BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE:ODALAREVU
(AUTONOMOUS)

B. Tech CSE (AI&ML) (BR23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

B.Tech. – III Year I Semester

S.No.	Course code	Category	Title	L	T	P	Credits
1	23ML5T01	PCC	Information Retrieval Systems	3	0	0	3
2	23AD5T03	PCC	Computer Networks	3	0	0	3
3	23CS5T04	PCC	Operating Systems	3	0	0	3
4	23ML5D01 23ML5D02 23AD5D03 23AD5D04 23AD5D05	PE-I	1. Software Engineering 2. Cloud Computing 3. Internet of Things 4. Exploratory Data Analysis with Python 5. Automata Theory & Compiler Design	3	0	0	3
5		OE- I		3	0	0	3
6	23ML5L02	PCC	Information Retrieval Lab	0	0	3	1.5
7	23CS5L07	PCC	Computer Networks Lab	0	0	3	1.5
8	23CS5S06	SEC	Full Stack development -II /SWAYAM Plus-Data Engineer/AI Engineer/	0	1	2	2
9	23ES5L09	ES	Tinkering Lab *(User Interface Design using Flutter)* / SWAYAM Plus - Android Application Development (with Flutter)	0	0	2	1
10	23BS5P01	Evaluation of Community Service Project		-	-	-	2
		Total		15	**1**	10	**23**

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B.Tech. – III Year II Semester

S.No.	Course code	Category	Title	L	T	P	Credits
1	23AM6T04	PCC	Natural Language Processing	3	0	0	3
2	23AM6T03	PCC	Deep Learning	3	0	0	3
3	23AD6T06	PCC	Data Visualization	3	0	0	3
4	23CS6D05 23AD6D05 23CS6D06 23AD6D06	PE-II	1. Software Testing Methodology 2. Cryptography & Network Security 3. DevOps 4. Recommender Systems 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	23CS6D08 23CS6D09 23AD6D08 23AD6D07	PE-III	1. Software Project Management 2. Mobile Adhoc Networks 3. Computer Vision 4. NoSQL Databases 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
6		OE - II		3	0	0	3
7	23AM6L02	PCC	Deep Learning Lab	0	0	3	1.5
8	23AM6L04	PCC	Data Visualization Lab	0	0	3	1.5
9	23HM6S02	SEC	Soft skills	0	1	2	2
10	23AC6T03	Audit Course	Technical Paper Writing & IPR	2	0	0	-
			Total	20	1	8	23

Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation.
*Under Industry Internship interested students can purse SWAYAM Plus courses viz, Hands on Masterclass on Data Analytics OR Artificial Intelligence for Real –World Applications.

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Open Electives offered by Dept of CSE(AI&ML), to other department students:

S.No.	Course Code	Category	Title	L	T	P	Credits
1	23CS5E01	OE-I	Principles of Operating Systems	3	0	0	3
2.	23AD5E01	OE-I	Computer Architecture and Organization	3	0	0	3
3	23CS6E03	OE-II	Principles of Database Management Systems	3	0	0	3

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HONORS Courses Offered by CSE(AIML) Department

Suggested MOOC Courses for Honors Degree in CSE(AI&ML)

Note: ***To obtain Honor's degree, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream (without duplication).***

S.No.	Category	Subject Code	Subject Name	L	T	P	Credits
Mandatory Course(s)							
1	PCC	23ADHT01	Applied Linear Algebra in AI & ML	3	0	0	3
2	PCC	23ADHT02	Deep Learning for Natural Language Processing	3	0	0	3
Any of the following for remaining 12 Credits							
3	PCC	23ADHT03	High Performance Scientific Computing	3	0	0	3
4	PCC	23ADHT04	Applied Time-Series Analysis	3	0	0	3
5	PCC	23ADHT05	GPU Architecture and Programming	3	0	0	3
6	PCC	23ADHT06	Computational Complexity	3	0	0	3
7	PCC	23ADHT07	Quantum Algorithms and Cryptography	3	0	0	3
8	PCC	23ADHT08	Practical High-Performance Computing	3	0	0	3
9	PCC	23ADHT09	Cryptography and Network Security	3	0	0	3

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III Year - I Semester	Code: 23ML5T01	L	T	P	C
		3	0	0	3

INFORMATION RETRIEVAL SYSTEMS

Course Objectives:

The main objectives of the course is to

- To learn the concepts and algorithms in Information Retrieval Systems
- To understand the data/file structures that are necessary to design, and implement information Retrieval (IR) systems.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Identify and explain basic data structures used in the design and implementation of IR systems.	BL 2
CO 2	Apply techniques to construct and update inverted file structures in an IR system.	BL3
CO 3	Compare different representations of PAT structures, including tree-based and array-based approaches.	BL4
CO 4	Evaluate the effectiveness of stemming algorithms through experimental analysis.	BL5
CO 5	Select appropriate string searching algorithms based on application context and performance requirements.	BL5

UNIT I

Introduction to Information storage and retrieval systems: 15 HRS

Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation **ltroduction to Data structures and algorithms related to Information Retrieval:** Basic Concepts, Data structures, Algorithms.

