation:** Normalization (Min-Max, Z-score), Discretization, and Concept hierarchy generation.	9
III	**Market Basket Analysis:** Basic concepts, frequent itemsets, support, confidence, and lift metrics. **The Apriori Algorithm:** Frequent itemset generation, mining association rules from frequent item sets, methods to improve Apriori efficiency. **FP-Growth Algorithm:** Introduction to FP-Tree construction and mining frequent patterns without candidate generation.	9
IV	**Introduction to ML**: Definition of Machine Learning, relationship with Data Mining and Artificial Intelligence; The Machine Learning pipeline (Data collection to Model deployment). **ML Paradigms:** Supervised Learning (Features, Labels, Target variable), Unsupervised Learning, Semi-supervised Learning, and Reinforcement Learning basics. **Mathematical Foundations & Concepts**: Overfitting vs. Underfitting, BiasVariance tradeoff, Training/Validation/Testing data splits, Cross-Validation techniques.	9

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V	**Supervised Learning (Regression & Classification):** **Linear Regression:** Simple and Multiple Linear Regression, Cost function, Gradient Descent optimizer. **Logistic Regression:** Binary classification, Sigmoid function, decision boundaries. **Instance-Based Learning:** k-Nearest Neighbors (k-NN) algorithm. Unsupervised Learning (Clustering): **Partitioning Methods:** k-Means clustering algorithm, Elbow method for choosing optimal k. **Performance Evaluation Metrics:** Confusion Matrix, Accuracy, Precision, Recall, F1-Score; Mean Absolute Error (MAE), Root Mean Squared Error (RMSE).	9
	Total	45

Text Books:

1. Data Mining- Concepts and -1.techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
2. Introduction to Data Mining, Psng-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Educatior.
3. Introduction to Machine Learning with Python by Andreas C. Muller and Sarah Guido 4. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.

Reference Books:

1. Data Mining Techniques, Arun KPujari, 3rd Edition, Universities Press.
2. Data Warehousing Fundament's, Pualraj Ponnaiah, Wiley Student Edition
3. Han, J., Kamber, M., & Pei, J. Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann.
4. Data Science for Business by Foster Provost and Tom Fawcett
5. Head First Data Analysis by Michael Milton
6. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE506B

Title of Course: **Distributed Systems**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.
CO2	Design and develop distributed programs using sockets and RPC/RMI.
CO3	Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems.
CO4	Analyse different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constrains.

Unit	Content	Hours
I	**Architecture of Distributed Systems:** Characteristics of Distributed System, Motivation, challenges /Issues in the design & development of Distributed System. **System Models:** Architecture Model, System Architecture, **Types of Architectural Model:** Client server model, Search engine, Proxy server & caches, Variation on client server model: mobile code, mobile agents. Fundamental Models: Interaction model, failure model, Security model.	9
II	**Distributed Objects & Distributed file system:** Inter-process communication, Sockets, middle ware, Group communication, and Remote procedure calls, Server design: stateless & stateful server, Cache update policies. **Theoretical Foundations:** Inherent limitations of distributed systems, Timing issues, clock synchronization, Network time protocol, Lamport's logical clocks, Vector clocks, Casual ordering of messages, Global state, Cuts of Distributed computation, Termination detection.	9
III	**Distributed Mutual Exclusion:** Leader election: Chang Robert Ring based leader election algorithm, Bully algorithm. Classification of mutual exclusion algorithms, Requirements and performance measures of mutual exclusion algorithms, Non-Token Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm. Token Based Algorithms: Suzuki-Kasami's Algorithm, Raymond's Algorithm, Comparative performance analysis	9
IV	**Distributed Deadlock Detection & Agreement Protocols:** Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection and resolution, Centralized deadlock detection algorithms, distributed deadlock detection algorithms Agreement Protocols: Synchronous vs. asynchronous computations, model of process failures, authenticated vs. non-authenticated messages. A classification of Agreement problems, Solutions to Byzantine Agreement problem, Applications of Agreement algorithms.	9
V	**Failure recovery and Fault Tolerance:** Classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous check pointing and recovery, asynchronous check pointing and recovery. Fault Tolerance: Atomic actions and committing, commit protocols, non-blocking commit	9

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	protocols, Voting protocols, Dynamic voting protocols, Dynamic Vote Reassignment Protocols.	
	Total	45

Text Books:

1. Advanced Concepts in Operating Systems: Distributed, Multiprocessor and Database Operating Systems, Mukesh Singhal and Niranjan G. Shivaratri McGraw Hill.
2. Distributed Operating Systems Concepts and Design G Coulouris, Jean Dollimore, Tim Kindberg Addison Wesley.

