

MALNAD COLLEGE OF ENGINEERING, HASSAN
(An Autonomous Institution Affiliated to VTU, Belagavi)



Autonomous Programme
Bachelor of Engineering



Department Of
COMPUTER SCIENCE AND BUSINESS SYSTEMS

SCHEME and SYLLABUS
(2023 Admitted Batch)

Academic Year 2026-2027



MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

VISION OF THE INSTITUTE

To be an institute of excellence in engineering education and research, producing socially responsible professionals.

MISSION OF THE INSTITUTE

1. Create conducive environment for learning and research
2. Establish industry and academia collaborations
3. Ensure professional and ethical values in all institutional endeavors

VISION OF THE DEPARTMENT

Emerge as an industry focused centre for promoting innovation, entrepreneurship, research and best practices of computer science together with managerial skills to serve the society and industry.

MISSION OF THE DEPARTMENT

1. Impart globally connected cutting-edge technologies and business skills
2. Enhance industrial experience, promote entrepreneurship and research through industry institute interaction
3. Implement best practices to enrich knowledge and skill sets
4. Produce competent professionals with societal and environmental concern

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Explore and excel in advanced technologies across emerging domains.

PEO2: Develop professional skills that enhance employability and support higher education in contemporary fields.

PEO3: Empower research skills through lifelong learning to adapt to the field of IT.

PEO4: Demonstrate environmental awareness and sustainable practices to address societal and community needs.

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PROGRAM OUTCOMES (POs)

7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: Develop business and IT solutions to solve real life problems.

PSO2: Implement software tools and new-generation technologies in industry-relevant fields.

Scheme of Evaluation (Theory Courses)

Assessment	Marks
CIE 1	10
CIE 2	10
CIE 3	10
Activities as decided by course faculty	20
SEE	50
Total	100

Scheme of Evaluation (Laboratory Courses)

Assessment	Marks
Continuous Evaluation in every lab session by the Course Coordinator	10
Record Writing	20
Laboratory CIE conducted by the Course Coordinator	20
SEE	50
Total	100

Examination	Maximum Marks	Minimum marks to qualify
CIE	50	20
SEE	50	20



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COURSE TYPES

Basic Science Course	BSC
Engineering Science Course	ESC
Emerging Technology Course	ETC
Programming Language Course	PLC
Professional Core Course	PCC
Integrated Professional Core Course	IPCC
Professional Core Course Laboratory	PCCL
Professional Elective Course	PEC
Open Elective Course	OEC
Project/Mini Project/Internship	PI
Humanities and Social Sciences, Management Course	HSMC
Ability Enhancement Course	AEC
Skill Enhancement Course	SEC
Universal Human Value Course	UHV
Non-credit Mandatory Course	MC



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Semester-wise Credit Distribution

Curricular Component / Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	8	8	3	4	-	-	-	-	23
Engineering Science Course (ESC)/ Emerging Technology Course (ETC)/Programming Language Course	9	9	3	3	-	-	-	-	24
Professional Core Course (PCC)	-	-	14	11	14	10	8	-	57
Professional Elective Course (PEC)	-	-	-	-	3	3	3	3	12
Open Elective Course (OEC)	-	-	-	-	-	3	3	3	9
Project/Mini Project/Internship (PI)	-	-	-	-	-	4	4	10	18
Humanities and Social Sciences, Management Course (HSMC)	1	2	1	3	1	-	-	-	8
Ability Enhancement Course (AEC)/ Skill Enhancement Course (SEC)	2	1	1	1	2	1	-	-	8
Universal Human Value Course (UHV)	-	-	-	1	-	-	-	-	1
Total Credits	20	20	22	23	20	21	18	16	160



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2023 - 2024 Admitted Batch

SEVENTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	PCC	23CB701	Business Intelligence	4	0	0	4	50	50	100	4
2	PCC	23CB702	Information Security and Cyber Law	3	0	0	3	50	50	100	3
3	PCCL	23CB703	Machine learning and Business intelligence laboratory	0	0	2	4	50	50	100	1
4	PI	23CB704	Main Project Phase II	0	0	8	8	50	50	100	4
5	PEC	23CB77x	Professional Elective Course - III	3	0	0	3	50	50	100	3
6	OEC	23OECB7X	Open Elective Course – II	3	0	0	3	50	50	100	3
Total							25				18

Professional Elective Course - III	
Course Code	Course Name
23CB771	Digital Image Processing
23CB772	Big Data Analytics
23CB773	Advanced JAVA
23CB774	Deep Learning

