VARDHAMAN
COLLEGE OF ENGINEERING

CURRICULUM
For
Master of Technology
Computer Science and Engineering

Under

Choice Based Credit System (CBCS)

M. Tech. - Regular Two-Year Degree Program

(For batches admitted from the Academic Year 2025 - 2026)

August 2025

VARDHAMAN COLLEGE OF ENGINEERING
(Autonomous)
Affiliated to **JNTUH,** Approved by **AICTE,** Accredited by **NAAC** with **A++** Grade
Kacharam, Shamshabad, Hyderabad- 501 218, Telangana, India
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Department Vision

To produce competent engineers with social responsibility to address the global challenges in the field of Electronics and Communication Engineering.

Department Mission

M1: Provide professional skills in electrical circuit design and simulation to the students.

M2: Bringing awareness among the students with emerging technologies to meet the dynamic needs of the society.

M3: Develop industry-institute interface for collaborative research, internship and entrepreneurial skills among the stakeholders (Students/Faculty).

M4: Encourage multi-disciplinary activities through research and continuous learning activities.

Program Educational Objectives (PEOs)

PEO1: Graduates will demonstrate peer recognized technical competency to design, analyze, develop solutions for problems in the field of power electronics and electrical drives.

PEO2: Graduates will demonstrate leadership and initiative to advance professional and organizational goals with commitment to ethical standards of profession, teamwork and respect for diverse cultural background.

PEO3: Graduates will be engaged in ongoing learning and professional development through pursuing higher education and self study.

PEO4: Graduates will be committed to creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.

Knowledge and Attitude Profile (WK)

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

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

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

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

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

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

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

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

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

Program Outcomes (POs)

Engineering Graduates will be able to:

PO1: An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: An ability to demonstrate a degree of mastery in the domain of power electronics and electrical drives.

PO4: An ability to identify Power Electronics based solutions to improve power conversion, power quality and reliability in Electrical systems.

PO5: An ability to conceptualize, design and analyze various control strategies for energy efficient drives.

United Nations Sustainable Development Goals (SDGs)

SDG1: **No Poverty** – End poverty in all its forms everywhere.

SDG2: **Zero Hunger** – End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

SDG3: **Good Health and Well-Being** – Ensure healthy lives and promote well-being for all at all ages.

SDG4: **Quality Education** – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG5: **Gender Equality** – Achieve gender equality and empower all women and girls.

SDG6: **Clean Water and Sanitation** – Ensure availability and sustainable management of water and sanitation for all.

SDG7: **Affordable and Clean Energy** – Ensure access to affordable, reliable, sustainable and modern energy for all.

SDG8: **Decent Work and Economic Growth** – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG9: **Industry, Innovation and Infrastructure** – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

SDG10: **Reduced Inequalities** – Reduce inequality within and among countries.

SDG11: **Sustainable Cities and Communities** – Make cities and human settlements inclusive, safe, resilient and sustainable.

SDG12: **Responsible Consumption and Production** – Ensure sustainable consumption and production patterns.

SDG13: **Climate Action** – Take urgent action to combat climate change and its impacts.

SDG14: **Life Below Water** – Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

SDG15: **Life on Land** – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

SDG16: Peace, Justice and Strong Institutions – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

SDG17: Partnerships for the Goals – Strengthen the means of implementation and revitalize the global partnership for sustainable development.

I M.Tech. I Semester												
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	B7501	Advanced Data Structures	PC	45	-	-	45	90	3	40	60	100
2	B7502	Neural Networks and Deep Learning	PC	45	-	-	45	90	3	40	60	100
3	B7001	Research Methodology and IPR	MC	30	-	-	30	60	2	40	60	100
Professional Elective – I												
4	B7551	Mining Massive Datasets	PE	45	-	-	45	90	3	40	60	100
	B7552	Web and Database Security										
	B7553	Agile Methodologies										
	B7554	Natural Language Processing										
Professional Elective – II												
5	B7555	Edge Analytics	PE	45	-	-	45	90	3	40	60	100
	B7556	Ethical Hacking										
	B7557	Robotic Process Automation										
	B7558	Large Language Models										
Practical Courses												
6	B7503	Advanced Data Structures Laboratory	PC	-	-	60	-	60	2	40	60	100
7	B7504	Neural Networks and Deep Learning Laboratory	PC	-	-	60	-	60	2	40	60	100
Audit Course												
8		Audit Course - I	AC	30	-	-	-	30	0	-	100	100
Total				240	0	120	210	570	18	280	520	800

I M.Tech. II Semester												
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Theory Courses												
1	B7505	Big Data Computing	PC	45	-	-	45	90	3	40	60	100
2	B7506	Systems and Network Security	PC	45	-	-	45	90	3	40	60	100
Professional Elective – III												
3	B7559	Bioinformatics	PE	45	-	-	45	90	3	40	60	100
	B7560	Cyber Security and Cyber Laws										
	B7561	Prompt Engineering										
	B7562	Generative AI										
Professional Elective – IV												
4	B7563	Predictive Analytics	PE	45	-	-	45	90	3	40	60	100
	B7564	Social Media Security										
	B7565	Augmented Reality and Virtual Reality										
	B7566	Conversational AI										
Practical Courses												
5	B7507	Big Data Computing Laboratory	PC	-	-	60	-	60	2	40	60	100
6	B7508	Systems and Network Security Laboratory	PC	-	-	60	-	60	2	40	60	100
Experiential Learning Course												
7	B7041	Mini-Project with seminar	PW	-	-	-	90	90	2	40	60	100
8		Dissertation Work Review - I	PW	-	-	-	-	-	-	-	-	-
Audit Course												
9		Audit Course - II	AC	30	-	-	-	30	0	-	100	100
Total				210	0	120	270	600	18	280	520	800

II M.Tech. I Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Professional Elective – V												
1	B7567	Video Analytics	PE	45	-	-	45	90	3	40	60	100
	B7568	Mobile Application Security										
	B7569	User Experience Design										
	B7570	Quantum Computing										
Open Elective												
2	B7081	Business Analytics	OE	45	-	-	45	90	3	40	60	100
	B7082	Waste to Energy										
	B7083	Operations Research										
	B7084	Blockchain Technology										
	B7085	Cyber Security										
Experiential Learning Course												
3	B7042	Dissertation Work Review – II	PW	-	-	-	270	270	6	100	-	100
Total				90	0	0	360	450	12	180	120	300

II M.Tech. II Semester													
#	Course Code	Title of the Course	Category	Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
				CI		LI	TW + SL	H	C	CIE	SEE	Total
				L	T	P	SL					
Experiential Learning Course												
1	B7043	Dissertation Work Review – III	PW	-	-	-	270	270	6	100	-	100
2	B7044	Dissertation Viva-Voce	PW	-	-	-	630	630	14	-	100	100
Total				0	0	0	900	900	20	100	100	200

List of Audit Courses

#	Course Code	Title of the Course
1	B7091	Disaster Management
2	B7092	Value Education
3	B7093	Constitution of India
4	B7094	Stress Management by Yoga
5	B7095	Pedagogy Studies
6	B7096	English for Research Paper Writing

Common Abbreviations Used in the Curriculum

PC	–	Professional Core	L	–	Lecture Hours
MC	–	Mandatory Course	T	–	Tutorial Hours
AC	–	Audit Course	P	–	Practical Hours
PE	–	Professional Elective	TW	–	Team Work
OE	–	Open Elective	SL	–	Self Learning
PW	–	Project Work	H	–	Hours
CI	–	Classroom Instruction	C	–	Credits
LI	–	Laboratory Instruction	CIE	–	Continuous Internal Evaluation
SDG	–	Sustainable Development Goals	SEE	–	Semester End Examination

I M.Tech. I Semester

B7501 – Advanced Data Structures

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course focuses on advanced methods for organizing and managing data efficiently. It helps students understand how different structures can improve searching, insertion, and deletion operations in large datasets. The course emphasizes efficient memory use and faster data access through well-structured algorithms. Students learn techniques to handle data collisions and maintain accuracy in storage and retrieval. It also introduces methods for processing and matching patterns in large text or data collections. The course strengthens analytical and programming skills for real-world data management. Overall, it prepares students to design efficient and reliable data-handling solutions.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7501.1. Analyze different search tree structures to identify their efficiency and applicability in solving data organization problems.

B7501.2. Choose appropriate heap to organize and perform operations on data efficiently.

B7501.3. Apply different hashing methods and collision resolution techniques to efficiently manage and retrieve data in hash tables.

B7501.4. Make use of various trie based structures to optimize searching and data retrieval processes.

B7501.5. Compare different pattern matching algorithms for specific text-processing problems.

Course Syllabus

Unit-I:

Search Trees: Binary search tree operations insertion , deletion and search, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion,Deletion and Searching, Red Black and Splay Trees, B- trees: definition and operations. R-trees: Nearest neighbor Query, join and range queries.

Unit-II:

Heap Structures: Introduction, Min-Max Heaps, Binomial Heaps, Fibonacci heaps, Priority Queues– Realizing a Priority Queue using Heaps, Definition,insertion, Deletion.

Unit-III:

Hashing and Collisions: Introduction, Hash Tables, hash table representation Hash Functions, different Hash Functions - Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collision resolution,

separate chaining, open addressing, linear probing, quadratic probing, Double hashing, rehashing, extendible hashing.

Unit-IV:

Digital Search Structures: Digital Search trees, Binary tries, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries.

Unit-V:

Pattern matching: Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String, Harspool, Rabin Karp.

Books and Materials

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran. *Fundamentals of Computer Algorithms* , 2nd ed., UniversityPress(India) PrivateLimited, 2015.
2. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to Algorithms*, 4th ed., MIT Press, 2022.

Reference Books:

1. Horowitz, Ellis, Sartaj Sahni, and Dinesh Mehta. *Fundamentals of Data Structures in C++.*, 2nd ed., Universities Press (India) Pvt. Ltd., 2008.
2. Pai, G. A. V. *Data Structures and Algorithms: Concepts, Techniques and Applications in C++.*, Tata McGraw-Hill Education, 2009.

B7502 – Neural Networks and Deep Learning

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides a comprehensive understanding of deep learning, focusing on designing and training neural networks to learn complex patterns from data. It emphasizes efficient learning, optimization, and strategies to improve generalization and avoid common pitfalls. Students explore methods for both feature extraction and sequence modeling, as well as techniques for generating and interpreting data representations. Practical applications span visual and textual domains, enabling tasks such as image and video analysis, language understanding, and content generation. The curriculum integrates approaches to enhance model performance, robustness, and scalability. By the end of the course, they are equipped to develop, evaluate, and deploy intelligent systems for real-world AI problems.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7502.1. Build neural network models to solve real world problems efficiently and accurately.

B7502.2. Apply deep learning techniques to build efficient models for real-world data analysis and prediction tasks.

B7502.3. Employ deep learning approaches to various computer vision tasks.

B7502.4. Make use of various text encoding methods for natural language processing applications.

B7502.5. Implement NLP tasks using deep learning techniques for real time applications.

Course Syllabus

Unit-I:

Introduction to Neural Networks: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Regularization, Dropout.

Unit-II:

Neural Networks: Convolution Neural Networks - Architectures, convolution /pooling layers. Recurrent Neural Networks- RNN , LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning - Auto encoders, Variational Auto encoders, Generative Adversarial Networks.

Unit-III:

Deep Learning for Computer Vision: Image segmentation, object detection, automatic image captioning,

Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks.

Unit-IV:

Deep Learning for NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations-Continuous Skip Gram Model, Continuous Bag of Words model (CBOW), Word2Vec, Glove, BERT.

Unit-V:

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks, Parsing and Sentiment Analysis using Recursive Neural Networks, Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

Books and Materials

Text Books:

1. Goodfellow, Yoshua Bengio, and Aaron Courville. *Deep Learning*, 9th ed., , MIT Press, 2016.
2. Je Heaton. *Deep Learning and Neural Networks*, 4th ed., Heaton Research Inc, 2015.

Reference Books:

1. Yegnanarayana, B. *Artificial Neural Networks*, 3rd ed., PHI Learning Pvt. Ltd., 2023.
2. Satish Kumar. *Neural Networks: A Classroom Approach*, Tata McGraw-Hill Education, 2020.

B7001 – Research Methodology and IPR

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	30	60	2	40	60	100

Course Description

Course Overview

Research is an art of scientific investigation. Research is an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. This course will help students to understand about the research process, tools, importance of ethics. Students can learn about the law of patent and copyrights and knowledge on IPR (Intellectual Property rights).

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7001.1. Identify an appropriate research problem in their suitable domain.
B7001.2. Construct a well-structured research paper and scientific presentations.
B7001.3. Express the importance of research ethics in scientific community.
B7001.4. Explore on various component of IPR and process of filing.
B7001.5. Gain knowledge on patents and copyrights.

Course Syllabus

Unit-I:

Research Problem: Scope and objectives, Selection criteria, Research Problems, Research Approaches, Data collection, Data analysis, Ethics, Instrumentation, Interpretation.

Unit-II:

Literature Studies: Effective literature studies, Types of literature review, Process and Purpose, Survey, Critical analysis, classification and comparison, case study, identifying the knowledge gap and propose a action plan.

Unit-III:

Technical Writing: Effective Report/Article/Thesis writing, tools required, documentation using suitable application (Word, LaTeX, Pages), data representation using graphs, bar diagrams, pi-charts, preparation of manuscript, plagiarism, presentation of research work, Abstract and Conclusion.

Unit-IV:

Research proposal: Problem defining, national and international Scenario of proposed research, key factors, cost and contingencies, preparing timeline for research plan, funding agencies, collaboration, product and patent development.

Unit-V:

Patent Rights and IPR: Process of Patenting and Development, Copyright, Trademark, Licensing and transfer of technology, Patent information and databases, New Developments in IPR, Administration of Patent System, Trade Secret, Copyright Infringement.

Books and Materials

Text Books:

1. C.R. Kothari, Gaurav Garg, Research Methodology : Methods And Techniques, New Age International Publishers; 4th edition, 2019
2. P Suganda Devi, Research Methodology: A Handbook for Beginners, Notion Press; 1st edition, 2017

Reference Books:

1. Brad Sherman and Lionel Bently, Intellectual Property Law, Oxford University Press, 4th edition, 2014

PROFESSIONAL ELECTIVE-I

B7551 – Mining Massive Datasets

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course equips students with advanced skills to extract insights and patterns from large-scale and dynamic datasets. It emphasizes efficient techniques for processing and analyzing data streams while ensuring scalability and accuracy. Students explore methods to measure similarity, detect trends, and summarize complex information effectively. Analytical approaches for ranking, clustering, and handling high-dimensional data are studied for practical applications. The course addresses real-world problems in online decision-making, recommendation systems, and targeted advertising. Graph-based data analysis is included to understand relationships, communities, and network dynamics. Emphasis is placed on implementing scalable algorithms suitable for big data environments. Overall, the course prepares students to design intelligent, data-driven solutions for diverse computational problems.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7551.1. Apply data mining concepts and MapReduce programming techniques for processing large scale datasets efficiently.