Reference Books:

1. Distributed Algorithms Nancy Lynch Morgan Kaufman
2. Modern Operating Systems Andrew S. Tanenbaum Pearson Education

MOOCs Links and additional reading, learning, video material

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_cs87/
2. https://www.mooc-list.com/course/modern-distributed-systems-edx

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE506C

Title of Course: **Social Network Analytics**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Understand the core concepts of Social Network Analysis and the different network growth models for real-world networks.
CO2	Apply algorithms of Link Analysis and Link Prediction Methods
CO3	Apply community detection methods and evaluating their effectiveness in real-world scenarios.
CO4	Illustrate Cascade Models and Cascade Predictions.
CO5	Apply Anomaly Network Detection Methods and Visualization.

Unit	Content	Hours
I	Social Network, Network Measures and Network Growth Models: - The Social Networks, Fundamental Concept in Network Analysis, Applications, Social Network Data, Boundary Specification and Sampling, Types of Networks, Network Data, Measurement and Collection, Data Sets, Network Measures, Properties of Real-World Network, Network Growth Models, Network Model with Accelerating Growth, Aging in Preferential Attachment.	9
II	Link Analysis and Link Prediction: - Mathematical Representation of Social Networks, Graphs, Relations, Matrices, Properties, Application of Link Analysis, Signed Networks, Link Analysis Algorithms, Link Prediction, Applications, Temporal Changes in the Network, Evaluating Link Prediction Methods, Models.	9
III	Community Structure in Networks: - Application of Community Detection, Types of Communities, Community Detection Methods, Disjoint Community Detection, Local Community Detection, Overlapping Community Detection, Community Detection versus Community Search, Evaluation of Community Detection Methods.	9
IV	Preliminaries and Important Terminologies, Cascade Models, Case Study – The "Indignados" Movement, Probabilistic Cascades, Epidemic Models, Independent Cascade Models, Cascade Prediction.	9
V	Outliers versus Network-Based Anomalies, Challenges, Anomaly Detection in Static Networks, Anomaly Detection in Dynamic Networks, Visualization and Tool Applications.	9
	Total	45

Text / Reference Books:

1. Social Network Analysis: Methods and Applications - Stanley Wasserman, Katherine Faus, Cambridge University Press 1994.
2. Social Network Analysis – Tanmoy Chakraborty, Wiley India Pvt Ltd 2021.
3. Network Science - Albert-Laszlo Barabasi, Cambridge University Press, 2016

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE507

Title of Course: **Design and Analysis of Algorithms Lab**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able:

CO1	
CO2	
CO3	
CO4	
CO5	

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE508

Title of Course: Database Management System Lab

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able:

CO1	
CO2	
CO3	
CO4	
CO5	

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V Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE509
Title of Course: Object Oriented Programming Lab

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able:

CO1	
CO2	
CO3	
CO4	
CO5	

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSEC601

Title of Course: MDM-IV - Machine Learning

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Content	Hours
I		9
II		9
III		9
IV		9
V		9
	Total	45

Text Books:

Reference Books:

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE602

Title of Course: **Computer Networks**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	1	--	3	4	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able:

CO1	Explain the fundamentals, architecture, and models of computer networks.
CO2	Describe the functions and protocols of different network layers.
CO3	Apply IP addressing, subnetting, and routing techniques to solve networking problems.
CO4	Analyze the performance of network and transport layer protocols.
CO5	Evaluate computer network services, protocols, and communication mechanisms for efficient data transmission.

Unit	Content	Hours
I	**Introduction to Computer Networks**: Uses of Computer Networks, Network Hardware, Network Software, Network Devices, Network Hardware Components, Network Topology, Transmission Media, Switching, Reference Models: OSI and TCP/IP, Example of Networks- Internet, X.25, Frame Relay, and ATM, Protocol and Network Standardization	9
II	**Data Link Layer:** Design Issues, Elementary Data Link Protocols, Sliding Window Protocols, HDLC, Point-to-Point Access (PPP) Protocol, The Medium Access Control Sublayer: Static and Dynamic Channel Allocation, Multiple Access Protocols: ALOHA, CSMA, CSMA/CD, CSMA/CA, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet: Fast, Switched, Gigabit and 10-Gigabit Ethernet, IEEE 802.3, 802.4, 802.5 Standards, FDDI	9
III	**Network Layer:** Design Issues, Switching, Connectionless and Connection-Oriented Service, Router, Routing Algorithms, Internet Protocol, IPV4 and IPV6 address, Subnetting and Supernetting, ICMP, IGMP, ARP, RARP, Internetworking, Firewalls	9
IV	**Transport Layer:** The Transport Services, Elements of Transport Protocols: Addressing, Connection Establishment and Release, Error Control and Flow Control, Multiplexing and Crash Recovery, Simple Transport Protocols, Transmission Control Protocol (TCP), TCP Services, TCP Connection, TCP Timers, TCP Congestion Control, User Datagram Protocol (UDP), UDP Services, Remote Procedure Call, Concept of Socket and Socket Programming	9
V	**Application Layer:** Domain Name Systems (DNS), Electronic Mail (Email), SMTP, POP3, IMAP, MIME, DHCP, FTP. TFTP, World Wide Web, Web Page, HTTP, Browser Architecture, Caching in Web Browser, Uniform Resource Locator (URL), LDAP, NetBios, Wireless web	9
	Total	45