Open Elective Course - II	
Course Code	Course Name
23OECB71	Business Management
23OECB72	AI for Business and Finance



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EIGHTH SEMESTER											
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week				Exam Marks			Credits
				L	T	P	Total	CIE	SEE	Total	
1	PEC	23SW01	Swayam (Online 12 weeks Course through NPTEL)	3	0	0	-	50	50	100	3
2	OEC	23SW02	Swayam (Online 12 weeks Course through NPTEL)	3	0	0	-	50	50	100	3
3	PI	23INT	Internship (Research/Industry) (14-20 weeks)	0	0	20	20	100	100	200	10
Total							20				16



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Course Title	BUSINESS INTELLIGENCE		
Course Code	23CB701	L-T-P-C	(4-0-0)4
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	52
Course Objective: To apply analytics and optimization techniques for data-driven decision-making, using AI, text mining, and ethical data practices.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Evaluate the fundamentals of Business Intelligence, decision support systems, business data preparation, and regression-based business prediction models.	1,2	-
2.	Apply predictive analytics techniques such as logistic regression, decision trees, regularized regression, ensemble learning, random forest, boosting, and stacking for business problems.	3,4	1
3.	Analyse the role of AI, robotics, chatbots, conversational AI, and virtual assistants in different business applications and decision-making processes.	2,5	-
4.	Develop and interpret collaborative decision support systems, descriptive analytics, business reporting, data visualization, and dashboard-based BI solutions.	5,10,12	2
Course Contents:			
Module 1			13 Hours
Fundamentals of Business Intelligence: Changing business environments and evolving needs for decision support and analytics, Business Data Preparation, Linear Regression for Business Prediction- Linear Regression, Bias Variance, Regularisation, Cross Validation and K-fold, Batch Gradient Descent, Logistic Regression for Business Classification - Binary Logistic Regression, Classification matrix and Imbalanced data.			
Module 2			13 Hours
Predictive Analytics for Business Intelligence: Decision Trees for Business Decision-Making - Decision Tree Classification, Decision Tree Regression, K – nearest neighbours, Customer churn prediction using Decision Tree, Regularised Regression Models - Ridge Regression, Lasso Regression, Elastic Net Regression, Ensemble Learning and Random Forest. Boosting and Stacking, Support Vector Machine (SVM).			
Module 3			13 Hours
AI and Robots in Business applications: Overview of AI in business applications, Human and computer intelligence, Major AI technologies and its derivatives, AI support for decision making, AI applications in various Business Functions, introduction to robotics, applications of robots, Conversational AI- chatbots, chatbot evolution, components of chatbots and the process of their use, drivers and benefits, enterprise chatbots, financial services, service industries, chatbot platforms, knowledge for enterprise chatbots, virtual personal assistants.			
Module 4			13 Hours
Collaborative systems and AI support: Making decision in groups, team collaboration with computerized systems, electronic support for group communication and collaboration. Descriptive Analytics: Nature of data in analytics, taxonomy of data, art and science of data processing, BI and data warehousing, Business Reporting, Data Visualization, different types of charts and graphs,			



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emergence of visual analytics, information dashboards, dashboard design.

Textbooks:

1. Géron, Aurélien, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Media, 2022.
2. An Introduction to Statistical Learning: With Applications in Python, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Jonathan Taylor, 1st Edition, Springer Publisher, 2023.
3. Business Intelligence, Analytics, Data Science and AI, Ramesh Sharda, Dursun Delen, Efraim Turban 5th Edition Pearson Publisher Year 2024
4. Analytics, Data Science and AI systems for decision support, Ramesh Sharda, Dursun Delen, Efraim Turban 11th Edition Pearson Publisher Year 2021

Reference Books:

1. Business Intelligence Strategy and Big Data Analytics, Steve Williams, Morgan Kaufmann, 2016
2. Data Analytics and Business Intelligence, Vincent Charles et al, CRC Press, 2023
3. Data Analytics for Business: Lessons for Strategy, Ira J. Haimowitz, Routledge, 2023

Online Courses and Video Lectures:

1. <https://www.tableau.com/business-intelligence/what-is-business-intelligence>
2. <https://cloud.google.com/learn/what-is-business-intelligence>
3. <https://www.geeksforgeeks.org/what-is-data-analytics/>
4. https://onlinecourses.nptel.ac.in/noc24_cs65/preview

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	-	3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	2	2	-	-	-	-	-	-	2