B7551.2. Make use of similarity search and data stream mining techniques to find patterns of datasets efficiently.

B7551.3. Employ link analysis and clustering techniques to identify important patterns and efficiently process streaming datasets.

B7551.4. Analyze online advertising techniques and recommendation system models for personalization and large-scale deployment.

B7551.5. Choose appropriate graph based method to find communities and important patterns in social network data.

Course Syllabus

Unit-I:

Data Mining and MapReduce: Introduction,Definition of Data Mining,Statistical Limits on Data Mining, Distributed File Systems, MapReduce, Algorithms Using MapReduce.

Unit-II:

Similarity Search and Streaming Data: Finding Similar Items Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Distance Measures. Streaming Data-Mining Data Streams-The Stream Data Model , Sampling Data in a Stream, Filtering Streams.

Unit-III:

Link Analysis and Clustering: PageRank, Efficient Computation of PageRank, Link Spam Frequent Itemsets,Handling Larger Datasets in Main Memory, Limited Pass Algorithms, Counting Frequent Items in a Stream. Clustering-The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism.

Unit-IV:

Advertising on the Web and Recommendation Systems: Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem,The Adwords Problem, Adwords Implementation. Recommendation Systems-A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction.

Unit-V:

Mining Social Network Graphs: Social Networks as Graphs, Clustering of Social-Network Graphs, Partitioning of Graphs, Simrank, Counting Triangles.

Books and Materials

Text Books:

1. Leskovec, Jure, Anand Rajaraman, and Jeff Ullman. *Mining of Massive Datasets* , 3rd ed., Cambridge University Press, 2020.

Reference Books:

1. Han, Jiawei, and Micheline Kamber. *Data Mining: Concepts and Techniques.*, 3rd ed., Elsevier, 2011.
2. Dunham, Margaret H. *Data Mining: Introductory and Advanced Topics.*, Pearson Education India, 2006.

B7552 – Web and Database Security

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course equips students with advanced skills to extract insights and patterns from large-scale and dynamic datasets. It emphasizes efficient techniques for processing and analyzing data streams while ensuring scalability and accuracy. Students explore methods to measure similarity, detect trends, and summarize complex information effectively. Analytical approaches for ranking, clustering, and handling high-dimensional data are studied for practical applications. The course addresses real-world problems in online decision-making, recommendation systems, and targeted advertising. Graph-based data analysis is included to understand relationships, communities, and network dynamics. Emphasis is placed on implementing scalable algorithms suitable for big data environments. Overall, the course prepares students to design intelligent, data-driven solutions for diverse computational problems.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7552.1. Develop secure web applications by implementing cryptographic techniques and best practices to mitigate web-based security risks.

B7552.2. Implement privacy-preserving and security mechanisms to protect user data and ensure safe web server operations.

B7552.3. Design secure database systems using access control, encryption, and trust management techniques to safeguard sensitive information.

B7552.4. Enhance database protection through security re-engineering, watermarking, and recovery mechanisms to ensure data integrity and trust.

B7552.5. Apply privacy-preserving frameworks and anonymization techniques to ensure secure data mining and publishing in distributed environments.

Course Syllabus

Unit-I:

Web Security: The Web Security Problem, Risk Analysis and Best Practices, Cryptogra phy and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identi cation.

Unit-II:

Web Privacy: The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

Unit-III:

Database Security: Recent Advances in Access Control, Access Control Models for XML, Access Control Policy Languages in XML, Database Issues in Trust Management and Trust Negotiation, Authenticated Index Structures for Outsourced Databases, Towards Secure Data Outsourcing, Managing and Querying Encrypted Data, Security in Data Warehouses and OLAP Systems.

Unit-IV:

Security Re-Engineering for Databases: Concepts and Techniques, Database Water marking for Copyright Protection, Database Watermarking: A Systematic View, Trust worthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities.

Unit-V:

Privacy Preserving Data Mining: A survey, Privacy in Database Publishing: Bayesian Perspective, Privacy-enhanced Location-based Access Control,Privacy Preserving Publication: Anonymization Frameworks and Principles,Privacy Protection through Anonymity in Location-based Services, E ciently Enforcing the Security and Privacy Policies in a Mobile Environment.

Books and Materials

Text Books:

1. Simson G. Ar nkel, Gene Spa ord., *Web Security, Privacy and Commerce*, 2nd ed., O'Reilly, 2018.
2. Michael Gertz, SushilJajodia., *Handbook on Database security applications and trends*,, Springer, 2010.

Reference Books:

1. Jonathan LeBlanc Tim Messerschmidt., *Identity and Data Security for Web Develop ment: Best Practices*,, 1st ed., O' Reilly, 2016.
2. Bryan Sullivan and Vincent Liu., *Web Application Security, A Beginner's Guide*, Mc GrawHill, 2012.
3. Mark O'Neill., *Identity and Data Security for Web Develop ment: Best Practices*,, Web Services Security (Application Development) ,McGrawHill, 2003

B7553 – Agile Methodologies

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides an in-depth understanding of agile development principles focused on achieving organizational success through flexibility, collaboration, and continuous improvement. It explores how agile practices enhance team productivity, product quality, and responsiveness to change. Students learn to assess project suitability for agile adoption and effectively implement agile values in real-world scenarios. The course emphasizes teamwork, communication, and reflective practices to foster trust and shared ownership. Learners gain insights into maintaining sustainable work practices, ensuring reliable releases, and managing iterations efficiently. It also highlights strategies for balancing planning with innovation and for achieving high-performance delivery cycles. Overall, the course equips students with the mind-set and techniques needed to lead and contribute effectively in agile software development environments.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7553.1. Apply flexible and team-based approaches to efficiently develop and deliver quality software solutions.

B7553.2. Make use of collaborative and reflective practices to improve teamwork, communication, and overall efficiency in software development.

B7553.3. Implement effective release practices to ensure reliable, maintainable, and high-quality software.

B7553.4. Develop effective project plans to manage risks, prioritize tasks, and ensure timely software delivery.

B7551.5. Build software step by step using tests and refinements to ensure quality and performance.

Course Syllabus

Unit-I:

Agile Development and Extreme Programming (XP) : Why Agile , Understanding Success, Beyond Deadlines, Importance of Organizational Success, How to Be Agile , Agile methods, Don't make your own method, Road to mastery. XP life cycle, XP team, XP Concepts , Adopting XP - Knowing whether XP is suitable, Implementing XP, assessing Agility.

Unit-II:

Practicing XP - Thinking and Collaborating: Pair Programming, Energized work, Informative Workspace, Root cause Analysis, Retrospectives. Collaborating - Trust, Sit together, Real customer involvement, Ubiquitous language, meetings, coding standards, Iteration demo, Reporting.

Unit-III:

Practicing XP -Releasing: Version, Release Plan, Risk Management, Iteration Planning, Slack, Stories, Estimating.

Unit-IV:

Practicing XP-Planning: Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem,The Adwords Problem, Adwords Implementation. Recommendation Systems-A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction.

Unit-V:

Practicing XP-Developing: Incremental requirements, Customer tests, Test driven development, Refactoring, Incremental design and architecture, spike solutions, Performance optimization, Exploratory testing.

Books and Materials

Text Books:

1. James Shore and Shane Warden. *The art of Agile Development*, 11th ed., O'Reilly,2018.

Reference Books:

1. Andrew Stellman and Jennifer Greene. *Learning Agile.*, 4th ed., O'Reilly, 2018.
2. Venkat Subramaniam and Andy Hunt *Practices of an Agile Developer.*, 5th ed., SPD,2015
3. Jim Highsmith. *Agile Project Management.*, 6th ed., Pearson Low price Edition 2004.

B7554 – Natural Language Processing

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides an in depth understanding of how machines process, interpret, and generate human language. It explores the principles and computational methods used to analyze linguistic structure at multiple levels, enabling effective communication between humans and computers. Students will learn to design and implement algorithms that can recognize linguistic patterns, resolve ambiguities, and extract meaningful information from text. The course emphasizes both rule-based and data-driven approaches, equipping learners to handle multilingual and cross-lingual language data. It also introduces modern machine learning techniques for understanding semantics and context in text processing. By integrating statistical models with deep learning representations, students gain insights into building efficient systems.

Course Pre/Co-requisites

B7502 – Neural Networks and Deep Learning

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7554.1. Apply linguistic analysis methods to process and structure textual data for better understanding of language components.

B7554.2. Use syntactic parsing techniques and data-driven models to analyze grammatical relationships within sentences.

B7554.3. Implement semantic interpretation and embedding models to capture meaning and contextual information in text.

B7554.4. Utilize statistical and machine learning–based language models to build adaptable and multilingual text processing systems.

B7554.5. Develop practical solutions for automated summarization and question answering using computational language techniques.

Course Syllabus

Unit-I:

Finding the Structure of Words and Documents: Words and Their Components, Issues and Challenges, Morphological Models. Introduction, Sentence Boundary Detection, Topic Boundary Detection, Methods, Complexity of the Approaches, Performances of the Approaches , Features, Processing Stages.

Unit-II:

Syntax Analysis: Parsing Natural Language, Tree banks - A Data Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

Unit-III:

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense, Predicate Argument Structure, Meaning Representation, Word Sense Disambiguation, Predicate Argument Structure, Meaning Representation. Word Embedding Techniques- BOW, CBOW, TF-IDF, Word2Vec, Glove and BERT.

Unit-IV:

Language Modeling: Introduction, n-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language Specific Modeling Problems, Multilingual and Cross lingual Language Modeling.

Unit-V:

Summarization and Question Answering : Multilingual Automatic Summarization - Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets. Question Answering - Architectures, Source Acquisition and Pre-processing, Question Analysis, Search and Candidate Extraction, Answer Scoring, Evaluation, Current and Future Challenges.

Books and Materials

Text Books:

1. Bikel, Daniel M., and Imed Zitouni.*Multilingual Natural Language Processing Applications: From Theory to Practice.*, 1st Ed., Pearson, 2012.
2. Siddiqui, Tanveer, and U. S. Tiwary.*Natural Language Processing and Information Retrieval.*, 1st Ed., Oxford University Press, 2008.

Reference Books:

1. Jurafsky, Daniel, and James H. Martin. *Speech and Language Processing.*, 3rd Ed., Pearson, 2023.

PROFESSIONAL ELECTIVE-II

B7555 – Edge Analytics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the principles and practical applications of edge analytics, enabling real-time data processing close to data sources. It emphasizes integrating sensors, microcontrollers, and communication technologies to build efficient edge solutions. Students gain hands-on experience with cloud platforms, hardware, and programming tools to develop intelligent and scalable edge applications. The course also addresses security measures to safeguard edge systems from potential threats. Overall, it equips students to design and implement effective, connected, and secure edge applications.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 11 – Sustainable Cities and Communities

Course Outcomes

After the completion of the course, the student will be able to:

B7555.1. Apply edge analytics concepts to implement efficient real-time data processing solutions.

B7555.2. Integrate sensors, microcontrollers, and communication technologies to build functional edge systems.

B7555.3. Deploy and manage edge devices using cloud platforms for real-world applications.

B7555.4. Develop intelligent edge applications by programming microcontrollers and leveraging edge computing tools.

B7555.5. Implement security measures to protect edge analytics applications from potential threats.

Course Syllabus

Unit-I:

Introduction to Edge Analytics: What is edge analytics, Applying and comparing architectures, Key benefits of edge analytics, Edge analytics architectures, Using edge analytics in the real world.

Unit-II:

Edge Analytics Components: Basic edge analytics components, connecting a sensor to the ESP-12F microcontroller, KOM-MICS smart factory platform, Communications protocols used in edge analytics, Wi-Fi communication for edge analytics, Bluetooth for edge analytics communication, Cellular technologies for edge analytics communication, Long-distance communication using LoRa and Signfox for edge analytics.

Unit-III:

Microsoft Azure and Raspberry Pi: Working with Microsoft Azure IoT Hub, Cloud Service providers, Microsoft Azure, Exploring the Azure portal, Azure ioT Hub, Using the Raspberry Pi with Azure IoT edge, Connecting our Raspberry Pi edge device, adding a simulated temperature sensor to our edge device.

Unit-IV:

Micropython for Edge Analytics: Using Micropython for Edge Analytics, Understanding Micropython, Exploring the hardware that runs MicroPython, Using MicroPython for an edge analytics application, Using edge intelligence with microcontrollers, Azure Machine Learning designer, Azure IoT edge custom vision.

Unit-V:

Securing Edge Applications: Designing a Smart Doorbell with Visual Recognition setting up the environment, Writing the edge code, creating the Node-RED dashboard, Types of attacks against our edge analytics applications, Protecting our edge analytics applications.

Books and Materials

Text Books:

1. Dow, Colin. *Hands-On Edge Analytics with Azure IoT: Design and Develop IoT Applications with Edge Analytical Solutions Including Azure IoT Edge.*, Packt Publishing, 2020.

Reference Books:

1. Mahajan, Ashish. *Learn Edge Analytics: Fundamentals of Edge Analytics: Automated Analytics at Source Using Microsoft Azure.*, Independently published, 2020.
2. Nayak, Sabuzima. *A Review on Edge Analytics: Issues, Challenges, Opportunities, Promises, Future Directions, and Applications.*, arXiv, 2021.

B7556 – Ethical Hacking

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides a comprehensive, hands-on introduction to ethical penetration testing and vulnerability assessment, covering social engineering, physical and insider threats, network and web application testing, and the use of industry-standard tools such as Metasploit and Meterpreter for exploit development and automation. Students learn core exploit development concepts including stack operations, buffer overflows, and Structured Exception Handling (SEH), along with defensive techniques on Linux and Windows platforms. The course also addresses client-side and browser-based attacks, web security based on the OWASP Top Ten with practical labs on SQL injection and cross-site scripting, malware collection and preliminary analysis, honeynet techniques, and structured penetration testing methodologies, emphasizing professional test planning, reporting, and the recommendation and implementation of effective security mitigations.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7556.1. Apply ethical penetration-testing and social-engineering techniques to conduct assessments, analyze findings, and recommend effective mitigations.

B7556.2. Examine physical and insider security tests and Metasploit results to identify weaknesses and suggest improvements.

B7556.3. Plan and conduct structured penetration tests, craft and validate basic Linux and Windows exploits, and present actionable findings.

B7556.4. Test for and exploit common web application vulnerabilities, analyze root causes and recommend fixes.

B7556.5. Apply client-side exploit techniques and basic malware collection/initial analysis to identify threats and recommend containment and mitigation.