Text/ Reference Books:

1. Tanenbaum A, "Computer Networks", 4 Edition, PHI
2. Fourauzan B., "Data Communications and Networking", 3 edition, Tata Mc-Graw Hill
3. TCP/IP Protocol Suite, 4th Edition by Behrouz A. Forouzan (Tata Megraw Hill 2010)
5. Comer D., "Computer Networks and Internet", 2140 Edition, Pearson Education, ISBN 81 -7808-086-9

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE603

Title of Course: **Compiler Design**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Content	Hours
I		9
II		9
III		9
IV		9
V		9
	Total	45

Text Books:

Reference Books:

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE604A

Title of Course: **Deep Learning**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Understand biological and artificial neural networks, neuron models, perceptrons, learning rules, and network types.
CO2	Apply single-layer perceptron algorithms and machine learning concepts for tasks like classification and regression.
CO3	Implement multilayer perceptron's with backpropagation and advanced optimization techniques.
CO4	Apply regularization techniques to improve neural network generalization and reduce overfitting.
CO5	Understand and analyze deep learning models, including CNNs and RNNs, using modern architectures and transfer learning.

Unit	Content	Hours
I	**Foundations of Neural Networks:** Introduction: What is a Neural Network?, Biological neuron vs. artificial neuron, Models of a neuron, neural networks as directed graphs, Feedback and network architectures, Rosenblatt's Perceptron: model, convergence theorem, Relation between Perceptron and Bayes classifier (Gaussian environment),Supervised learning networks: Perceptron, ADALINE, Backpropagation network, Associative memory networks: BAM, Hopfield networks.	9
II	**Multilayer Perceptrons & Training:** Multilayer feedforward neural networks (MLFFNN), Batch learning vs. online learning, Backpropagation algorithm and variants, XOR problem and its solution, Heuristics for improving backpropagation performance, Gradient-based learning, hidden units, architecture design, Empirical risk minimization, bias-variance tradeoff, Output units: linear, softmax; hidden units: tanh, ReLU	9
III	**Deep Learning Basics & Regularization:** Introduction to deep learning, historical trends, Deep feedforward networks, greedy layer wise training, Optimization challenges: ill-conditioning, local minima, plateaus, saddle points, Advanced optimizers: AdaGrad, RMSProp, Adam, Regularization techniques: L2 parameter norm penalties, Dataset augmentation, semi-supervised learning, Dropout, batch normalization, early stopping, Ensemble methods (bagging), adversarial training, Curse of dimensionality and strategies to overcome	9
IV	**Convolutional Neural Networks (CNNs)** Convolution operation, motivation, pooling, Variants of convolution functions, structured outputs, efficient algorithms, CNN architectural overview: layers, filters, parameter sharing, Popular CNN architectures: LeNet, AlexNet, VGG, ResNet, DenseNet, Handling vanishing gradient problem, weight initialization methods, Transfer learning and fine-tuning, Applications: computer vision, image classification, object detection	9

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V	**Sequence Models & Unsupervised Deep Learning** Sequence modeling: unfolding computational graphs, Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder-Decoder sequence-to-sequence architectures, Backpropagation through time (BPTT), Long Short-Term Memory (LSTM), Gated RNNs (GRU), Recursive neural networks, Applications: speech recognition, NLP, case studies in classification/regression	9
	Total	45

Text Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Michael A. Nielsen, Neural Networks and Deep Learning , Determination Press, 2015.
3. Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009

Reference Books:

1. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.
2. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
3. Navin Kumar Manaswi ,Deep Learning with Applications Using Python Chatbots and Face, Object, and Speech Recognition With TensorFlow and Keras , Apress,2018.