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Course Title	INFORMATION SECURITY AND CYBER LAW		
Course Code	23CB702	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to apply cryptography techniques on malicious networks and cyberlaw, IPR, IT Act.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the various types of Security attacks and Ciphers	1,12	-
2.	Develop and apply the Traditional and Modern Block Ciphers	3,4	-
3.	Analyse the Symmetric and Asymmetric key Cryptography Algorithms	2,4	-
4.	Assess the new strategies and regulations of Cyber law and IT act.	6,8	1
Course Contents:			
Module 1			10 Hours
Introduction: Security goals, Cryptographic attacks, Services and Mechanisms, Techniques for security goals. Mathematics of cryptography: Integer Arithmetic, The Extended Euclidean Algorithm; Traditional Symmetric-Key Ciphers: Symmetric-Key Ciphers, Categories of traditional ciphers. Stream and Block ciphers;			
Module 2			10 Hours
Introduction to Modern Symmetric-Key Ciphers: Modern block ciphers, Components of modern block ciphers, Two classes of Product Ciphers, Attacks designed for block ciphers.; Data Encryption Standard: History and Data Encryption Standard, DES Structure, DES Analysis, Security of DES, Multiple DES-Conventional Encryption Algorithm.			
Module 3			10 Hours
The CAST Block Cipher, Data Encryption Standard Blowfish, IDEA; Advanced Encryption Algorithm: History and Advanced Encryption Algorithm, Transformation used by AES; Asymmetric Key cryptography: Difference between symmetric cryptography and asymmetric Key cryptography Cryptosystem, RSA cryptosystem, Rabin Cryptosystem.			
Module 4			10 Hours
Security and Cyber Law: Cyberspace , Cyber security, Cyber security Policy , Cyber Crime, Nature of Threat , Enabling People, Mission and Vision of Cyber security Program , OBJECTIVES : Emerging Trends of Cyber Law , Create Awareness , Areas of Development , International Network on Cyber security; The information Technology Act - IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records.			
Self Study: Modular Arithmetic, Matrices and Linear Congruence, Mathematics of Symmetric-Key cryptography: Field and GF (2n) Field, Mathematics of Asymmetric-Key cryptography: Primes, Primality testing, Factorization, Chinese Remainder Theorem. Intellectual Property Rights: Types of Intellectual Property Rights, Advantages of Intellectual Property Rights, Intellectual Property Rights in India, Intellectual Property in Cyber Space;			



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Text Books:

1. Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security"
Third edition published by McGraw Hill Education-2017.
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition

Reference Books:

1. Hans Delfs, Helmut Knebl, "Introduction to Cryptography: Principles and Applications", Springer
2. Neal Koblitz, "Number theory and cryptography", Springer, 2007.
3. William Stallings: Cryptography and Network Security, Fifth Edition, Pearson Education-2013

MOOCs:

1. <http://nptel.ac.in/courses/106105031/>
2. <https://www.edx.org/learn/cybersecurity>
3. https://www.tutorialspoint.com/information_security_cyber_law/index.htm

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	2	3	-	-	-	-	-	-	-	-	-	-
CO3	-	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	2	-	-	-	-	2	-



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Course Title	MACHINE LEARNING AND BUSINESS INTELLIGENCE LABORATORY		
Course Code	23CB703	L-T-P-C	(0-1-2)2
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	14+14 Hrs
Course Objective: Students will be able to apply cryptography techniques on malicious networks and cyberlaw, IPR, IT Act. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Apply appropriate supervised and unsupervised machine-learning algorithms for classification, regression, clustering, dimensionality reduction, and anomaly-detection problems.	4,5	-
2	Develop, evaluate, tune, and interpret end-to-end machine-learning models using data preprocessing, pipelines, cross-validation, performance metrics, and ensemble-learning techniques.	5,12	-
Lab Components 1. Perform exploratory data analysis (EDA) and feature engineering on the Titanic dataset using Jupyter Notebook and Python to identify key patterns and prepare the data for machine learning. 2. Descriptive Analytics and Customer Profiling of AeroFit Treadmill Products Using Contingency Tables and Probability Analysis. 3. Analysis of Customer Purchase Behavior by Gender and Other Factors Using Walmart Black Friday Sales Data. 4. Demand Prediction and Factor Analysis of Yulu Shared Electric Cycles in the Indian Market. 5. Prediction of Graduate Admission Chances and Analysis of Key Admission Factors Using Jamboree Dataset 6. Creditworthiness Assessment and Loan Approval Prediction for Personal Loan Underwriting Using LoanTap Dataset. 7. Develop a machine learning model for predicting driver attrition at Ola using driver demographic details, tenure information, performance ratings, monthly business, grade, and income data. 8. Market Basket Optimization Using Apriori Algorithm. 9. Rainfall Prediction Using Weather Data with Random Forest Algorithm 10. Prediction of Baseball Player Salary Using Forward Selection on Hitters Dataset. 11. Implementation of Ridge and Lasso Regression on Hitters Dataset Using Scikit-Learn			
Text Books: 1. Géron, Aurélien, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Media, 2022. 2. An Introduction to Statistical Learning: With Applications in Python, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Jonathan Taylor, 1st Edition, Springer Publisher, 2023.			