Course Syllabus

Unit-I:

Introduction Ethics of Ethical Hacking: Why you need to understand your enemy's tactics, recognizing the gray areas in security, Vulnerability Assessment and Penetration Testing. Penetration Testing and Tools, Social Engineering Attacks- How a social engineering attack works, conducting a social engineering attack, common attacks used in penetration testing, preparing yourself for face-to-face attacks, defending against social engineering attacks.

Unit-II:

Physical Penetration Attacks: Why a physical penetration is important, conducting a physical penetration, Common ways into a building, Defending against physical penetrations. Insider Attacks: Conducting an insider attack, Defending against insider attacks. Metasploit: The Big Picture, Getting Metasploit, Using the Metasploit Console to Launch Exploits, Exploiting ClientSide Vulnerabilities with Metasploit, Penetration Testing with Metasploit's Meterpreter, Automating and Scripting Metasploit, Going Further with Metasploit.

Unit-III:

Managing a Penetration Test: Planning a penetration test, structuring a penetration test, execution of a penetration test, information sharing during a penetration test, reporting the results of a Penetration Test. Basic Linux Exploits- Stack Operations, Buffer Overflows, Local Buffer Overflow Exploits, Exploit Development Process. Windows Exploits- Compiling and Debugging Windows Programs, Writing Windows Exploits, understanding Structured Exception Handling (SEH), Understanding Windows Memory Protections (XPSP3, Vista, 7 and Server 2008), Bypassing Windows Memory Protections.

Unit-IV:

Web Application Security Vulnerabilities: Overview of top web application security vulnerabilities, Injection vulnerabilities, cross-Site scripting vulnerabilities, the rest of the OWASP Top Ten SQL Injection vulnerabilities, Cross site scripting vulnerabilities. Vulnerability Analysis- Passive Analysis, Source Code Analysis, Binary Analysis.

Unit-V:

Client-Side Browser Exploits: Why clientside vulnerabilities are interesting, Internet explorer security concepts, history of client side exploits and latest trends, finding new browser based vulnerabilities heap spray to exploit, protecting yourself from client side exploit. Malware Analysis- Collecting Malware and Initial Analysis, Malware, Latest Trends in Honeynet Technology, Catching Malware- Setting the Trap, Initial Analysis of Malware.

Books and Materials

Text Books:

1. Allen Harper, Stephen Sims, Michael Baucom. *Gray Hat Hacking-The Ethical Hackers Handbook*, 3rd ed., Tata Mc Graw-Hill., 2019.
2. Dafydd Suttard, Marcus pint., *The Web Application Hacker's Handbook-Discovering and Exploiting Security flaws*, 1st ed., Wiley Publishing, 2015.

Reference Books:

1. Georgia Weidman., *Penetration Testing: Hands-on Introduction to Hacking*, 1st ed., Starch Press,2014.
2. L. Wylie, Kim Crawly., *The Pen Tester Blueprint-Starting a Career as an Ethical Hacker*, 1st ed., Wiley Publications,2021.

B7557 – Robotic Process Automation

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides an understanding of Robotic Process Automation (RPA) and its practical applications in automating business processes. Students will learn to design, develop, and deploy software bots using industry-standard RPA platforms, focusing on workflow sequencing, control structures, and data management. It emphasizes effective interaction with user interfaces, plugins, and extensions to handle complex automation tasks reliably. The program covers event-driven automation, exception handling, and debugging techniques to ensure robust bot performance. Learners gain skills in project organization, workflow reusability, and configuration management for scalable automation solutions. The course also introduces deployment strategies, orchestration, and license management to manage bots efficiently in enterprise environments. By the end of the course, students are equipped to develop, monitor, and maintain automated solutions that enhance operational efficiency.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7557.1. Apply edge analytics concepts to implement efficient real-time data processing solutions.

B7557.2. Integrate sensors, microcontrollers, and communication technologies to build functional edge systems.

B7557.3. Deploy and manage edge devices using cloud platforms for real-world applications.

B7557.4. Develop intelligent edge applications by programming microcontrollers and leveraging edge computing tools.

B7557.5. Implement security measures to protect edge analytics applications from potential threats.

Course Syllabus

Unit-I:

Introduction to RPA: Introduction , Scope and Techniques of Automation, What can RPA do? , Benefits of RPA , Components of RPA, RPA Platforms,RPA and Use cases, UiPath, UiPath Stack, Learning UiPath Studio, Task Recorder, Step by Step examples using recorder, Ways to create Bots.

Unit-II:

Sequence , Control Flow and Data Manipulation: Sequencing the workflow, Activities, Control Flow, Loops , decision making , step by step example using sequence and flow chart , sequence and control flow , Variables and Scope , Collections, Arguments , Data table usage , Clipboard management , File Operations , CSV/Excel to data table and vice versa.

Unit-III:

Controls , Plugins and Extensions: Finding and Attaching Windows, Fining the control ,Techniques for waiting for a control , Act on controls - mouse and keyboard activites, Working with UI explorer , Handling events, Revisit recorder, Screen scrapping , OCR , Types of OCR, How to use OCR, Avoiding Typical Failure Points , Plugins - Java, Mail, Pdf , Excel and Word. Extensions - Java , Chrome , Fire Fox.

Unit-IV:

Events and Exception Handling: Assistant Bots , Monitoring System event triggers, Monitoring Image and Element Triggers , Launching an assistant bot on a keyboard event , Common Exceptions and ways to handle , Logging and Taking Screen shots , Debugging Techniques , Collecting crash dumps , Error Reporting.

Unit-V:

Managing and Deploying Code and Bots : Project Organization, Nesting Work Flows, Reusability of Work Flows , Commenting Techniques, State Machine , When to use flowcharts, state machines or sequences , Using config files , Integrating a TFS server, Publishing using public utility , Orchestration Server, Using Orchestration Server to control and Deploy bots, License Management , Publishing and Managing updates.

Books and Materials

Text Books:

1. Alok Mani Tripathi *Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool- UIPath.*, Packt Publishing, 2018.
2. Gerardus Blokdyk. *Robotic Process Automation: A Complete Guide.*, Apress, 2020.

Reference Books:

1. Taulli, Tom.textit The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems , Apress, 2020.

B7558– Large Language Models

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the concepts of large language models by tracing their evolution from early language processing methods to modern transformer based systems. It explains how attention driven architectures enable models to understand and generate human like text at scale. Learners gain insight into how large models are trained on massive data and later adapted efficiently for specific tasks and domains. The course emphasizes practical strategies to guide model behavior using well designed inputs rather than retraining from scratch. It explores how these models are applied across diverse real world problems such as writing, reasoning, coding, and conversational systems. Students are exposed to commonly used platforms and ecosystems that support building intelligent language based applications. Methods to assess model quality, reliability, and usefulness are discussed using both automated and human centered approaches. The course also covers how such systems are deployed efficiently while balancing performance, cost, and response time. Ethical concerns such as bias, misuse, and trustworthiness are examined in the context of responsible AI use. Finally, it looks ahead to emerging directions that are shaping the future of intelligent language technologies.

Course Pre/Co-requisites

B7502 – Neural Networks and Deep Learning

B7554 – Natural Language Processing

Relevant SDG(s)

SDG 4 – Quality Education

SDG 8 – Decent Work and Economic Growth

SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7558.1. Employ foundational concepts of large language models to identify suitable models and learning approaches

B7558.2. Examine how different model training and tuning methods influence performance and adaptability in real-world language tasks.

B7558.3. Implement prompt design techniques and supporting tools to build effective language model based solutions for real world applications.

B7558.4. Utilize evaluation methods and deployment strategies to optimize the performance and scalability of large language models.

B7558.5. Apply ethical and safety practices to ensure responsible use and deployment of large language models.

Course Syllabus

Unit-I:

Foundations of Large Language Models: Introduction to LLMs: Definition, scope, and historical evolution from statistical NLP to transformers. The Transformer architecture: Attention mechanisms, self-attention, multi-head attention. Pretraining objectives: Masked language modeling (MLM), Causal language modeling (CLM). Evolution of LLMs: BERT, GPT series, T5, LLaMA, Mistral.

Unit-II:

Training and Fine-Tuning LLMs: Pretraining datasets and tokenization: BPE, SentencePiece, WordPiece. Fine-tuning approaches: Full fine-tuning, LoRA, adapters, instruction tuning. Domain adaptation and few-shot/zero-shot learning. Data augmentation for LLMs and prompt-based tuning.

Unit-III:

Prompt Engineering and Applications: Principles of prompt design: Zero-shot, few-shot, and chain-of-thought prompting. System prompts, role prompting, and context length optimization. Use cases: Text generation, summarization, code generation, question answering, chatbots. Tools & frameworks: Lang Chain, Llama Index, Hugging Face Transformers.

Unit-IV:

Evaluation and Deployment of LLMs: Evaluation metrics: Perplexity, BLEU, ROUGE, METEOR, human evaluation. Benchmark datasets: GLUE, SuperGLUE, HELM, BIG-bench. Deployment strategies: API-based deployment, on-prem deployment, inference optimization. Scaling and latency considerations; quantization and pruning for LLMs.

Unit-V:

Ethics, Safety, and Future Directions: Bias, fairness, and toxicity in LLMs. Hallucination problem and mitigation techniques. Legal and regulatory issues: Copyright, data privacy, AI Act. Trends in LLM research: Multimodal LLMs, retrieval-augmented generation (RAG), open-source LLM ecosystems.

Books and Materials

Text Books:

1. Tunstall, Lewis, Leandro von Werra, and Thomas Wolf. *Natural Language Processing with Transformers.*, O'Reilly Media, 2022.
2. Brown, Tom B. *Language Models are Few-Shot Learners.*, OpenAI Research Paper,2021

Reference Books:

1. Jurafsky, D., & Martin, J. H. *Speech and Language Processing* , 3rd ed., Pearson, 2022.
2. Hugging Face Documentation – https://huggingface.co/docs/

B7503 – Advanced Data Structures Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	60	0	60	2	40	60	100

Course Description

Course Overview

This course focuses on advanced data structures and algorithms, emphasizing efficient storage, retrieval, and manipulation of data. Students will learn to implement and manage hierarchical and heap-based structures for optimized performance. It covers techniques for handling collisions, organizing data, and prioritizing tasks effectively. The course also introduces methods for efficient pattern matching and text processing. Through hands-on practice, students develop skills to design, analyze, and evaluate data-driven solutions. Overall, it equips students to solve complex computational problems with optimized and robust approaches.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7503.1. Implement insertion, deletion, and search operations to manage hierarchical data efficiently.
B7503.2. Apply heap based structures to organize and prioritize data for optimized access and processing.
B7503.3. Develop programs using hashing techniques to handle collisions and enable fast lookups.
B7503.4. Implement pattern matching algorithms to solve string search and text processing problems.
B7503.5. Design trie structures for efficient storage and retrieval of data.

Course Syllabus

List of Experiments:

1. Write a program to perform insert,delete and search operations on Binary Search tree.
2. Write a program to perform insert,delete and search operations on AVL tree.
3. Write a program to perform insert,delete and search operations on Red-Black tree.
4. Write a program to perform insert,delete and search operations on B-tree.
5. Write a program to perform insert,delete and search operations on Min-Max Heap.
6. Write a program to perform insert,delete and search operations on Binomial Heap.
7. Write a program to implement priority queue.
8. Write program to implement the various functions of dictionary using hashing.
9. Write a program to implement linear probing, quadratic probing
10. Write a program to implement double hashing, rehashing
11. Write a program to implement Brute-Force Pattern Matching Algorithm.
12. Write a program to implement Boyer- Moore Pattern Matching Algorithm.

13. Write a program to implement Knuth-Morris-Pratt Pattern Matching Algorithm.
14. Write a program to implement Program to implement binary tries.

Laboratory Equipment/Software/Tools Required:

1. A computer Systems (PCs) installed with Ubuntu Operating System.
2. C/C++ Compiler.

Books and Materials

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran. *Fundamentals of Computer Algorithms* , 2nd ed., UniversityPress(India) PrivateLimited, 2015.
2. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to Algorithms*, 4th ed., MIT Press, 2022.

Reference Books:

1. Horowitz, Ellis, Sartaj Sahni, and Dinesh Mehta. *Fundamentals of Data Structures in C++.*, 2nd ed., Universities Press (India) Pvt. Ltd., 2008.
2. Pai, G. A. V. *Data Structures and Algorithms: Concepts, Techniques and Applications in C++.*, Tata McGraw-Hill Education, 2009.

B7504 – Neural Networks and Deep Learning Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	60	0	60	2	40	60	100

Course Description

Course Overview

This course provides a practical understanding of deep learning and its applications in computer vision and natural language processing tasks. Students learn to design, train, and optimize neural network models for various real-world problems. Emphasis is placed on understanding model performance and improving accuracy through effective techniques. The curriculum develops skills in analyzing sequential and structured data for prediction and generation tasks. Hands-on exercises focus on implementing and evaluating models using modern representation methods. Overall, the course equips students with the ability to build and apply deep learning solutions effectively.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7504.1. Apply neural network models and optimize their performance using suitable activation and regularization techniques.

B7504.2. Design and implement models to classify, encode, and process sequential data effectively.

B7504.3. Develop models for generating meaningful outputs from images and videos.

B7504.4. Utilize advanced representation techniques to process text for classification and analysis.

B7504.5. Apply deep learning models for extracting insights from text and generating responses.

Course Syllabus

List of Experiments:

1. Implementation of Feed forward Neural Network using Backpropagation.
2. Develop a model describes the Effect of Activation Functions and Regularization Techniques on Neural Network Performance.
3. Image classification on MNIST dataset (CNN model with Fully connected layer).
4. Applying the Autoencoder algorithms for encoding the real-world data.
5. Sequence-to-Sequence Learning using Encoder–Decoder with LSTM.
6. Automatic Image Captioning using CNN–LSTM Model.
7. Applying Generative Adversial Networks for image generation and unsupervised tasks.
8. Build a model for video to text with LSTM models.
9. Word Embeddings using CBOW and Skip-Gram (Word2Vec).

10. Text Classification using GloVe Embeddings.
11. Contextual Word Embeddings using BERT.
12. Sentiment Classification using BERT Fine-Tuning.
13. Opinion Mining using Recurrent Neural Networks.
14. Dialogue Generation using LSTMs.

Laboratory Equipment/Software/Tools Required:

1. A computer Systems (PCs) installed with Ubuntu Operating System.
2. Python (Open Source/ Freeware), Jupyter Notebook, Anaconda (Open Source/ Freeware)
3. Keras, Tensorflow and Pytorch libraries (Open Source/ Freeware)

Books and Materials

Text Books:

1. Goodfellow, Yoshua Bengio, and Aaron Courville. *Deep Learning*, 9th ed., , MIT Press, 2016.
2. Je Heaton. *Deep Learning and Neural Networks*, 4th ed., Heaton Research Inc, 2015.