MOOCs Links and additional reading, learning, video material:

1. Deep Learning – Prof. Mitesh Khapra (IIT Ropar), Swayam Course
   https://onlinecourses.nptel.ac.in/noc22_cs124/preview
2. Neural Networks and Deep Learning, Andrew Ng
   https://www.coursera.org/learn/neuralnetworks-deep-learning#syllabus

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE604B

Title of Course: **Real Time Operating System**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Enumerate the need and the challenges in the design of hard and soft real time systems.
CO2	Compare different scheduling algorithms and the schedulability criteria.
CO3	Determine schedulability of a set of periodic tasks given a scheduling algorithm.
CO4	Develop algorithms to decide the admission criterion of sporadic jobs and the schedule of aperiodic jobs.
CO5	Integrate resource access mechanisms with the scheduling techniques and develop integrated schedulibility criteria.

Unit	Content	Hours
I	Introduction to RTS, WCET notion, Types of RTS, Task Types, Jobs – Periodic, Sporadic, Aperiodic, Applications of RTS, Predictability, Reference Model, Types of schedulers, Cyclic and Priority based Schedulers.	9
II	Cyclic, priority-based schedulers – static/dynamic – RM, EDF, LST, Optimality of EDF, Nonoptimality of EDF, Scheduling with precedence constraints, Multiprocessor scheduling – static and dynamic systems, Problems of Predictability in multi-processor systems, Predictability of pre-emptive priority-based scheduling in uniprocessor systems, Performance Measure of validation techniques.	9
III	Cyclic scheduling, frame size constraints, Job Slicing, Aperiodic job scheduling using Slack stealing, Sporadic job scheduling, Practical considerations, Disadvantage of cyclic scheduling.	9
IV	Priority Based Sched, Static-Dynamic Systems, Fixed, Variable Priorities, Schedulable Utilization, Schedulable Utilization of EDF, Schedulability Test of EDF, Unpredictability of Dynamic Priority in Overload, Liu-Layland Theorem, Optimality of RM in Simply-Periodic Systems, Concept of Critical Instants, Time Demand Analysis, Practical factors – Non-preemption, self-suspension, context switch time, Limited priority levels, Mapping techniques, Impact on schedulability, Tick Scheduling.	9
V	Aperiodic jobs in Priority based systems, Polling Server, Combining with background server,Polling Server Parameters, Deferrable Server (DS), Combining with Background Server, Deferrable Server parameters, Disadv of DS, Simple Sporadic Server Rules, Combining Background time, Proof of Simple Sporadic Server as a periodic task, Constant Utilization Server for Deadline Driven systems, Total Bandwidth Server, Starvation free CU/Background Server, Preemptive Weighted Fair Queuing Server, Scheduling of Sporadic Jobs in Fixed Priority and Dynamic Priority Systems.	9
	Total	45

Text Books:

1. Real-Time Systems : Jane W.S. Liu, Pearson Education
2. Real Time Systems : C.M. Krishna & Kang G. Shin : McGraw Hill

Reference Books:

4. Real-Time Systems: Theory and Practice, R. Mall, Pearson Education
5. Real-Time Systems: Scheduling, Analysis, and Verification, Albert M. K. Cheng, Wiley

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE604C

Title of Course: **Digital Forensics**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Content	Hours
I		9
II		9
III		9
IV		9
V		9
	Total	45

Text Books:

Reference Books:

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE605A

Title of Course: **Natural Language Processing**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Content	Hours
I		9
II		9
III		9
IV		9
V		9
	Total	45

Text Books:

Reference Books:

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE605B

Title of Course: **Big Data Analytics**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Content	Hours
I		9
II		9
III		9
IV		9
V		9
	Total	45

Text Books:

Reference Books:

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE605C

Title of Course: **Information Retrieval**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Content	Hours
I		9
II		9
III		9
IV		9
V		9
	Total	45

Text Books:

Reference Books:

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STEMCCSE606

Title of Course: **Enterprise Resource Planning**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Content	Hours
I		
II		
III		
IV		
V		
	Total	

Text Books:

Reference Books:

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE607

Title of Course: Computer Networks Lab

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	Perform networking experiments using networking devices and simulation tools.
CO2	Configure IP addressing, subnetting, and routing in computer networks.
CO3	Analyze network traffic and protocols using packet analysis tools.
CO4	Implement client-server communication and network services.
CO5	Troubleshoot and evaluate computer network performance in different networking scenarios.