UNIT II

nverted Files and Signature Files:

ntroduction, Structures used in Inverted Files, building an Inverted file using a sorted array, Modifications to he Basic Techniques.

Signature Files: Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

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UNIT III **12 HRS** **New Indices for Text, Lexical Analysis and Stoplists: PAT Trees and PAT Arrays:** Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays. Stoplists
UNIT IV **15 HRS** **Stemming Algorithms and Thesaurus Construction:** Types of Stemming algorithms, Experimental Evaluations of Stemming, stemming to Compress Inverted Files. **Thesaurus Construction**: Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.
UNIT V **12 HRS** **String Searching Algorithms:** Introduction, Preliminaries, The Naive Algorithm, The Knutt-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm.
Text Books: 1. Modern Information Retrieval,Ricardo Baeza-Yates, Neto, PEA,2007. 2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.
Reference Books: 1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992. 2. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons. 3. Modern Information Retrieval by Yates and Neto Pearson Education.

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III Year - I Semester	Code: 23ML5D01	L	T	P	C
		3	0	0	3

SOFTWARE ENGINEERING

Course Objectives:

The main objectives of the course is to Introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Explain software engineering evolution and life cycle models for effective software development.	BL2
CO 2	Apply project estimation and specification techniques for effective software project management.	BL3
CO 3	Analyze software design principles, including cohesion, coupling, and design methodologies.	BL4
CO 4	Apply coding standards, testing techniques, and debugging methods in software development.	BL3
CO 5	Evaluate software reuse strategies and their implementation at the organizational level.	BL5

UNIT I **15Hrs**

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.**Software Life Cycle Models:** Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

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UNIT II **15Hrs** **Software Project Management**: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management. Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.
UNIT III **12Hrs** **Software Design:** Overview of the design process, how to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design. Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2) Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review. User Interface Design: Characteristics of a good user interface,Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.
UNIT IV **15Hrs** **Coding and Testing:** Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, testing object-oriented programs, Smoke testing, and Some general issues associated with testing **Software Reliability and Quality Management:** Software reliability. Statistical testing, Software quality Software quality management system, ISO9000.SEICapability maturity model. Few other Important quality standards, and Six Sigma.
UNIT V **12Hrs** **Computer-Aided Software Engineering (Case):** CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment. Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost. Software Reuse: Reuse-definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

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Text Books:

1. Fundamentals of Software Engineering, Rajib Mall,5th Edition,PHI.
2. Software Engineering A Practitioner's Approach, Roger S. Pressman, 9th Edition, McGraw Hill International Edition.

Reference Books:

1. Software Engineering ,Ian Sommerville,10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

Online Learning Resources:

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview

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III Year - I Semester	Code: 23ML5D02	L	T	P	C
		3	0	0	3

CLOUD COMPUTING

Course Objectives:

The main objectives of the course is to

- To explain the evolving utility computing model called cloud computing.
- To introduce the various levels of services offered by cloud.
- To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- To emphasize the security and other challenges in cloud computing.
- To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Explain cloud computing models, services, deployment types, and major cloud service providers.	BL2
CO 2	Analyze architectures and communication mechanisms supporting cloud-based systems.	BL4
CO 3	Evaluate container orchestration tools like Docker Swarm and Kubernetes in cloud services.	BL5
CO 4	Analyze cloud interoperability issues and the role of standards.	BL4
CO 5	Apply Function-as-a-Service in cloud-native application development.	BL3

UNIT I **15Hrs**

Introduction to Cloud Computing Fundamentals: Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).

UNIT II **15Hrs**

Cloud Enabling Technologies: Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

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UNIT III **12Hrs**

Virtualization and Containers: Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT IV **15Hrs**

Cloud computing challenges: Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT V **12Hrs**

Advanced concepts in cloud computing: Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. 1. Mastering Cloud Computing, 2nd edition, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

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III Year - I Semester	Code: 23ML5L02	L	T	P	C
		0	0	3	1.5

INFORMATION RETRIEVAL LAB

Course Objectives:

1. Understand text representation, pre-processing, and similarity computation techniques.
2. Develop inverted index structures for efficient document retrieval.
3. Apply classification algorithms to categorize text documents using standard datasets.
4. Perform clustering on text data and evaluate using standard performance metrics.
5. Explore web mining, XML parsing, and social media data analysis for information retrieval.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Preprocess and represent text documents using vector space models.	BL3
CO2	Construct inverted index and compute document similarity.	BL4
CO3	Classify and cluster documents using machine learning algorithms.	BL5
CO4	Implement web crawling and XML parsing for data extraction.	BL4
CO5	Analyze trends and ranks using LSI, PageRank, and social media mining	BL5

Programming Language: Python/R

Lab Experiments:

1. Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.
2. Pre-processing of a Text Document: stop word removal and stemming
3. Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.
4. Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rocchio's, Support Vector Machine). Standard Datasets will have to be used to show the results.

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5. Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.
6. Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.
7. To parse XML text, generate Web graph and compute topic specific page rank
8. Implement Matrix Decomposition and LSI for a standard dataset.
9. Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.
10. Implementation of PageRank on Scholarly Citation Network.

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