Reference Books:

1. Yegnanarayana, B. *Artificial Neural Networks*, 3rd ed., PHI Learning Pvt. Ltd., 2023.
2. Satish Kumar. *Neural Networks: A Classroom Approach*, Tata McGraw-Hill Education, 2020.

I M.Tech. II Semester

B7505 – Big Data Computing

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course offers a clear and structured understanding of how large-scale data is generated, managed, and analyzed in modern systems. It explains the shift from traditional data management to scalable and distributed processing approaches. Students learn how data is stored, processed, and accessed efficiently across multiple machines. The course focuses on practical methods for transforming raw data into meaningful insights using analytical frameworks. It covers techniques for querying, processing, and integrating data from diverse sources. Workflow scheduling and coordination in distributed environments are emphasized to ensure reliable execution. The course also introduces flexible data management models suited for unstructured and semi-structured data. Performance optimization and resource utilization are discussed for handling large workloads. Real-world use cases highlight how these technologies support data-driven decision making. Overall, the course prepares students to effectively work with and manage large-scale data systems.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7505.1. Demonstrate core big data concepts and processing technologies to manage, store, and analyze large-scale data in real-world environments.

B7505.2. Apply Hadoop ecosystem tools and MapReduce principles to develop and optimize scalable big data storage and processing solutions.

B7505.3. Utilize Hive and Pig to process, manipulate, and analyze large-scale data efficiently.

B7505.4. Leverage Oozie and NoSQL technologies to streamline data processing and manage large-scale datasets.

B7505.5. Integrate ZooKeeper and Sqoop to coordinate distributed systems and efficiently transfer large-scale data.

Course Syllabus

Unit-I:

Overview and Technologies for Big Data: Getting an Overview of Big Data Big Data, History of Data Management – Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data. Technologies for Handling Big Data : Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-Memory Computing Technology for Big Data.

Unit-II:

Hadoop, MapReduce and HBase: Hadoop Ecosystem, Hadoop Distributed File System, MapReduce, Hadoop YARN, Hbase, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie. The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Uses of MapReduce, Role of HBase in Big Data Processing.

Unit-III:

Hive and Pig: Exploring Hive Introducing Hive, Getting Started with Hive, Data Types in Hive, Built-In Functions in Hive, Hive DDL, Data Manipulation in Hive, Data Retrieval Queries, Using JOINS in Hive Analyzing Data with Pig : Introducing Pig, Running Pig, Getting Started with Pig Latin, Working with Operators in Pig, Working with Functions in Pig.

Unit-IV:

OOzie and NOSQL: Using Oozie Introducing Oozie, Installing and Configuring Oozie, Understanding the Oozie Workflow, Oozie Coordinator, Oozie Bundle, Oozie Parameterization with EL, Oozie Job Execution Model, Accessing Oozie, Oozie SLA. NoSQL Data Management: Introduction to NoSQL, Aggregate Data Models, Key Value Data Model, Document Databases, Relationships, Graph Databases, Schema-Less Databases, Materialized Views, Distribution Models, Sharding, MapReduce Partitioning and Combining, Composing MapReduce Calculations.

Unit-V:

Zookeeper and Scoop: Zookeeper: Installing and Running ZooKeeper, An Example, Group Membership in ZooKeeper, Creating the Group, Joining a Group, Listing Members in a Group, The ZooKeeper Service, Data Model, Operations, Implementation, Consistency, Sessions, Building Applications with ZooKeeper, A Configuration, Service, The Resilient ZooKeeper Application, A Lock Service, More Distributed Data Structures and Protocols, ZooKeeper in Production. Sqoop: Getting Sqoop, Sqoop Connectors, A Sample Import, Generated Code, Imports: A Deeper Look, Working with Imported Data, Importing Large Objects, Performing an Export, Exports: A Deeper Look.

Books and Materials

Text Books:

1. DT Editorial Services. *Big Data Black Book*, Dreamtech Press, 2015.
2. Tom White. *Hadoop: The Definitive Guide*, 3rd ed., O'Reilly Media, 2012.

Reference Books:

1. Acharya, Seema, and Subhashini Chellappan. *Big Data Analytics.*, Wiley, 2015.
2. Arvind Sathi. *Big Data Analytics: Disruptive Technologies for Changing the Game*, 1t ed., IBM Corporation, 2012.

B7506 – Systems and Network Security

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

This course provides a comprehensive study of protecting information and communication in digital systems. It introduces the challenges of unauthorized access, data modification, and information loss, along with strategies to ensure confidentiality, integrity, authentication, and availability. Students explore encryption methods, including classical and modern techniques, and learn key management and secure data exchange. Authentication mechanisms, digital signatures, and message verification techniques are studied to establish trust and prevent forgery. The course covers secure communication protocols for networks and web-based applications, ensuring safe data transmission. Threats from malicious software, intruders, and system vulnerabilities are analyzed, along with detection and prevention techniques. Firewalls, trusted systems, and intrusion detection mechanisms are examined as protective measures. Practical applications of these techniques in email, transactions, and directory services are included. Overall, the course equips students with the skills to design and implement robust information protection solutions in complex digital environments.

Course Pre/Co-requisites

This course has no specific Pre/Co-Requisites

Relevant SDG(s)

SDG 4 – Quality Education

SDG 9 – Industry, Innovation and Infrastructure

SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7506.1. Apply security principles to design, evaluate, and implement solutions that protect information to ensure reliable communication.

B7506.2. Assess various public key cryptography and authentication methods for exchange of data.

B7506.3. Develop authentication and secure communication solutions to safeguard information and ensure trust.

B7506.4. Make use of IP Protocols and Web Security framework for reliable data transmission.

B7506.5. Examine system vulnerabilities and evaluate protective measures to detect, prevent, and mitigate security threats.

Course Syllabus

Unit-I:

Classical Encryption Methods: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security. Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

Unit-II:

Public key Cryptography and Authentication: Public key Cryptography Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

Unit-III:

Authentication Protocols: Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service. Email Security: Pretty Good Privacy (PGP) and S/MIME.

Unit-IV:

IP and Web Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Unit-V:

Threats: Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

Books and Materials

Text Books:

1. Stallings, William. *Cryptography and Network Security: Principles and Practice* , 4th ed., Pearson Education, 2016..

Reference Books:

1. Stallings, William. *Network Security Essentials: Applications and Standards.* , Pearson Education, 2011.
2. Whitman, Michael E., and Herbert J. Mattord. *Principles of Information Security.* , Thomson Course Technology, 2014.

PROFESSIONAL ELECTIVE-III

B7559 – Bioinformatics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides an advanced foundation in computational methodologies for the analysis and interpretation of biological information across molecular, cellular, and systems scales. It elucidates how biological data is formally represented, computationally processed, and transformed into actionable knowledge using algorithmic and statistical frameworks. Students develop practical proficiency in programming for high-throughput sequence analysis, data parsing, and workflow automation. The course emphasizes scalable data modeling, storage, integration, and retrieval strategies for large and heterogeneous biological datasets. Core algorithmic techniques for sequence alignment, comparison, and modeling are covered alongside probabilistic methods and learning-based paradigms. Emerging artificial intelligence and deep learning approaches are examined for predictive modeling and large-scale biological inference. Evolutionary analysis and structural bioinformatics perspectives are applied to interpret biological function, variation, and relationships. By integrating theory, computational tools, and applied case studies, the course prepares learners to address complex research and industrial challenges in bioinformatics and computational biology.

Course Pre/Co-requisites

B7502 – Neural Networks and Deep Learning

Relevant SDG(s)

SDG 3 – Good Health and Well-being
SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7559.1. Use digital data-structuring approaches to organize molecular information and transform biological data into meaningful biological knowledge.

B7559.2. Implement computational scripts to handle, analyze, and interpret biological sequence data for real-world bioinformatics applications.

B7559.3. Design data management solutions to efficiently store, access, and analyze complex biological datasets for practical bioinformatics tasks.

B7559.4. Analyze biological sequences using computational and AI methods to identify patterns and extract meaningful insights.

B7559.5. Use computational and analytical approaches to interpret biological data and extract meaningful insights.

Course Syllabus

Unit-I:

The Central Dogma & XML (Bio-XML) for Bioinformatics : Watson's definition, information flow, data → knowledge pathway, Organization of DNA & proteins, Introduction to XML & Bio-XML, Differences between HTML and XML, XML fundamentals, namespaces, DTDs, declaring elements & attributes, XML schemas, simple & complex types.

Unit-II:

Perl (Bioperl) for Bioinformatics Representing DNA & protein sequence data, Programs to store DNA sequences, concatenation. Transcription, reverse complement in Perl. File handling, arrays, flow control. Motif finding, nucleotide counting. Exploding strings into arrays, subroutines, debugging.

Unit-III:

Databases & Modern Biological Data Management: Flat file, relational, object-oriented, and object-relational databases. Hypertext & biological file formats. Database life cycle, architecture, DBMS interfaces. Biological databases overview: NCBI, EMBL, DDBJ, UniProt, PDB, KEGG, Reactome. Metadata standards for biological datasets. Graph databases & knowledge graphs for bioinformatics. Cloud-based Bioinformatics databases (NCBI SRA, ENA).

Unit-IV:

Sequence Alignment Algorithms & AI-Driven Sequence Analysis: Biological motivations, models for sequence analysis. Global & local alignment. End free-space alignment and gap penalties. Sequence analysis tools and techniques. Hidden Markov Models (HMMs) for gene prediction (e.g., GENSCAN). Machine Learning for sequence analysis: Protein/DNA classification, Deep learning models for sequence prediction. Multiple Sequence Alignment (MSA) using MUSCLE, Clustal Omega. Introduction to NGS alignment (Bowtie2, BWA).

Unit-V:

Phylogenetic Analysis, Structural Bioinformatics & NGS: Introduction to phylogenetics, distance methods. NJ method, Fitch–Margoliash method. Character-based methods. Tree evaluation & problems in phylogenetic analysis. Clustering, protein structure visualization & prediction. Next-Generation Sequencing (NGS) workflow: Quality control, alignment, variant calling. Tools: FASTQC, SAMtools, GATK. Protein structure prediction using AI: AlphaFold2 basics Molecular Docking & Drug Discovery: AutoDock, PyRx. Structural alignment tools (TM-align, DALI).

Books and Materials

Text Books:

1. S.C. Rastogi, N. Mendiratta *Bioinformatics: Methods and Applications.*, 2nd Ed., CBS Publications, 2018.
2. James D. Tisdall. *Beginning Perl for Bioinformatics* , 4th ed., O'Reilly Media, 2017.
3. Andreas D. Baxevanis, Francis Ouellette. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins* , 3rd ed., Wiley-Blackwell, 2019.

Reference Books:

1. David W. Mount *Bioinformatics: Sequence and Genome Analysis.*, 2nd ed., Cold Spring Harbor Laboratory Press.
2. Bryan Bergeron. *Bioinformatics Computing.*, Pearson Education, 2003.

B7560 – Cyber Security and Cyber Laws

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course enables students to apply cybersecurity principles to protect systems, networks, and data from real-world threats. Learners will analyze attacker methods and system vulnerabilities to implement effective security measures. They will investigate cybercrime incidents and secure mobile and organizational environments using practical strategies. Students will apply legal and policy frameworks to ensure compliance in digital operations. They will conduct digital forensics, collecting and analyzing evidence to respond to security breaches. Privacy protection techniques will be applied across different domains to safeguard sensitive information. Organizational risks and social media security challenges will be assessed and mitigated using applied approaches. Overall, students will gain hands-on skills to detect, prevent, and respond to cyber threats in practical scenarios.

Course Pre/Co-requisites

B7506 – Systems and Network Security

B7556 – Ethical Hacking

Relevant SDG(s)

SDG 4 – Quality Education

SDG 9 – Industry, Innovation and Infrastructure

SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7560.1. Use core cyber security concepts to identify threats and vulnerabilities for protecting digital assets.

B7560.2. Employ cyber laws and digital forensics principles to analyze cyber incidents, handle digital evidence, and support lawful cyber investigations.

B7560.3. Apply mobile security principles to detect cybercrimes and enforce safeguards for protecting mobile and wireless devices.

B7560.4. Evaluate the impact of cyber threats, IPR issues, and privacy risks on organizational security.

B7560.5. Implement data privacy principles to identify privacy risks and protect sensitive information across domains.

Course Syllabus

Unit-I:

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Comprehensive Cyber Security Policy.

Unit-II:

Cyberspace and the Law and Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and

Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics.

Unit-III:

Cybercrime - Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

Unit-IV:

Cyber Security Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations .

Unit-V:

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains medical and financial.

Books and Materials

Text Books:

1. Nina Godbole and Sunit Belpure. *Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, WILEY Publications, 2018.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang.*Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives*, CRC Press, ISBN 9780815371335, 2018.

Reference Books:

1. James Graham, Richard Howard and Ryan Otson. *Cyber Security Essentials*, CRC Press, 2021.
2. Chwan-Hwa(john) Wu, J. David Irwin *Introduction to Cyber Security*, CRC Press T and F Group,2017

B7561 – Prompt Engineering

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the principles and practices of prompt engineering for effective use of large language models. It explains the fundamentals of text generation, transformer architectures, and the evolution of modern LLMs. Learners gain hands-on experience with ChatGPT for generating structured, high-quality, and context-aware text. The course covers advanced prompting techniques, style control, and structured data formats such as JSON and YAML. Text chunking, tokenization, and memory-based retrieval methods are explored for handling large documents. Students are introduced to embeddings, vector databases, and retrieval-augmented generation techniques. By the end, learners can design robust prompts and build practical LLM-driven applications.

Course Pre/Co-requisites

B7502 - Neural Networks and Deep Learning B7558 – Large Language Models B7554 – Natural Language Processing

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7561.1. Utilize effective prompts by applying core prompt-engineering principles to control and improve generative AI outputs.

B7561.2. Employ core mechanisms of modern generative AI to interpret, evaluate, and effectively utilize state-of-the-art language models.

B7561.3. Implement effective prompting strategies to generate, transform, validate, and adapt content across multiple formats and writing styles using large language models.

B7561.4. Examine various text chunking approaches based on their impact on context retention and language-model performance.

B7561.5. Make use of vector databases for efficient information retrieval.

Course Syllabus

Unit-I:

Fundamentals and Principles of Prompting: Overview of the Five Principles of Prompting: Give Direction, Specify Format, Provide Examples, Evaluate Quality, Divide Labor.

Unit-II:

Large Language Models for Text Generation: What Are Text Generation Models, Vector Representations: The Numerical Essence of Language, Transformer Architecture: Orchestrating Contextual Relationships, Probabilistic Text Generation: The Decision Mechanism, Historical Underpinnings: The Rise of Transformer Architectures, OpenAI's Generative Pretrained Transformers, GPT-3.5-turbo and ChatGPT, GPT-4, Google's Gemini, Meta's Llama and Open Source.