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MAIN PROJECT PHASE - II					
Course Code	23CB704	L-T-P-C	(0-0-8) 4		
Exam Hrs.	3	Hours / Week	8		
SEE	50 Marks	Total Hours	-		
Course Objective: Design and implement solution for the identified real world problem.					
Course Outcomes (COs): Upon completion of course the students will be able to					
	Course Outcomes	Mapping to POs	Mapping to PSOs		
1.	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2		
2.	Communicate effectively with team members and mentors, make presentations and prepare technical document	9,10,11	2		
3.	Use ethical practices in all endeavors	8	-		
4.	Share the responsibilities for carrying out the project & playing individual roles appropriately	9	-		
5.	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2		
<i>The project teams will implement the project started in their seventh semester</i>					
The project work is to be evaluated in three stages:					
Stage I (30M) - First internal evaluation shall be taken up during this phase. This includes presentation on fine tuning of SRS & Design carried out in seventh semester.					
Stage II (20 M) – Mid phase evaluation shall be taken up during this phase. This includes presentation, intermediate project demonstration, draft copy of the paper					
Stage III (50 M) – Final project Demo, report submission and details of technical paper publication.					
The evaluation of the project stages shall be carried out by the evaluation committee comprising of project guide & other faculty members. The committee will be constituted by the project coordinator in consultation with the Head of the department. <i>For Multidisciplinary projects guides will be allotted from each concerned branch.</i>					
Rubrics for Evaluation of project					
Stage I (Project Progress):					
Evaluation of project phase II is carried out by evaluation committee.					
Sl. No.	Performance Indicators	Needs Improvement (0-2 marks)	Average (4-6 marks)	Good (7-10 marks)	Max marks
1.	System design and development	System specification is not identified.	System specification is identified but not satisfactory.	System specification identified correctly.	10



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2.	Identification of appropriate tool for application	Application tools are not identified.	Application tools identified but not used.	Application tools identified and used.	10
3.	Oral presentation	Entire contents not delivered.	Contents not delivered clearly.	Contents delivered	10
Total					30

Stage II (Mid Phase Project Demonstration with Draft paper):					
Evaluation of this phase is done by evaluation committee.					
Sl. No.	Performance Indicator	Needs Improvement (0-1 marks)	Average (2-3 marks)	Good (4-5 marks)	Total marks allocated
1.	Design and Implementation	Design not complete	Design partially completed	Design completed	5
2.	Demonstration	Incomplete.	Complete but not satisfactory.	Complete and satisfactory	5
3.	Technical paper Draft	Organization and technical content not relevant	Organization and technical content of paper complete but needs improvement	Organization and technical content of report are complete and satisfactory	5
4.	Oral presentation	Presentation slides are not clear.	Presentation slides are clear, but not satisfactory.	Presentation slides are clear and satisfactory.	5
Total					20
Stage III (Final Project Demonstration):					
Evaluation of this phase is done by evaluation committee.					
Sl. No.	Performance Indicator	Needs Improvement	Average	Good	Total marks allocated
1.	Final project demonstration	Project incomplete (4)	Project complete but needs improvement in interface design/ functionality, etc. (7)	Project completed (10)	10



Course Articulation matrix

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Professional Elective Course – III