List of Practicals:

1. Programs on Error detection and correction: CRC, Hamming Code, Checksum, etc Use network simulators like N52 to implement.
2. Analysis of CSMA and Ethernet protocols.
3. Network Routing: Shortest path routing, DVR, LSR.
4. Analysis of congestion control (TCP and UDP).
5. Write a program in C/C++ to implement a Client-Server program, using Socket programming.
6. Write a program in C/C++ to implement a Client-Server program, using Socket programming with Stop and Wait protocol.
7. Write a program in C/C++ to implement a Client-Server program, using Socket programming with Sliding Window Protocols.
8. Installation and configuration of US /PWS/Apache server.
9. File transfer using RS-232.
10. File transfer using Stop and Wait Protocol / Go back n / Selective Repeat Protocol.
11. File transfer using TCP or UDP.
12. Implementation of Shortest Path algorithm.
13. Study of Linux and/or Novel Netware Network configurations and commands.
14. Study different types of windows related networking commands.
15. Study the network simulator of cisco packet tracer and create a any simple network topology on packet tracer.
16. Study the concept of subnetting and create 2 subnets using cisco packet tracer (Consider IP address 192.168.4.0).
17. Study ARP and simulate using cisco packet tracer.
18. Configure Static Routing using cisco packet tracer.
19. Configure Dynamic Routing using RIP protocol in cisco packet tracer.
20. Configure a basic firewall to filter packets using cisco packet tracer.
21. Configure NAT in cisco packet tracer.
22. Configure Application Layer protocol (HTTP, FTP, DNS) using cisco packet tracer.
23. Configure DHCP server, Email server and FTP server using cisco packet tracer.
24. Configure HTTP/Web server and DNS server using cisco packet tracer.

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE608A

Title of Course: **Deep Learning Lab**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE608B

Title of Course: Real Time Operating System Lab

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	Enumerate the need and the challenges in the design of hard and soft real time systems.
CO2	Compare different scheduling algorithms and the schedulability criteria.
CO3	Determine schedulability of a set of periodic tasks given a scheduling algorithm.
CO4	Develop algorithms to decide the admission criterion of sporadic jobs and the schedule of aperiodic jobs.
CO5	Integrate resource access mechanisms with the scheduling techniques and develop integrated schedulibility criteria.

Sr. No.	Problem Statements
1	WCET Measurement • Write a program to measure the *Worst Case Execution Time (WCET)* of a simple sorting algorithm (e.g., bubble sort) using a timer. • Compare WCET with average execution time.
2	Task Classification • Implement a simulation that distinguishes between periodic, sporadic, and aperiodic tasks. • Use a timer interrupt to generate tasks and log their arrival times.
3	Rate Monotonic Scheduling (RMS) • Implement RMS for three periodic tasks with different computation times and periods. • Verify schedulability using Liu-Layland bound.
4	Earliest Deadline First (EDF) • Simulate EDF scheduling for a set of periodic tasks. • Compare task completion with RMS results.
5	Multiprocessor Scheduling • Write a program to schedule tasks on two processors using static partitioning. • Demonstrate predictability issues when tasks migrate between processors.
6	Cyclic Scheduler Implementation • Design a cyclic scheduler with a given frame size. • Show how frame size constraints affect schedulability.

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7	Slack Stealing for Aperiodic Jobs • Implement slack stealing in a cyclic scheduler. • Demonstrate how aperiodic tasks can be scheduled without violating deadlines of periodic tasks.
8	Schedulability Test of EDF • Write a program to test schedulability of a given task set under EDF. • Use time demand analysis to validate results.
9	Critical Instant Analysis • Simulate a task set under RMS and identify the critical instant for each task. • Show how overload affects predictability.
10	Impact of Context Switch Time • Modify a scheduler to include context switch overhead. • Compare schedulability results with and without overhead.
11	Polling Server Implementation • Implement a polling server to handle aperiodic tasks in a fixed-priority system. • Compare response times with background scheduling.
12	Sporadic Server Simulation • Implement a sporadic server in a dynamic priority system. • Demonstrate starvation-free scheduling using Constant Utilization Server (CUS).

Software Mapping:

- Labs 1–2 (WCET, Task Types) → C/Python + profiling tools
- Labs 3–5 (RMS, EDF, Multiprocessor) → SimSo, Cheddar
- Labs 6–7 (Cyclic Scheduling, Slack Stealing) → Cheddar, MATLAB/Simulink
- Labs 8–10 (Schedulability Tests, Critical Instants) → SimSo, MATLAB
- Labs 11–12 (Polling & Sporadic Servers) → FreeRTOS, RTEMS

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VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPECCSE608C

Title of Course: **Digital Forensics Lab**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Sign	Sign	Sign	Sign
BoS Member	BoS Member	BoS Member	BoS Chairman

VI Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STVSECCSE609

Title of Course: **Soft Skills**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
						25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	
CO2	
CO3	
CO4	
CO5	

Sign	Sign	Sign	Sign
BoS Member	BoS Member	BoS Member	BoS Chairman