Unit-III:

Text Generation with ChatGPT Generating Lists, Hierarchical List Generation, When to Avoid Using Regular Expressions, Generating JSON, YAML Filtering YAML Payloads, Handling Invalid Payloads in YAML, Diverse Format Generation with ChatGPT, Mock CSV Data, Universal Translation Through LLMs, Ask for Context, Text Style Unbundling, Identifying the Desired Textual Features, Generating New Content with the Extracted Features, Extracting Specific Textual Features with LLMs.

Unit-IV:

Text Chunking with ChatGPT Chunking Text, Benefits of Chunking Text, Scenarios for Chunking Text, Poor Chunking Example, Chunking Strategies, Sentence Detection Using SpaCy, building a Simple Chunking Algorithm in Python, Sliding Window Chunking, Text Chunking Packages, Text Chunking with Tiktoken, Encodings, Understanding the Tokenization of Strings.

Unit-V:

Vector Databases : Retrieval Augmented Generation (RAG), Introducing Embeddings, Document Loading. Memory Retrieval with FAISS, RAG with Lang Chain, Hosted Vector Databases with Pinecone, Self Querying, Alternative Retrieval Mechanisms.

Books and Materials

Text Books:

1. Phoenix J, Taylor M.*Prompt engineering for generative AI.* , 1st ed., O'Reilly Media, Inc."; 2024.
2. John Berryman, Albert Ziegler. *Prompt Engineering for LLMs: The Art and Science of Building Large Language Model-Based Applications* , 1st ed., O'Reilly Media ,2024.

Reference Books:

1. Tunstall L, Von Werra L, Wolf T. *Natural language processing with transformers.*, 1st ed., O'Reilly Media, Inc. , 2022.
2. Foster D. *Generative deep learning.*, O'Reilly Media, Inc,2022.

B7562 – Generative AI

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides a comprehensive exploration of modern generative artificial intelligence, covering foundational theory, cutting edge architectures, multimodal applications, and practical deployment. Students will gain both theoretical understanding and hands on experience in building and fine tuning generative models—including large language models (LLMs), diffusion models, and generative adversarial networks (GANs)—while critically examining their ethical implications and real world use cases.

Course Pre/Co-requisites

B7502 – Neural Networks and Deep Learning

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7562.1. Demonstrate generative and discriminative AI methods to design models that handle prediction and data generation tasks effectively.

B7562.2. Analyze the structure and working of transformer-based and large language models to evaluate their effectiveness in language understanding and generation.

B7562.3. Design and fine tune transformer based models for text and multimodal generation tasks.

B7562.4. Build innovative solutions using generative models and reinforcement learning to create art, music, and intelligent autonomous agents.

B7562.5. Utilize modern development and deployment toolchainsto build generative applications.

Course Syllabus

Unit-I:

Introduction to Generative AI : Historical overview of generative modeling , Difference between Generative AI and discriminative modeling ,Importance of generative models in AI and machine learning , Types of generative models: GANs, VAEs, autoregressive models and diffusion models. Understanding probabilistic modeling and the generative process , Challenges in generative modeling, Future of Generative AI , Ethical aspects of AI , Responsible AI,Use cases.

Unit-II:

Transformers and Large Language Models (LLMs) : Language model basics , Building blocks of language models , Transformer architecture , Encoder and decoder , Attention mechanisms ,Text generation ,Models like BERT and GPT, Autoencoding and autoregressive models , Exploring ChatGPT , Prompt engineering ,Designing and revising prompts using Reinforcement Learning from Human Feedback (RLHF) , Retrieval Augmented Generation (RAG) ,Multimodal LLMs ,Issues of LLMs such as hallucination.

Unit-III:

Multimodal and Advanced Image Generation: Introduction to Generative Adversarial Networks ,Adversarial training process ,Nash equilibrium, Variational Autoencoders , Encoder-decoder architectures ,Stable Diffusion models , Transformer based image generation ,CLIP , Vision Transformers (ViT), DALL-E 2 and DALL-E 3, GPT-4V ,Issues in image generation models, such as mode collapse and training stability.

Unit-IV:

Creative Applications and Generative Reinforcement Learning : Variants of GANs , Types of GANs , CycleGAN for generating paintings , Neural style transfer , Music generation with RNNs , MuseGAN ,Autonomous agents , Deep Q-learning , Actor-critic networks.

Unit-V:

The Generative AI Tool chain: Development & Deployment: Training and fine tuning generative models , GPT4All , Transfer learning and pretrained models , Training vision models , GitHub Copilot , Programming with LLMs: LangChain Open source models: LLaMA ,Programming for TimeSformer , Deployment with Hugging Face.

Books and Materials

Text Books:

1. Denis Rothman. *Transformers for Natural Language Processing and Computer Vision.*, 3rd Ed., Packt Books, 2024

Reference Books:

1. David Foster. *Generative Deep Learning.*, 2nd Ed., O'Reily Publications, 2024.
2. Altaf Rehmani. *Generative AI for Everyone.*, BlueRose One, 2024

PROFESSIONAL ELECTIVE-IV

B7563 – Predictive Analytics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course focuses on developing theoretical and practical foundation in prediction and forecasting techniques used in data science. It emphasizes supervised and unsupervised learning methods, including linear models, neural networks, support vector machines, tree-based models, boosting, and ensemble techniques. The course also highlights model assessment, validation, and selection strategies such as bias–variance trade-off, cross-validation, and bootstrap methods to ensure reliable and generalizable predictions. By integrating statistical approaches with machine learning algorithms, the course equips students with the ability to analyse complex datasets, build robust predictive models, and apply these techniques to real-world problems across diverse domains.

Course Pre/Co-requisites

B7551 – Mining Massive Datasets

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 11 – Sustainable Cities and Communities

Course Outcomes

After the completion of the course, the student will be able to:

B7563.1. Utilize predictive analytics and regression modeling techniques to build, interpret, and validate data-driven business models for decision-making.

B7563.2. Asses linear regression and classification techniques to assess their efficiency and effectiveness in supervised learning tasks.

B7563.3. Employ model assessment and selection techniques to optimize predictive accuracy and manage bias-variance trade-offs on real-world datasets.

B7563.4. Make use of advanced modeling techniques to analyze and address practical prediction and classification problems.

B7563.5. Interpret patterns in unlabeled data by applying clustering, association, and dimensionality reduction techniques to derive actionable insights.

Course Syllabus

Unit-I:

Predictive Analytics & Linear Regression: What and Why Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of data and variables, Data Modeling Techniques, Missing imputations etc. Need for Business Modeling, Regression — Concepts, Blue Property-Assumptions-Least Square Estimation, Variable Rationalization, and Model Building.

Unit-II:

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

Unit-III:

Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Bootstrap methods, conditional or expected test error.

Unit-IV:

Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Real Time Examples- Spam data, California housing, New Zealand fish, Demographic data.

Unit-V:

Unsupervised Learning: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

Books and Materials

Text Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman. *The Elements of Statistical LearningData Mining, Inference, and Prediction*, 2nd ed., Springer Verlag, 2009.

Reference Books:

1. C.M. Bishop *Pattern Recognition and Machine Learning*, 2nd ed., Springer,2006
2. Wasserman, Larry. *All of Statistics: A Concise Course in Statistical Inference*, Springer Science ,2014
3. Gareth James. Daniela Witten. *An Introduction to Statistical Learning with Applications in R* , 2nd ed., Springer Nature, 2021.

B7564 – Social Media Security

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides an understanding of social media and its growing influence on individuals, organizations, and society. It explores how social platforms create value while also presenting technical, ethical, and security challenges. Learners gain insight into online risks such as cybercrime, misuse of information, and manipulative practices, along with the role of human behavior in digital interactions. The course highlights responsible usage, effective communication strategies, and the impact of well-planned and poorly managed online activities. It emphasizes awareness of privacy, data protection, and long-term consequences of online actions. Students also examine risk mitigation, content control, and reputation management in digital environments. Practical understanding of safety measures and user controls is encouraged. Overall, the course balances opportunities and threats to promote informed, secure, and ethical participation in social media.

Course Pre/Co-requisites

B7552 – Web and Database Security

B7506 – Systems and Network Security

Relevant SDG(s)

SDG 4 – Quality Education

SDG 9 – Industry, Innovation and Infrastructure

SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7564.1. Use social media effectively by managing platforms, understanding their types and trends, and addressing associated challenges and security issues.

B7564.2. Identify and evaluate various cyber threats and malicious activities affecting social media users and online environments.

B7564.3. Examine effective and ineffective social media campaigns by applying content management and promotional strategies.

B7564.4. Analyze social media platforms to understand their types, trends, and potential risks for effective and responsible online communication.

B7564.5. Apply privacy policies and security practices to protect from risks.

Course Syllabus

Unit-I:

Social Media: Introduction to Social Media, Understanding Social Media, Different Types and Classifications, The Value of Social Media, Cutting Edge Versus Bleeding Edge, The Problems That Come With Social Media, Is Security Really an Issue? Taking the Good With the Bad

Unit-II:

Cyber Threats: Dark side Cyber crime, Social Engineering, Hacked accounts, cyber stalking, cyber bullying, predators, phishing, hackers

Unit-III:

Campaign Management: Being bold versus being overlooked Good social media campaigns, Bad social media campaigns, sometimes it's better to be overlooked, social media hoaxes, The human factor, Content management, Promotion of social media

Unit-IV:

Social Media Risks: Risks of Social media Introduction Public embarrassment, Once it's out there, it's out there False information, Information leakage, Retention and archiving, Loss of data and equipment.

Unit-V:

Privacy & Security: Policies and Privacy Blocking users controlling app privacy, Location awareness, Security Fake accounts passwords, privacy and information sharing.

Books and Materials

Text Books:

1. Altshuler Y, EloviciY, Cremers A.B, Aharony N, Pentland A. *Interdisciplinary Impact Analysis of Privacy in Social Networks, Recognizing Your Digital Friends, Encryption for Peer-to-Peer Social NetworksCrowd-sourcing and Ethics*

Reference Books:

1. Michael Cross. *Social Media Security Leveraging Social Networking While Mitigating Risk.*
2. Brij B. Gupta, Somya Ranjan Sahoo. *Online Social Networks Security Principles, Algorithm, Applications, and Perspectives.*, CRC press.

B7565 – Augmented Reality and Virtual Reality

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the principles and evolution of immersive technologies that blend digital content with the real and simulated worlds. It explains how humans perceive visual, auditory, and motion cues and how these perceptions guide the design of immersive experiences. Learners explore how environments are sensed, tracked, and aligned accurately with user movement and surroundings. The course emphasizes how interaction techniques allow users to intuitively engage with digital elements embedded in physical space. It also covers the geometric, optical, and physical foundations needed to construct believable virtual environments. Attention is given to rendering methods that enhance realism while maintaining performance and comfort. The course highlights the role of human physiology in shaping effective and safe immersive systems. Overall, it builds a strong conceptual foundation for designing, analyzing, and implementing immersive experiences across diverse applications.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 11 – Sustainable Cities and Communities

Course Outcomes

After the completion of the course, the student will be able to:

B7565.1. Utilize augmented reality principles to integrate display technologies and tracking systems for accurate placement of virtual elements in real environments.

B7565.2. Develop augmented reality solutions by applying computer vision tracking methods, interaction techniques, and suitable software architectures.

B7565.3. Make use of virtual reality concepts, geometric modeling, and optical principles to create and evaluate virtual environments.

B7565.4. Employ concepts of visual perception and rendering to improve quality and realism in immersive applications.

B7565.5. Examine motion and sound cues in virtual environments to assess their impact on user perception and interaction.

Course Syllabus

Unit-I:

Augmented Reality: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors.

Unit-II:

Computer Vision for Augmented Reality: Marker Tracking, Multiple Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking. Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs.

Unit-III:

Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays.

Unit-IV:

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color Visual Rendering: Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos.

Unit-V:

Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Interaction: Motor Programs and Remapping, Locomotion, Social Interaction. Audio: The Physics of Sound, the Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Books and Materials

Text Books:

1. Schmalstieg, Dieter, and Tobias Hollerer. *Augmented Reality: Principles & Practice.*, 1st ed., Pearson Education India, 2016.
2. LaValle, Steven M. *Virtual Reality.*, Cambridge University Press, 2016.

Reference Books:

1. Fowler, Allan. *AR Game Development.*, 1st ed., Apress, 2018.
2. Craig, Alan B., William R. Sherman, and Jeffrey D. Will. *Developing Virtual Reality Applications: Foundations of Effective Design.*, Morgan Kaufmann, 2009.

B7566 – Conversational AI

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces how conversational systems are designed to interact naturally with users in both text and speech. It explains how user inputs are understood, contextual meaning is maintained, and conversations are guided toward meaningful outcomes. Learners explore methods for managing dialogue flow, tracking user goals, and handling multi-turn interactions. The course covers different ways systems generate responses, from fixed patterns to data-driven and neural approaches. It highlights how modern language models are adapted for conversational use and how response quality is measured. Practical aspects of building systems using popular development frameworks are discussed. Ethical considerations such as bias, safety, and transparency are emphasized throughout. The course concludes with emerging trends, real-world applications, and case studies of advanced conversational systems.

Course Pre/Co-requisites

B7502 – Neural Networks and Deep Learning

B7562 – Generative AI

Relevant SDG(s)

SDG 4 – Quality Education

SDG 9 – Industry, Innovation and Infrastructure

SDG 10 – Reduced Inequalities

Course Outcomes

After the completion of the course, the student will be able to:

B7566.1. Apply core conversational AI principles to build a functional interactive system that understands user input, maintains context, and responds appropriately in real-world scenarios.

B7566.2. Examine user inputs to determine their intent and contextual meaning for effective conversational interaction.

B7566.3. Manage conversations effectively by keeping track of user details and steering the interaction toward the desired goal.

B7566.4. Implement suitable response strategies to generate clear, relevant, and context-aware replies in conversational systems and assess their effectiveness.

B7566.5. Analyse conversational systems by assessing their performance, ethical impact, and advanced capabilities in real-world use cases.

Course Syllabus

Unit-I:

Fundamentals of Conversational AI: Introduction to Dialogue Systems, Types of Conversational Agents (Chatbots, Task-oriented, Social Bots). Key Architecture Components: NLU, Dialogue State Tracking, Dialogue Policy, NLG. Overview of Toolkits and Platforms (RASA, Dialogflow).

Unit-II:

Natural Language Understanding for Dialogue: Intent Classification and Entity Extraction techniques. Context Modeling and Discourse Analysis. Introduction to Speech Recognition (ASR) and its integration. Semantic Parsing for dialogues.

Unit-III:

Dialogue Management: Dialogue Management Architectures: Rule-based (Finite-State, Frame-based), Statistical and Machine Learning based approaches. Dialogue State Tracking (DST). Dialogue Policy Learning using Reinforcement Learning. Form filling and slot tracking.