Course Title	DIGITAL IMAGE PROCESSING		
Course Code	23CB771	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To enable students to apply image restoration, noise filtering, edge detection, thresholding, and region-based segmentation methods for analyzing and improving digital images. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Review the fundamental concepts of a digital image processing system	1,6	-
2.	Evaluate the techniques for image enhancement and image restoration	1,2,3,5	-
3.	Interpret image segmentation and representation techniques	4,5,6,7	-
4.	Apply Advanced image processing techniques, including noise reduction, edge detection, and region-based segmentation	4,5	-
Course Contents:			
Module 1			10 Hours
Fundamentals: Introduction, Fundamental steps in digital image processing (DIP), components of DIP system, Structure of Human eye, Image formation in the eye, Brightness Adaption & Discrimination, Image acquisition using a single sensing element, Image acquisition using sensor arrays, A simple image formation model, Image sampling and quantization, Image Representation, Interpolation, Basic relationship between pixels. Self-Learning Component: Introduction To The Basic Mathematical Tools Used In Digital Image Processing			
Module 2			10 Hours
Image Enhancement in Spatial Domain-1: Background, Point processing – Image negatives, Log transformations, Power law transformations, Contrast stretching, Gray level slicing, Bit plane slicing, Histogram processing – Histogram equalization, Histogram matching (specification) and Local enhancement. Image Enhancement in Spatial Domain-2: Arithmetic/Logic operations – Image subtraction, Image averaging, Basics of spatial filtering, Smoothing spatial filters – Smoothing linear filters, ordered statistics filters, Sharpening spatial filters – Foundation, Laplacian and gradient.			
Module 3			10 Hours
Image Enhancement in Frequency Domain: Background, Basic properties of the frequency domain, Basic filtering in the frequency domain, Basic filters and their properties, Smoothing frequency domain filters – Ideal low-pass filters, Butterworth low-pass filters, Gaussian low-pass filters, Sharpening frequency domain filters – Ideal high-pass filters, Butterworth high-pass filters, Gaussian high-pass filters, Homomorphic filtering. Image Restoration: A model of Image degradation and restoration process, Some important Noise Probability functions, restoration in the presence of noise only - spatial filtering, Periodic noise reduction by Frequency domain filtering,			



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Course Title	BIG DATA ANALYTICS		
Course Code	23CB772	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To design and implement big data systems using modern analytics platforms, stream processing, and scalable frameworks.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe big data concepts, database models and big data techniques.	1,2	-
2.	Describe architectural elements of HDFS, Map Reduce, YARN, Spark and Storm.	1	-
3.	Apply big data concepts and techniques to address issues in a given scenario.	3,5	1
4.	Design Map reduce solution or Hbase query for a given Problem	2	1
Course Contents:			
Module 1			10 Hours
Introducing Hadoop and Seeing What It's Good for – Big Data and the Need for Hadoop, The Origin and Design of Hadoop, Examining the Various Hadoop Offerings. Use Cases for Big Data in Hadoop – The Keys to Successfully Adopting Hadoop, Log Data Analysis, Data Warehouse Modernization, Fraud detection, Risk modeling, Social Sentiment Analysis, Image Classification, Graph Analysis, To Infinity and Beyond. Storing Data in Hadoop: The Hadoop Distributed System – Data Storage in HDFS, Sketching Out the HDFS Architecture, HDFS Federation, And HDFS High Availability.			
Module 2			10 Hours
MapReduce Programming – Thinking in Parallel, Seeing the Importance of MapReduce, Doing Things in Parallel: Breaking Big Problems into Many Bite-Size Pieces, Writing MapReduce Applications, Getting Your Feet Wet: Writing a Simple MapReduce Application. Frameworks for Processing Data in Hadoop: YARN and MapReduce – Running Application Before Hadoop 2, Seeing a World Beyond MapReduce, Real-time and Streaming Applications. Statistical Analysis in Hadoop – Pumping Up Your Statistical Analysis, Machine Learning with Mahout, R on Hadoop.			
Module 3			10 Hours
Hadoop and the Data Warehouse: Friends or Foes? – Comparing and Contrasting Hadoop with Relational Databases, Modernizing the Warehouse with Hadoop. Extremely Big Tables: Storing Data in HBase – Say Hello to HBase, Understanding the HBase Data Model, Understanding the HBase Architecture, Taking HBase for a Test Run, Getting Things Done with HBase, HBase and the RDBMS world.			
Module 4			10 Hours
Introducing Spark: Spark's Background and History, Common Use Cases for Spark,			



Text Books:

1. Hadoop for Dummies: Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, Roman B. Melnyk, 2nd, John Wiley & Sons, Inc, 2017
2. Spark for Dummies: Robert D. Schneider and Jeff Karmiol, 2nd, John Wiley & Sons, Inc, 2019

Reference Books:

1. Big data and Analytics: Seema Acharya, Subhashini Chellappan, 3rd edition, Wiley publications, 2014
2. Hadoop Operations other text for spark and stormtex, Eric Sammer, 1st edition, O'Reilley, 2012

E Books and online course materials:

1. https://public.dhe.ibm.com/software/de/pdf/Hadoop_for_dummies.pdf
2. <https://nptel.ac.in/courses/106104189>

Online Courses and Video Lectures:

1. <https://www.youtube.com/watch?v=bAyrObI7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ>
2. <https://www.youtube.com/watch?v=GG-VRm6XnNk>

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MALNAD COLLEGE OF ENGINEERING, HASSAN
(An Autonomous Institution Affiliated to VTU, Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

Course Title	ADVANCED JAVA		
Course Code	23CB773	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students should be able to use J2EE concepts to create an application.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain and use java enumerations, collections, type wrapper and auto boxing in developing modular programs	1	-
2.	Design GUI using swings and applets	3	-
3.	Build database applications using JDBC.	2,3	-
4.	Develop distributed web application using Servlets and JSP.	2,3	-
Course Contents:			
Module 1			10 Hours
Enumeration and Autoboxing: Enumeration fundamentals, values() and valuesOf() Methods, Java Enumerations are class types, example, Type Wrappers, Autoboxing and Autounboxing. Event Handling The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes			
Module 2			10 Hours
User Interface components with Swing Components and containers, Layout managers, A first simple swing example, Event Handling, Creating a swing applet, Exploring Swing Controls-JLabel and ImageIcon, Jtextfield The Swing buttons, JTabbedPane, JScrollPane, JList, JCombobox.			
Module 3			10 Hours
The Collections Framework – Collections overview, The collection Interfaces, The collection classes, Accessing collection via an iterator. Database Access- The Concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview of the JDBC process, Database Connection, Statement Objects, Result Set			
Module 4			10 Hours
Servlets and JSP - Lifecycle of a sevelet, A simple servlet, The Servlet API, javax.servlet Package, Reading Servlet parameters, The javax.servlet.http Package, Handling HTTP Request and Responses, Using Cookies, Session tracking. Java Server Pages (JSP): JSP, JSP Tags, User Sessions, Cookies, Session Objects. RMI -. Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.			
Text Books:			
1. Java The Complete Reference, Herbert Schildt, 8th Edition, McGraw Hill, 2013 2. J2EE The Complete Reference, Jim Keogh, Tata McGraw Hill, 2007			
Reference Books:			
1. Advanced Java Programming, Uttam.K.Roy, Oxford Press, 2015			



- ### Course Articulation matrix

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MALNAD COLLEGE OF ENGINEERING, HASSAN
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Course Title	DEEP LEARNING		
Course Code	23CB774	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To understand deep learning fundamentals and apply CNNs, RNNs, and algorithms to real-world problems. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Analyze and interpret the concepts of neural networks relating to artificial intelligence.	2,3	-
2.	Illustrate the learning processes and their statistical properties.	3,4	1
3.	Design deep learning models using regularization and convolutional operations.	3,4	1
4.	Analyze sequential data to build recurrent and recursive models.	3,4	-
Course Contents:			
Module 1			10 Hours
Neural Networks and Learning Fundamentals Neural networks overview, Biological neuron vs artificial neuron, Models of a neuron, Neural Networks as Directed Graphs, Feedback, Network Architectures, Perceptron and its convergence theorem, Perceptron vs Bayes Classifier. Introduction to Multilayer Perceptrons, Batch and Online Learning, Backpropagation Algorithm, XOR Problem, Heuristics for Improving Backpropagation, Differentiation in Backpropagation.			
Module 2			10 Hours
Regularization and Optimization in Deep Learning L2 Parameter Regularization, Dataset Augmentation, Semi-supervised Learning. Optimization Challenges – Ill-conditioning, Local Minima, Plateaus, Saddle Points, Flat Regions. Training difficulties and solutions.			
Module 3			10 Hours
Convolutional and Recurrent Neural Networks Convolution Operation, Pooling, Efficient Convolution Algorithms, CNN Variants, History of Deep Learning. Recurrent and Recursive Nets, Unfolding Computational Graphs, Bidirectional RNNs, Encoder-Decoder Models, Deep RNNs, LSTM and Gated RNNs.			
Module 4			10 Hours
Autoencoders and Deep Learning Applications Concept of Autoencoders, Training Autoencoders, Applications in Dimensionality Reduction and Data Compression, Real-world Use Cases in Vision, NLP, and Forecasting.			
Text Books:			



- ## Online Courses and Video Lectures:

- ### Course Articulation matrix

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OPEN ELECTIVES – II

Course Title	BUSINESS MANAGEMENT		
Course Code	23OECB71	L-T-P-C	(3-0-0) 3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To equip students with foundational knowledge and practical insights into key principles, functions, and strategies of management in modern organizations. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Analyze key management concepts, including managerial roles, social responsibility, and ethics, as well as different types of business ownership.	6,7	-
2.	Illustrate knowledge of planning, strategy formulation (e.g., TOWS matrix), and decision-making techniques for managerial effectiveness.	2,10	-
3.	Identify and apply principles of organizational design and staffing, including types of structures and performance appraisal techniques.	1,6	-
4.	Distinguish between various leadership theories, motivation models, and communication processes, with insights into international management approaches like Japanese Theory Z.	1,10	-
Course Contents:			
Module 1			10 Hours
Management, Science, Theory and Practice: Definition of Management, Its nature and purpose, managerial skills and organizational hierarchy, Managing- Science or Art? Contributions of F.W. Taylor and Henry Fayol, Functions of managers, levels of management, Management and Society: Social responsibility of managers, Ethics of managing. Ownership of Enterprises: Proprietorship, Partnership, types, Joint stock Companies - Private and Public limited companies Public sector companies, Co-operative organizations, types, methods of raising capital.			
Module 2			10 Hours
Planning: Definition of planning, Types of plans, steps in planning, MBO, how to Set Objectives, Benefits and weakness of MBO Some Recommendations. Strategies, Policies and Planning Premises: Nature and Purpose of Strategies and Policies, TOWS matrix: A modern tool for analysis of the situation, Major kinds of strategies and policies. Decision Making: Importance and limitations of rational decision making, Rationality in decision making, Evaluation of alternatives, Selecting an alternative- three approaches, Programmed and Non-programmed decisions.			
Module 3			10 Hours
Organizing: The nature and purpose of organizing, Formal and informal organization. Organization			



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levels and Span of management, a system approach to organization, principles of organization, principles of organization, Types of organization: line, military or scalar, functional, project/product/departmentation, matrix/grid. Staffing: Definition of Staffing, Systems approach to human resources, Situational factors affecting staffing. Selection- matching the person with the job, Skills and personal characteristics needed by managers, Selection process, Techniques and instruments, purpose of Performance appraisal.	
Module 4	10 Hours
Leading: Human factors in managing, Motivations and motivators. Maslows Hierarchy of needs Theory, Herzberz motivation- Hygine theory, mcgregors theory X and theory Y, Leadership: Leadership behavior and Leadership styles. Communication: Importance of Communication, Purpose of Communication, Communication process, Types of communication, Effective communication. International Management: Managerial functions in international business, Japanese management and Theory Z.	
Text Books: 1. Principles of Management, Harold Koontz, H. Weihrich, A.R. Aryasri, 4th Tata McGraw-Hill, New Delhi. 2015 2. Industrial Engineering and Management ,OP Khanna, 3rd Dhanpat Rai and Sons 3. Management of Organizational Behaviour, Hershey Paul and Kenneth Blanchard 2012	
Reference Books: 1. Essentials of Management, Harold Koontz, H. Weihrich, 5th Tata McGraw-Hill, 2015 2. Management of Organizational Behaviour, 2nd PHI, 2013	
Online Courses and Video Lectures: 1. https://onlinecourses.nptel.ac.in/noc23_mg33/preview	

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	3	3	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	2	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	2	-	-	-



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Course Title	AI FOR BUSINESS AND FINANCE		
Course Code	23OECB72	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To integrate fundamental finance concepts with artificial intelligence and data analytics, enabling students to apply machine learning, and AI models in investment analysis, portfolio construction, optimization, and performance evaluation. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Evaluate risk-return characteristics of financial instruments and markets.	2,3	-
2.	Apply AI and machine learning algorithms to financial data.	3,4	-
3.	Develop and optimize portfolios using R-based statistical analysis.	3	-
4.	Analyze and interpret performance using asset pricing models.	3,4	-
Course Contents:			
Module 1			10 Hours
Introduction to Financial Markets and Investment Decisions Risk-Return Analysis, Measures of Risk and Return, Value and Goals of a Firm, Cash Flow Discounting, Investment Decisions, Valuation of Fixed Income Securities and Common Stocks, Portfolio Theory, Asset Pricing Models, Cost of Capital.			
Module 2			10 Hours
AI Models and R Programming in Finance Overview of AI & Machine Learning, Supervised and Unsupervised Learning, Probability Modelling, Inferential Statistics, Hypothesis Testing. R Programming Basics, Exploratory Data Analysis (EDA), Data Visualization, Statistical Analysis with R.			
Module 3			10 Hours
Market Microstructure and Portfolio Construction Market Types: Order-driven and Quote-driven, Market Efficiency, Risk Preferences, Limit Order Books, Economic Theory of Choice, Interest Rate Compounding. Portfolio Risk and Return (Two & Multi-Asset), Risk Diversification, Correlation Structure, Mean-Variance Framework, Portfolio Construction using R.			
Module 4			10 Hours
Portfolio Optimization, Asset Pricing and Performance Evaluation Efficient Frontier, Minimum Variance Portfolios, Risk-Free Lending & Borrowing, Market Risk and Beta, CAPM, Security Market Line, Single & Multi-Index Models, Fama-French 3-Factor Model, Active vs Passive Management, Performance Measures, Application of Asset Pricing Models.			
Text Books:			
1. Machine Learning in Finance, M. Dixon, I. Halperin, P. Bilokon, 1 st Springer 2. Advances in Financial Machine Learning, Marcos Lopez, 1 st Wiley			