Unit-IV:

Response Generation: Response Generation Methods: Template-based, Retrieval-based, and Generative models. Introduction to Sequence-to-Sequence (Seq2Seq) models with attention for dialogue. Language Model fine-tuning for conversation. Evaluating response quality.

Unit-V:

Advanced Topics and Evaluation: Evaluation Metrics for Conversational AI: Perplexity, BLEU, Task Success Rate, Human Evaluation. Ethical Issues: Bias, Safety, and Transparency in Chatbots. Introduction to Multi-modal and Emotion-aware Dialogue Systems. Case Studies.

Books and Materials

Text Books:

1. Daniel Jurafsky & James H. Martin. *Speech and Language Processing*, 3rd ed., Pearson Publications.
2. Michael McTear. *Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots.*, Morgan and Claypool, 2020.

Reference Books:

1. Gao, J., Galley, M., & Li, L. *Neural Approaches to Conversational AI.*, Now Publisher, 2019.
2. Pieraccini R.textit The Voice in the Machine., MIT Press, 2012.

B7507 – Big Data Computing Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	60	0	60	2	40	60	100

Course Description

Course Overview

This course focuses on advanced data structures and algorithms, emphasizing efficient storage, retrieval, and manipulation of data. Students will learn to implement and manage hierarchical and heap-based structures for optimized performance. It covers techniques for handling collisions, organizing data, and prioritizing tasks effectively. The course also introduces methods for efficient pattern matching and text processing. Through hands-on practice, students develop skills to design, analyze, and evaluate data-driven solutions. Overall, it equips students to solve complex computational problems with optimized and robust approaches.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7507.1. Apply HDFS commands to create, read, write, and manage files and directories with proper permissions and replication.

B7507.2. Develop and run MapReduce programs to process and analyze large datasets efficiently.

B7507.3. Execute Hive queries to manipulate, join, and aggregate data for meaningful insights.

B7507.4. Design and run Pig scripts to transform, combine, and summarize datasets effectively.

B7503.5. Configure and execute Oozie workflows and use ZooKeeper and Sqoop to automate and coordinate data operations.

Course Syllabus

List of Experiments:

1. HDFS File Operations:
   Create, read, write, and delete files in HDFS.
   Set permissions and manage directories.
   Experiment with file replication and block size configurations.
2. HDFS File Access and Permission Management:
   Create multiple directories and files in HDFS.
   Set different permission levels (read, write, execute) for users and groups.
   Perform file ownership and permission modifications using chmod, chown, and chgrp.
   Test access restrictions by attempting operations with different user accounts.
   Analyze how HDFS enforces security and manages multi-user access.
3. MapReduce Job Development and Optimization:
   Implement a MapReduce program for data aggregation (e.g., sales totals).

Experiment with tuning mapper and reducer tasks for better performance.
Monitor job execution using Hadoop YARN Resource Manager.

4. MapReduce for Word Frequency Analysis in Large Text Files:
   Implement a MapReduce program to count the frequency of each word in a large dataset.
   Use custom partitioners to distribute workload efficiently across reducers.
   Apply combiners to reduce data shuffling between map and reduce phases.
   Analyze job execution and performance metrics using Hadoop YARN.
5. Hive Table Creation and Data Manipulation:
   Create a Hive database and define tables with various data types.
   Load data into Hive tables from local files or HDFS.
   Perform basic data manipulation operations: INSERT, UPDATE, DELETE.
   Execute retrieval queries using SELECT, filtering with WHERE, and sorting with ORDER BY.
   Apply built-in functions (e.g., string, numeric, date functions) on table data and observe results.
6. Hive Joins and Querying: Create multiple related Hive tables (e.g., Employees, Departments).
   Load data into these tables.
   Write and execute queries using different types of JOINs: INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL OUTER JOIN.
   Aggregate data using GROUP BY and HAVING clauses.
   Analyze and interpret the output of complex queries combining joins and aggregations.
7. Basic Data Processing with Pig Latin:
   Load data from HDFS into Pig using the LOAD statement.
   Perform basic data operations such as FILTER, GROUP, ORDER, and FOREACH.
   Apply built-in functions for string and numeric manipulation.
   Store the processed data back into HDFS using the STORE command.
   Validate the output by querying the stored results.
8. Data Transformation and Analysis in Pig:
   Load multiple datasets into Pig.
   Perform relational operations like JOIN, CROSS, and UNION to combine data.
   Use Pig functions for aggregation (SUM, COUNT, AVG) and data transformation.
   Execute a complete Pig script to generate summary reports (e.g., sales per region).
   Analyze the results to ensure correctness and efficiency of the Pig script.
9. Creating and Running Oozie Workflows:
   Install and configure Oozie on the Hadoop cluster.
   Create a basic Oozie workflow XML to run a MapReduce or Pig job.
   Submit the workflow using the Oozie CLI or web console.
   Monitor the workflow execution, check job status, and debug errors if any.
   Analyze the workflow logs to understand job execution order and dependencies.
10. Oozie Coordinator and Parameterization:
    Create an Oozie Coordinator XML to schedule periodic workflow execution.
    Use parameterization with EL (Expression Language) to pass dynamic values to jobs.
    Submit and monitor the coordinator job, verifying execution at scheduled intervals.
    Implement SLA monitoring for job completion and duration.
    Analyze how parameterization and scheduling improve automation in Hadoop workflows.

11. ZooKeeper Setup and Basic Operations:
    Install and configure ZooKeeper on a local or cluster environment.
    Start the ZooKeeper server and connect a client to it.
    Create znodes, set and get data, and delete znodes using the ZooKeeper CLI.
    Explore different types of znodes (persistent, ephemeral, sequential) and their behavior.
    Verify consistency and session handling by observing changes from multiple clients.
12. Group Membership and Distributed Coordination:
    Create a group in ZooKeeper and implement membership management for multiple clients.
    Join clients to the group and list all active members.
    Implement a basic distributed lock service using ZooKeeper znodes.
    Simulate a client failure and observe how session and ephemeral nodes help maintain consistency.
    Build a simple application that demonstrates coordination and synchronization among distributed processes.
13. Importing Data from RDBMS to HDFS:
    Install and configure Sqoop on the Hadoop cluster. Connect to a relational database using a Sqoop connector (e.g., MySQL or PostgreSQL). Perform a basic import of a table from the database into HDFS. Explore the generated code and review the imported data. Experiment with importing large objects (BLOBs/CLOBs) and verify data integrity.
14. Exporting Data from HDFS to RDBMS:
    Prepare data in HDFS for export (e.g., a transformed CSV or Parquet file).
    Use Sqoop to export the data back to a relational database table.
    Explore export options and analyze how Sqoop handles primary keys and updates.
    Perform incremental imports and exports to observe data synchronization behavior.
    Validate exported data in the RDBMS to ensure accuracy.

Laboratory Equipment/Software/Tools Required :

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. Cloudera-Hadoop (Open Source/ Freeware), Virtual Box (Open Source/ Freeware)
3. Apache Oozie, Apache zookeeper, Apache Sqoop Tools (Open Source / Freeware)

Books and Materials

Text Books:

1. White, Tom. *Hadoop: The Definitive Guide.*, 4th ed., O'Reilly Media, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman. *Big Data for Dum Mies.*, John Wiley & Sons, Inc., 2013.

Reference Books:

1. Capriolo, Edward, Dean Wampler, and Jason Rutherglen. *Programming Hive.*, O'Reilly Media, 2012.
2. Gates, Alan. *Programming Pig.*, O'Reilly Media, 2011.
3. Russell, John. *Oozie Essentials.*, Packt Publishing, 2013.

B7508 – Systems and Network Security Laboratory

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
0	0	60	0	60	2	40	60	100

Course Description

Course Overview

This laboratory course provides hands-on experience in the design, implementation, and analysis of modern cryptographic algorithms and security mechanisms. The course covers symmetric and asymmetric cryptographic techniques, hash functions, digital signatures, key exchange protocols, public key cryptosystems, and network security mechanisms such as Kerberos, firewalls, and secure web transactions. Students will also explore cryptographic libraries, PKI, digital certificates, MACs, and PKCS standards, enabling them to build secure communication systems. The lab emphasizes practical implementation, security analysis, and real-world applicability of cryptographic protocols.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education

SDG 9 – Industry, Innovation and Infrastructure

SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7508.1. Implement and evaluate symmetric and asymmetric cryptographic algorithms to secure data and communication

B7508.2. Develop secure methods to exchange information safely, confirm user identities, and preserve data integrity in real-world communication systems.

B7508.3. Use probabilistic and number-theoretic cryptographic methods to secure data and communications.

B7508.4. Design and evaluate security mechanisms to safeguard networks and communications from security threats.

B7508.5. Employ cryptographic libraries to build secure, reliable, and standards-compliant security solutions for real-world applications

Course Syllabus

List of Experiments:

1. Implementation of symmetric cipher algorithm (AES and RC4).
2. Random number generation using a subset of digits and alphabets.
3. Implementation of RSA based signature system
4. Implementation of Subset sum
5. Authenticating the given signature using the MD5 hash algorithm.
6. Implementation of Diffie-Hellman algorithm
7. Implementation of the ELGAMAL cryptosystem.

8. Implementation of Goldwasser-Micali probabilistic public key system
9. Implementation of Rabin Cryptosystem. (Optional).
10. Implementation of Kerberos cryptosystem
11. Firewall implementation and testing
12. Implementation of a trusted secure web transaction.
13. Cryptographic Libraries-Sun JCE/OpenSSL/Bouncy Castle JCE.
14. Digital Certificates and Hybrid (ASSY/SY) encryption, PKI.
15. Message Authentication Codes.
16. Elliptic Curve cryptosystems (Optional)
17. PKCS Standards (PKCS1, 5, 11, 12), Cipher modes.

Laboratory Equipment/Software/Tools Required:

1. Computer Systems (PCs) installed with Ubuntu OS (Open source/ Freeware)
2. JDK (Open Source/Freeware)
3. NS2, OpenSSL and Apache (Open Source)

Books and Materials

Text Books:

1. William Stallings., *Cryptography and Network Security (principles and approaches)* , 4th ed.,. Pearson Education,2021.

Reference Books:

1. Michael E. Whitman, Herbert J. Mattord *Principles of Information Security*, Thomson Pubblications.

II M.Tech. I Semester

PROFESSIONAL ELECTIVE-V

B7567 – Video Analytics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course provides an overview of signals, systems, and digital video, emphasizing the processing and analysis of visual information. It introduces motion estimation techniques for understanding 2D and 3D movement in videos. Students learn methods for video analytics, including object detection and tracking in complex scenes. Behavioral analysis and activity recognition are covered to identify and model human actions. The course also explores human recognition using face and gait, focusing on algorithm evaluation and performance. Techniques for video summarization and efficient surveillance are discussed. Emphasis is placed on integrating theory with practical applications. Overall, learners gain skills to analyze, interpret, and utilize video data effectively.

Course Pre/Co-requisites

This course has no specific Pre/Co-requisites

Relevant SDG(s)

SDG 4 – Quality Education

SDG 9 – Industry, Innovation and Infrastructure

SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7567.1. Apply concepts of signals and digital video to analyze and process multimedia data effectively.

B7567.2. Employ motion estimation techniques to analyze and interpret movement in images and video sequences.

B7567.3. Make use of video analytics techniques to detect, track, and interpret objects and activities in dynamic scenes.

B7567.4. Assess video data to identify human activities and interpret behavioral patterns effectively.

B7567.5. Analyze human recognition techniques to evaluate the performance of face and gait recognition methods

Course Syllabus

Unit-I:

Multi-dimensional signals and systems: signals, transforms, systems, sampling theorem. Digital Images and Video: human visual system and color, digital video, 3D video, digital-video applications, image and video quality.

Unit-II:

Motion Estimation : Image formation, motion models, 2D apparent motion estimation, differential methods, matching methods, non-linear optimization methods, transform domain methods, 3D motion and structure estimation.

Unit-III:

Video Analytics: Introduction- Video Basics - Fundamentals for Video Surveillance- Scene Artifacts- Object Detection and Tracking: Adaptive Background Modelling and Subtraction- Pedestrian Detection and Tracking Vehicle Detection and Tracking- Articulated Human Motion Tracking in Low-Dimensional Latent Spaces.

Unit-IV:

Behavioural Analysis and Activity Recognition: Event Modelling- Behavioural Analysis- Human Activity Recognition-Complex Activity Recognition Activity modelling using 3D shape, Video summarization, shape-based activity models- Suspicious Activity Detection.

Unit-V:

Human Face Recognition & Gait Analysis: Overview of Recognition algorithms – Human Recognition using Face: Face Recognition from still images, Face Recognition from video, Evaluation of Face Recognition Technologies- Human Recognition using gait: HMM Framework for Gait Recognition, View Invariant Gait Recognition, Role of Shape and Dynamics in Gait Recognition.

Books and Materials

Text Books:

1. Tekalp, A. Murat. *Digital Video Processing.* , 2nd ed., Pearson Publications, 2015.
2. Chellappa, Rama, Amit K. Roy-Chowdhury, and Kevin Zhou.S. *Recognition of Humans and Their Activities Using Video.* , Morgan &Claypool Publishers, 2005.

Reference Books:

1. Szeliski, Richard. *Computer Vision: Algorithms and Applications.* , Springer, 2011.
2. Wang, Yao, Jorn Ostermann, and Ya-Qin Zhang. *Video Processing and Communications.* , Prentice Hall, 2001.

B7568 – Mobile Application Security

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course explores the critical aspects of mobile security, emphasizing protection against threats to devices, applications, and data. It examines challenges in authentication, secure storage, malware, and safe browsing, alongside strategies for secure mobile application development. Students learn about vulnerabilities in mobile web technologies, including encryption, session management, and browser limitations. Wireless communication security, particularly Bluetooth and Wi-Fi, is addressed with focus on threats, standards, and mitigation techniques. Messaging systems such as SMS and MMS are analyzed for protocol and application-level risks. Enterprise mobile security topics include device security options, encryption, policy enforcement, and application sandboxing. The course also covers security features across major platforms like iOS, Android, Windows Mobile, and BlackBerry.

Course Pre/Co-requisites

B7506 – Systems and Network Security

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7568.1. Demonstrate the ability to secure mobile applications and protect data against common security threats.

B7568.2. Examine mobile web applications to identify vulnerabilities and assess security risks effectively.

B7568.3. Apply security measures to protect wireless communication technologies and safeguard devices against potential threats.

B7568.4. Inspect messaging platforms to uncover security vulnerabilities and assess their impact.

B7568.5. Manage security measures on mobile devices and applications to protect data and ensure secure operation.

Course Syllabus

Unit-I:

Mobile Issues and Development Strategies: Top Issues Facing Mobile Devices, Physical Security, Secure Data Storage (on Disk), Strong Authentication with Poor Keyboards, Multiple-User Support with Security, Safe Browsing Environment, Secure Operating Systems, Application Isolation, Information Disclosure, Virus, Worms, Trojans, Spyware, and Malware, Difficult Patching/Update Process, Strict Use and Enforcement of SSL, Phishing, Cross-Site Request Forgery (CSRF), Location Privacy/Security, Insecure Device Drivers, Multi Factor Authentication, Tips for Secure Mobile Application Development.

Unit-II:

WAP and HTTP Security: WAP and Mobile HTML Security WAP and Mobile HTML Basics, Authentication on WAP/Mobile HTML Sites, Encryption, Application Attacks on Mobile HTML Sites, Cross-Site Scripting, SQL Injection, Cross-Site Request Forgery, HTTP Redirects, Phishing, Session Fixation, Non-SSL Login, WAP and Mobile Browser Weaknesses, Lack of HTTPOnly Flag Support, Lack of SECURE Flag Support, Handling Browser Cache, WAP Limitations.

Unit-III:

Bluetooth Security: Bluetooth Security Overview of the Technology , History and Standards , Common Uses , Alternatives , Future, Bluetooth Technical Architecture , Radio Operation and Frequency, Bluetooth Network Topology , Device Identification , Modes of Operation , Bluetooth Stack ,Bluetooth Profiles, Bluetooth Security Features , Pairing , Traditional Security Services in Bluetooth, Security "Non-Features" , Threats to Bluetooth Devices and Networks, Bluetooth Vulnerabilities, Bluetooth Versions Prior to v1.2, Bluetooth Versions Prior to v2.1. Security for 1g Wi-Fi Applications, Security for 2g Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications

Unit-IV:

SMS Security: SMS Security Overview of Short Message Service, Overview of Multimedia Messaging Service, Wireless Application Protocol (WAP), Protocol Attacks, Abusing Legitimate Functionality, Attacking Protocol Implementations, Application Attacks, iPhone Safari, Windows Mobile MMS, Motorola RAZR JPG Overflow, Walkthroughs, Sending PDUs, Converting XML to WBXML.

Unit-V:

Enterprise Security: Enterprise Security on the Mobile OS Device Security Options, PIN, Remote, Secure Local Storage, Apple iPhone and Keychain, Security Policy Enforcement, Encryption, Full Disk Encryption, E-mail Encryption, File Encryption, Application Sandboxing, Signing, and Permissions, Application Sandboxing, Application Signing, Permissions, Buffer Overflow Protection, Windows Mobile, iPhone, Android and BlackBerry.

Books and Materials

Text Books:

1. Dwivedi, Himanshu, Chris Clark, and David Thiel. *Mobile Application Security.*, Tata McGraw-Hill, 2010.

Reference Books:

1. Makki, S. Kami, Peter Reiher, Kia Makki, Niki Pissinou, and Shamila Makki. *Mobile and Wireless Network Security and Privacy.*, Springer, 2007.
2. Misra, Anmol, and Abhishek Dubey. *Android Security: Attacks and Defenses.*, CRC Press, 2013.

B7569 – User Experience Design

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the concepts of user experience design, focusing on how users think, feel, and interact with digital products. It explores user behavior, motivations, and emotional responses to create meaningful and effective experiences. Learners study methods to observe users, gather insights, and translate research into useful user profiles. The course emphasizes principles of interface and visual design to guide user behavior and improve usability. It covers interaction patterns and layouts that enhance clarity, trust, and engagement in web environments. Motion and feedback are examined as tools to improve user understanding and flow. Mobile experience design is also addressed, considering platform constraints and interaction styles. Overall, the course equips learners to design intuitive, user-centered interfaces across web and mobile platforms.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 10 – Reduced Inequalities

Course Outcomes

After the completion of the course, the student will be able to:

B7569.1. Make use of user-centered thinking to design experiences that account for user behavior, emotions, and motivations.

B7569.2. Choose more appropriate user observations and research outcomes to enhance real-world design solutions.

B7569.3. Apply interface and visual design principles to create intuitive, engaging, and responsive user interfaces for real-world applications.

B7569.4. Design effective web interfaces by applying interaction patterns, visual flow, and feedback mechanisms to enhance user experience.

B7569.5. Implement mobile design principles to create usable and effective interfaces across diverse mobile platforms and applications.

Course Syllabus

Unit-I:

Introduction to UX Design : Introduction: Introduction about UX , Five Main Ingredients of UX , Three "Whats" of User Perspective ,Pyramid of UX Impact , UX Is a Process ,UX Not an Event or Task. Behaviour Basics: Psychology versus Culture, User Psychology, Experience, Conscious vs Subconscious Experience , Emotions , Gain and Loss, Motivations.

Unit-II:

User Observation And Experience: User Research, Subjective Research, Objective Research, Sample Size, Three Basic Types of Questions. Observe a User: Watch How They Choose, Interviews, Surveys, Card Sorting, Creating User Profiles, Bad profile, Useful profile.

Unit-III:

User Interface Design Principles: Designing Behaviour: Designing with Intention , Rewards and Punishments , Conditioning and Addiction , Timing Matters , Gamification , Social/Viral Structure, Trust , Hidden versus Visible. Basic Visual Design Principles: Visual Weight, Contrast, Depth and Size, Color. Layout: Page Framework, Footers, Navigation, Images, and Headlines, Forms, One Long Page or a Few Short Pages, Input Types, Labels and Instructions, Primary and Secondary Buttons, Adaptive and Responsive Design, Touch versus Mouse.

Unit-IV:

Web Interface Design: Designing Web Interfaces ,Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow, Using Motion for UX, Design Pattern: Z-Pattern, F-Pattern, Visual Hierarchy, Lookup patterns, Feedback patterns.

Unit-V:

Mobile Interface Design: Mobile Ecosystem: Platforms, Application frameworks , Types of Mobile Applications: Widgets, Applications, Games,Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Books and Materials

Text Books:

1. Marsh, Joel. *UX for Beginners: A Crash Course in 100 Short Lessons.*, 1st ed., O'Reilly Media, Inc., 2015.
2. Fling, Brian. *Mobile Design and Development.*, 1st ed., O'Reilly Media, 2009.

Reference Books:

1. Dix, Alan, Janet Finlay, Gregory Abowd, and Russell Beale. *Human-Computer Interaction.*, 3rd ed., Pearson Education, 2014.
2. Cooper, Alan. *The Essentials of User Interface Design.*, Wiley DreamTech Ltd., 2012.

B7570 – Quantum Computing

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces the mathematical foundations and physics principles essential for understanding quantum computing, including linear algebra, complex numbers, and basic quantum theory. Students explore quantum states, entanglement, and the behavior of quantum systems, linking fundamental physics to computational models. The course covers quantum architecture and hardware, focusing on qubits, gates, circuits, and strategies to address decoherence. Core quantum algorithms are examined to demonstrate computational advantages over classical methods. Practical implications for cryptography are highlighted, including the impact on current asymmetric algorithms and security protocols. Emphasis is placed on understanding both theoretical and applied aspects of quantum computation. Overall, the course prepares learners to apply quantum computing concepts to emerging technological challenges.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7570.1. Employ linear algebra and complex number concepts to solve problems in vectors, matrices, and quantum representations.

B7570.2. Explore quantum physics concepts to evaluate quantum states, entanglement, and their role in computing systems.

B7570.3. Implement quantum computing concepts to design and optimize computational systems and operations effectively.

B7570.4. Apply quantum algorithms and quantum computing principles to solve computational problems efficiently.

B7570.5. Assess the impact of quantum computing on cryptography and evaluate the security of existing asymmetric algorithms.

Course Syllabus

Unit-I:

Linear Algebra and Complex Numbers Introduction to Essential Linear Algebra Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. Complex Numbers: Definition of Complex NumbersAlgebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers.

Unit-II:

Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement Basic Quantum Theory Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

Unit-III:

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

Unit-IV:

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

Unit-V:

Quantum Computing and Cryptography: Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve The Impact of Quantum Computing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications.

Books and Materials

Text Books:

1. Nielsen, Michael A. *Quantum Computation and Quantum Information.*, Cambridge University Press,2018.
2. Easttom, Chuck. *uantum Computing Fundamentals.*, 1st ed., Pearson Education, 2021.

Reference Books:

1. Yanofsky, Noson S., and Mirco A. Mannucci. *Quantum Computing for Computer Scientists.*, Cambridge University Press, 2018.
2. Benenti, Giuliano, Giulio Casati, and Giuliano Strini. *Principles of Quantum Computation and Information: Basic Concepts.*, World Scientific Publishing Company, 2014.

OPEN ELECTIVES

B7081 - Business Analytics

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course addresses the scope of business analytics, process and tools used to get competitive advantages of business analytics. It covers the forecasting techniques to predict the given data for various decision making. Apart from prediction it also establishes the relationship between the given data to formulate the strategies for business decisions..

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7081.1 Describe the fundamentals and techniques of data analytics.

B7081.2 Evaluate data and apply critical thinking to make informed decisions using deep analytics.

B7081.3 Develop predictive models to support business decision-making.

B7081.4 Design prescriptive models to recommend optimal business solutions.

B7081.5 Interpret analytical results and present them as clear, actionable insights.

Course Syllabus

Unit-I:

Business analytics and Statistical Tools: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit-II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit-III:

Organization Structures of Business Analytics:, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit-IV:

Forecasting Techniques and Monte Carlo Simulation and Risk Analysis: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model,Overbooking Model, Cash Budget Model.

Unit-V:

Decision Analysis and recent trends: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Books and Materials

Text Books:

1. Varshney, N., and Maheswari. *Business Analytics: Principles, Concepts, and Applications.* By Marc J. Schniederjans, Dara G. Schniederjans, and Christopher M. Starkey, 1st ed., Pearson FT Press, 2014.

Reference Books:

1. Evans, James R. *Business Analytics.* Global Edition, Pearson Higher Education & Professional Group, 2020.

B7082 - Waste to Energy

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

The course deals with the production of energy from different types of wastes through thermal, biological and chemical routes. This course provides insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production. This course is explores Biomass Pyrolysis, Biomass gasification, Biomass combustions and Bio energy systems.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 7 – Affordable and Clean Energy
SDG 12 – Responsible Consumption and Production

Course Outcomes

After the completion of the course, the student will be able to:

B7082.1. Classify different waste material produces from all sources.

B7082.2. Analyze Bio energy systems resources, process and application.

B7082.3. Apply emerging methods for Bio mass Pyrolysis, gasification and combustion to improve the efficiency.

B7082.4. Analyze different case studies for understanding success and failure of waste to energy technologies.

Course Syllabus

Unit-I:

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Unit-II:

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III:

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers - Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Books and Materials

Text Books:

1. Desai, Ashok V. *Non-Conventional Energy.* Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C., and S. S. Mahdi. *Biogas Technology: A Practical Handbook.* Vols. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Reference Books:

1. Challal, D. S. *Food, Feed and Fuel from Biomass.* IBH Publishing Co. Pvt. Ltd., 1991.
2. WereKo-Brobby, C. Y., and E. B. Hagan. *Biomass Conversion and Technology.* John Wiley & Sons, 1996.

B7083 - Operations Research

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

The courses in Operational Research offer a unique blend of traditional coursework, practical skills, and real-world problem-solving experience designed to position students for success in today's competitive world. This course covers Linear Programming, Non-Linear Programming Problem, Mathematical Models and problems.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 12 – Responsible Consumption and Production

Course Outcomes

After the completion of the course, the student will be able to:

B7083.1. Gain knowledge in concepts and techniques of Operations Research.

B7083.2. Determine the optimal solution for Linear Programming problems.

B7083.3. Formulate and obtain the optimal solution for non- Linear Programming problems.

B7083.4. Solve to get optimal solution using queuing and inventory models.

B7083.5. Determine solution for non- Linear Programming problems using dynamic programming.

Course Syllabus

Unit-I:

Linear Programming Problem & Its Application I: Introduction, Formulation of LPP. Slack Variable, Surplus Variable and Artificial Variables. Standard Form and Matrix Form. Concept of Duality. Graphical Method. Simplex Method. Big - M method & Two - Phase Method. Problems of Degeneracy.

Unit-II:

Linear Programming Problem & Its Application II: Parametric Programming introduction . Types of Linear Variations. Graphical and Analytical Sensitivity Analysis.

Unit-III:

Non-Linear Programming Problem I: Introduction, Formulation and Graphical Method, Kuhn-Tucker Conditions, Quadratic Programming Problems by Wolfe's and Beale's Method.

Unit-IV:

Non-Linear Programming Problem II: Geometric programming introduction and analytical methods , Fractional programming introduction and analytical methods, Dynamic programming introduction and analytical methods.

Unit-V:

General Mathematical Models: Sequencing - n Jobs and m Machines, Inventory Control - introduction and its analytical methods. Single server queuing model.

Books and Materials

Text Books:

1. Desai, Ashok V. *Non-Conventional Energy.* Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C., and S. S. Mahdi. *Biogas Technology: A Practical Handbook.* Vols. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Reference Books:

1. Challal, D. S. *Food, Feed and Fuel from Biomass.* IBH Publishing Co. Pvt. Ltd., 1991.
2. WereKo-Brobby, C. Y., and E. B. Hagan. *Biomass Conversion and Technology.* John Wiley & Sons, 1996.

B7084 - Blockchain Technology

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course introduces blockchain, a revolutionary technology that enables peer-to-peer transfer of digital assets without any intermediaries, and is predicted to be just as impactful as the Internet. A blockchain is a permanent, sequential list of transaction records distributed over a network. The course introduces consensus, proof of work, mining, in Bitcoin. The course introduces ethereum blockchain and smart contracts.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education

SDG 9 – Industry, Innovation and Infrastructure

SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7084.1. Identify and explain the fundamental concepts, architecture, and working principles of blockchain technology.

B7084.2. Demonstrate the process of cryptocurrency transactions using Bitcoin and analyze its underlying mechanisms.

B7084.3. Compare and choose suitable blockchain platforms such as Ethereum for ensuring data security and integrity.

B7084.4. Design and implement smart contracts based on given problem requirements using Ethereum or similar platforms.

B7084.5. Evaluate blockchain applications and deployment on Testnet environments for real-world use cases.

Course Syllabus

Unit-I:

Introduction to Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency. How Bitcoin Achieves Decentralization: Centralization vs. Decentralization, Distributed Consensus, Consensus without Identity: the Block Chain, Incentives and Proof of Work, Putting It All Together.

Unit-II:

Mechanics of Bitcoin: Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations Improvements. Store Usage: How to Store and Use Bitcoins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

Unit-III:

Bitcoin Mining: The Task of Bitcoin Miners, Mining Hardware, Energy Consumption Ecology, Mining Pools, Mining Incentives and Strategies. Bitcoin and Anonymity: Anonymity Basics, How to de-anonymizeBitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash, Tor and the Silk Road.

Unit-IV:

Ethereum: What is Ethereum, smart contracts, Solidity Ethereum Virturalmachine. Installing solidity ethereum wallet, basics of solidity by example, Layout of a solidity source file structure of smart contracts, General value types, ether units, Time units, Globally available variables and functions.