1. Machine Learning for Asset Managers Marcos Lopez 1st Cambridge Univ. Press
2. Machine Learning for Algorithmic Trading, Stefan Jansen, 2nd Packt
3. Modern Portfolio Theory, Elton & Gruber, 9th Wiley

1. <https://www.investopedia.com/>
2. <https://www.r-bloggers.com/>
3. <https://www.coursera.org/specializations/ai-for-finance>

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EIGHTH SEMESTER : SYLLABUS

Course Title		RESEARCH / INDUSTRY INTERNSHIP		
Course Code	23INT	L-T-P-C	(0-0-20)10	
Exam Hrs.	3	Hours / Week	-	
CIE	100 Marks	Total Hours	-	
Course Objective: To gain the perspective of work environment in Research organization/Industry.				
Course Outcomes (COs): Upon completion of the course, students shall be able to:				
No.	Course Outcomes		Mapping to POs	Mapping to PSOs
1.	Apply the domain knowledge in solving the real world problems.		1,2	1,2
2.	Work as a team member towards the chosen problem		9	1,2
3.	Work with industry professionals and practice ethics in work environment.		8, 10,12	1,2
4.	Document, publish and present the work carried out.		9,10,11,12	1,2
Guideline: Students shall undergo In-house/ Research organization/Industry internship for a duration of <i>one</i> semester. At the end of the semester internal evaluation will be conducted for 100 marks according to the following rubrics.				
Rubrics:				
Criteria	Excellent	Good	Average	Poor
Ability to apply domain knowledge (20M)	Apply domain knowledge for design and development of all issues (20M)	Apply domain knowledge for design and Development of most issues (15M)	Apply domain knowledge for Design and development of specific issues (10M)	Unable to apply complete domain knowledge for Design and development issues (5M)
Ability to develop/ implement the solutions with appropriate techniques, resources and contemporary tools (20M)	Able to develop/ implement all the solutions with appropriate techniques, resources and contemporary tools (20M)	Able to develop/ implement most of the solutions with appropriate techniques, resources and contemporary tools (15M)	Able to develop /implement specific solutions with appropriate techniques, resources and contemporary tools (10M)	Not confident to develop/implement solutions with appropriate techniques, resources and contemporary tools (5M)



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Ability to work independently and in collaboration /multidisciplinary environment. (20M)	Able to work independently and in collaboration/ multidisciplinary environment. (20M)	Able to work independently with minimal guidance and in collaboration/ multidisciplinary environment.(15 M)	Able to work independently with more guidance and in collaboration/ multidisciplinary environment. (10M)	Unable to work independently without guide support and in collaboration/ multidisciplinary environment. (5M)
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Ability to allocate time effectively and manage to complete the work allotted within appropriate time. (15M)	Able to allocate time effectively and complete all the work allotted within appropriate time. (15M)	Able to allocate time effectively and complete most of the work allotted within appropriate time. (10M)	Able to allocate time effectively and manage to complete the work allotted (5M)	Unable to use time effectively and complete the work allotted.(3M)
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Ability to exhibit integrity and ethical behaviour while carrying Out the internship and For the preparation of internship report. (15M)	Able to effectively exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report.(15M)	Able to moderately exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (10M)	Able to partially exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (6M)	Unable to exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (3M)
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Ability to demonstrate effective oral and written communication skills (10M)	Able to demonstrate effective oral and written communication skills (10M)	Able to demonstrate oral and written communication skills moderately. (7M)	Able to demonstrate oral and written communication skills minimally. (5M)	Unable to demonstrate effective verbal and written communication skills (2M)
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Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	-	-	-	-	-	-	-	3	-	-	-	3	2
CO3	-	-	-	-	-	-	-	3	-	3	-	3	3	2
CO4	-	-	-	-	-	-	-	-	3	3	3	3	3	2