Unit-V:

Operators: Arithmetic, Logical Bitwise operators, Control structure (if-else, for, while, do-while), Scoping and declarations, Input parameters and output parameters, Function calls return types, Function Modifiers, Fallback functions, Abstract contract, Creating contracts via new operator, Inheriting smart contracts, Importing smart contracts compiling contracts, Events logging, exceptions, Examples of smart contract : crowd funding, voting ballot.

Books and Materials

Text Books:

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., Goldfeder, S.,Bitcoin and Cryptocurrency Technologies: a comprehensive introduction, Princeton University Press, 2016.
2. Dave Hoover, Kevin Solorio, and Randall Kanna., Hands–On Smart Contract Development with Solidity and Ethereum, O'Reilly Media, Inc., 2019.

Reference Books:

1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, 1st Edition, O'Reilly Media, Inc., 2019.

B7085 - Cyber Security

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
45	0	0	45	90	3	40	60	100

Course Description

Course Overview

This course drawing upon a wealth of experience from academia, industry, and government service, Cyber Security details and dissects, in current organizational cyber security policy issues on a global scale—taking great care to educate students on the history and current approaches to the security of cyberspace. It includes thorough descriptions of Cyber Offences, Cyber Crime, tools and methods used in Cyber Crime. It also delves into organizational implementation issues, and equips students with descriptions of the positive and negative impact of specific policy choices.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 9 – Industry, Innovation and Infrastructure
SDG 16 – Peace, Justice and Strong Institutions

Course Outcomes

After the completion of the course, the student will be able to:

B7085.1. Demonstrate the basics of cybercrime in computer, networked device or a network.

B7085.2. Identify various cyber offences in real time.

B7085.3. Identify the different attacks in cybercrime.

B7085.4. Use various methods and tools to control cybercrimes and cyber offences.

B7085.5. Examine how to protect organizations from intruders, attackers and cyber criminals.

Course Syllabus

Unit-I:

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes. The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Unit-II:

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector, and Cloud Computing.

Unit-III:

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit-IV:

Tools and Methods: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Unit-V:

Cyber Security: Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications. Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Books and Materials

Text Books:

1. Godbole, Nina, and Sunil Belapure. *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives.* 1st ed., Wiley India, 2011.

Reference Books:

1. Graham, James, Richard Howard, and Ryan Otson. *Cyber Security Essentials.* 1st ed., CRC Press, 2011.
2. Wu, Chwan-Hwa (John), and J. David Irwin. *Introduction to Cyber Security.* 1st ed., CRC Press/T&F Group, 2013.
3. Clarke, Richard A., and Robert Knake. *Cyberwar: The Next Threat to National Security & What to Do About It.* Ecco, 2010.

AUDIT COURSES

B7091 – Disaster Management

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	0	30	0	-	100	100

Course Description

Course Overview

The course has been framed with an intention to provide a general concept in the dimensions of disasters caused by nature beyond human control as well as the disasters and environmental hazards induced by human activities with emphasis on Natural disaster, Man-made disaster, vulnerability and risks of disasters, Disaster Management Mechanism, Capacity Building and disaster coping Strategies and Disaster management planning.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 11 – Sustainable Cities and Communities
SDG 13 – Climate Action

Course Outcomes

After the completion of the course, the student will be able to:

B7091.1. Identify concepts, hazards and vulnerabilities of different types of disasters.

B7091.2. Examine the components of disaster management mechanism.

B7091.3. Select suitable capacity building framework for disaster management.

B7091.4. Interpret various disaster coping strategies.

B7091.5. Develop Strategies for disaster management planning.

Course Syllabus

Unit-I:

Introduction: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. *Disaster Prone Areas in India:* Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Unit-II:

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit-III:

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

Unit-IV:

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Unit-V:

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Books and Materials

Text Books:

1. Nishith, R., and A. K. Singh. *Disaster Management in India: Perspectives, Issues and Strategies.* New Royal Book Company.
2. Sahni, Pardeep, et al., editors. *Disaster Mitigation: Experiences and Reflections.* Prentice Hall of India, New Delhi.
3. Goel, S. L. *Disaster Administration and Management: Text and Case Studies.* Deep & Deep Publication Pvt. Ltd., New Delhi.

B7092 – Value Education

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	0	30	0	-	100	100

Course Description

Course Overview

The present education system does not prepare students well for dealing with life. Primarily, it prepares them for profession or jobs. It concentrates on providing "How to do" rather than "What to do" or "Why to do?". This course will be helpful for students to develop critical ability, commitment and courage in real life problems. Students will learn about happiness, character development, self control, honesty, time management.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 16 – Peace, Justice and Strong Institutions
SDG 10 – Reduced Inequalities

Course Outcomes

After the completion of the course, the student will be able to:

B7092.1. Identify the importance of value-based living for character development.

B7092.2. Emerge as responsible citizens with clear conviction to practice values and ethics in life.

B7092.3. Interpret their role in nation building for a better tomorrow.

B7092.4. Develop a sense of commitment and decision-making capability.

B7092.5. Demonstrate ethical reasoning and leadership in personal and professional life.

Course Syllabus

Unit-I:

Values and Self - Development: Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgments.

Unit-II:

Importance of Cultivation of Values: Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truth fullness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature Discipline.

Unit-III:

Personality and Behavior Development: Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness.

Unit-IV:

Achieving Happiness: Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Unit-V:

Character and Competence: Holy Books vs Blind faith. Self-Management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, and Studying effectively.

Books and Materials

Text Books:

1. Chakroborty, S. K. *Values and Ethics for Organizations: Theory and Practice.* Oxford University Press, New Delhi.
2. Aspin, David N., and Judith D. Chapman. *Values Education and Lifelong Learning: Principles, Policies, Programmes.* Springer, 2007.

B7093 – Constitution of India

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	0	30	0	-	100	100

Course Description

Course Overview

This course enables the students to understand the constitution of India as the Supreme law of India. The student will also gain knowledge about the parliament of India and how it functions. This course will survey the basic structure and operative dimensions of the Indian constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian constitution.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 16 – Peace, Justice and Strong Institutions
SDG 10 – Reduced Inequalities

Course Outcomes

After the completion of the course, the student will be able to:

B7093.1. Identify the important components of Indian Constitution.

B7093.2. Explore the basics of Constitutional right in various domains .

B7093.3. Illustrate the evolution of Indian Constitution.

B7093.4. Analyze the Administrative process in India from grass-root level.

B7093.5. Relate the basic concepts of democracy, liberty, equality, secular and justice.

Course Syllabus

Unit-I:

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working), **Philosophy of the Indian Constitution:** Preamble, Salient Features.

Unit-II:

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit-III:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

Unit-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI:

Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Unit-V:

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Books and Materials

Text Books:

1. The Constitution of India, 1950. Government Publication.
2. Busi, S. N., and B. R. Ambedkar. *Framing of the Indian Constitution.* 1st ed., 2015.

Reference Books:

1. Jain, M. P. *Indian Constitution Law.* 7th ed., Lexis Nexis, 2014.
2. Basu, D. D. *Introduction to the Constitution of India.* Lexis Nexis, 2015.

B7094 - Stress Management by Yoga

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	0	30	0	-	100	100

Course Description

Course Overview

Stress has been determined to be a key factor of illness and disease. Prolonged stress in any person can lead to negative thinking, depression and worse. The course is based on managing stress by practice of yogic principles that are proven to be highly effective and easy to learn. In this course the students will learn about different types of yoga practices, Meditation, Yoga asanas, Pranayama for stress, anger and fear management.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 3 – Good Health and Well-being
SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth

Course Outcomes

After the completion of the course, the student will be able to:

B7094.1. Make use of yoga for stress management in educational environments.

B7094.2. Improve emotional intelligence to better deal with stress.

B7094.3. Develop flexibility through participation in yoga.

B7094.4. Learn methods of performing asanas, pranayama, mudras and bandhas.

B7094.5. Practice meditation for holistic living.

Course Syllabus

Unit-I:

Meaning and Definition of Stress: Eutress, Distress, Anticipatory Anxiety, Intense Anxiety and Depression. Necessity of Stress Management, Concept of Stress according to Yoga.

Unit-II:

Introduction to Yoga: Definition and Meaning of Yoga, Historical Perceptive on yoga – yoga before the time of Patanjali (Indus valley civilization, Vedas, Brahmnas, Upanishads, Epics, Puranas).

Unit-III:

Schools of Yoga: Eight Limbs of Yoga: Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana & Samathi. General principles of practicing Asana, Pranay- ama, Meditation, Kriyas Bandhas and Mudra.

Unit-IV:

Essentials of yoga practices: Prayer, Disciplines in Yogic Practices, Place & Timing, Diet & Schedule for Yoga Practitioner. Obstacles in the Path of Yoga Practice, Sequence for yogic practices, Different between yogic & non yogic system of exercise. Do's and donts during Yoga.

Unit-V:

Personality development by yoga: Yoga and development of Social qualities of personality, Co-operation, Simplicity, Tolerance, Social adjustments, Yoga and personal efficiency. Improvement of personal efficiency through yoga.

Books and Materials

Text Books:

1. Andrews, Wasmer Linda. *Stress Control for Peace of Mind.* Barnes & Noble Publisher, 2005.
2. Nagendra, H. R., and R. Nagarathana. *Yoga Practices for Anxiety & Depression.* Bangalore: Swami Sukhabodhanandha Yoga Prakashana, 2004.

Reference Books:

1. Iyengar, B. K. S. *The Art of Yoga.* New Delhi: Harper Collins Publishers, 2003.

B7095 - Pedagogy Studies

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	0	30	0	-	100	100

Course Description

Course Overview

Pedagogy is the relationship between learning techniques and culture. It requires meaningful classroom interactions between educators and learners. The objective of this course is to help students build on prior learning and develop skills and attitudes. Furthermore it can improve the quality of your teaching and the way students learn, helping them gain a deeper grasp of fundamental material.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7095.1. Develop a positive attitude towards life and the teaching profession.

B7095.2. Critically analyze classroom teaching, learning processes, and student behavior.

B7095.3. Compare teaching and learning practices in educational institutes over the past decade.

B7095.4. Summarize the aspects of an effective teaching process.

B7095.5. Apply innovative strategies to enhance teaching and learning outcomes.

Course Syllabus

Unit-I:

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

Unit-II:

Thematic Overview: Pedagogical practices in formal and informal classrooms in developing countries, Curriculum development, Teacher education.

Unit-III:

Evidence on the Effectiveness of Pedagogical Practices : Quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?. Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit-IV:

Professional Development: Alignment with classroom practices and followup support. Peer support, Support from the head teacher and the community. Curriculum and assessment. Barriers to learning: limited resources and large class sizes.

Unit-V:

Research Gaps and Future Directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment. Dissemination and research impact.

Books and Materials

Text Books:

1. Ackers, J., and F. Hardman. "Classroom Interaction in Kenyan Primary Schools." *Compare*, vol. 31, no. 2, 2001, pp. 245-261.
2. Agrawal, M. "Curricular Reform in Schools: The Importance of Evaluation." *Journal of Curriculum Studies*, vol. 36, no. 3, 2004, pp. 361-379.
3. Akyeampong, K. *Teacher Training in Ghana—Does It Count?* Multi-site Teacher Education Research Project (MUSTER) Country Report 1, London: DFID, 2003.

Reference Books:

1. Akyeampong, K., K. Lussier, J. Pryor, and J. Westbrook. "Improving Teaching and Learning of Basic Maths and Reading in Africa: Does Teacher Preparation Count?" *International Journal of Educational Development*, vol. 33, no. 3, 2013, pp. 272–282.
2. Alexander, R. J. *Culture and Pedagogy: International Comparisons in Primary Education.* Oxford and Boston: Blackwell, 2001.
3. Chavan, M. *Read India: A Mass Scale, Rapid, 'Learning to Read' Campaign.* 2003.

B7096 - English for Research Paper Writing

Teaching and Learning Scheme				Hours	Credits	Assessment Marks		
CI		LI	TW+SL	H	C	CIE	SEE	Total
L	T	P	SL					
30	0	0	0	30	0	-	100	100

Course Description

Course Overview

This course equips students with essential academic writing skills, including sentence and paragraph structuring, clarity, conciseness, and avoidance of ambiguity. Students will learn to structure research papers effectively, covering abstracts, introductions, literature reviews, methods, results, discussions, and conclusions. Emphasis is placed on ethical writing practices, paraphrasing, and avoiding plagiarism. By the end of the course, students will be able to produce clear, coherent, and professionally written research papers suitable for publication.

Course Pre/Co-requisites

This course has no specific prerequisite and co-requisite.

Relevant SDG(s)

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure

Course Outcomes

After the completion of the course, the student will be able to:

B7096.1. Develop effective planning and preparation skills for academic writing, including sentence structuring and paragraph development.

B7096.2. Apply techniques to clarify meaning, avoid ambiguity, and maintain conciseness and coherence in writing.

B7096.3. Demonstrate the ability to structure research papers, including abstracts, introductions, literature review, methods, results, discussion, and conclusions.

B7096.4. Utilize skills for proper paraphrasing, citation, avoiding plagiarism, and critically analyzing findings in research writing.

B7096.5. Employ advanced writing skills for finalizing papers, including crafting titles, abstracts, and ensuring first-time submission quality.

Course Syllabus

Unit-I:

Planning and Preparation: Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Unit-II:

Clarifying and Writing Techniques: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Unit-III:

Paper Structure: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit-IV:

Writing Key Sections of a Research Paper: Skills needed when writing a Title, Abstract, Introduction, and Review of the Literature.

Unit-V:

Writing and Finalizing Research Papers: Skills needed when writing the Methods, Results, Discussion, Conclusions, useful phrases, and ensuring the paper is as good as possible for first-time submission.

Books and Materials

Text Books:

1. Goldbort, R. *Writing for Science.* Yale University Press, 2006. Available on Google Books.
2. Day, R. *How to Write and Publish a Scientific Paper.* Cambridge University Press, 2006.

Reference Books:

1. Highman, N. *Handbook of Writing for the Mathematical Sciences.* SIAM, 1998.
2. Wallwork, Adrian. *English for Writing Research Papers.* Springer, New York, Dordrecht, Heidelberg, London, 2011.

Vision

To be a pioneer institute and leader in engineering education to address societal needs through education and practice.

Mission

To adopt innovative student centric learning methods.
To enhance professional and entrepreneurial skills through industry institute interaction.
To train the students to meet dynamic needs of the society.
To promote research and continuing education.

Quality Policy

We at Vardhaman College of Engineering, endeavor to uphold excellence in all spheres by adopting the best practices in effort and effect.

VCE
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(Autonomous)

Affiliated to **JNTUH,** Approved by **AICTE,** Accredited by **NAAC** with **A++** Grade
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