

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VIII Semester (Artificial Intelligence & Data Science)

w.e.f. July 2023

Week July 2020

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	AI81	PEC/DLC	Professional Elective Course-IV	70	20	10	-	-	100	3	1	-	4
2	AI82	OEC/DLC	Open Elective Course-III	70	20	10	-	-	100	3	1	-	4
3	AI83	PI	Major Project / Internship	-	-	-	150	100	250	-	-	16	8
Total				140	40	20	150	100	450	6	2	16	16

Note: 1. Departmental BOS will decide list of three/four optional subjects those are available in MOOC/NPTEL, PEC as well for OEC.

Professional Elective Course-IV		
S.No.	Subject Code	Subject Name
1	AI81A	Financial Engineering
2	AI81B	DevOps & MLOPs
3	AI81C	Advanced AI Algorithms-Gen AI

Open Elective Course-III		
S.No.	Subject Code	Subject Name
1	AI82A	Computer Vision
2	AI82B	Bio Informatics
3	AI82C	Design Thinking

Note: 2. Students going for internship would have to opt MOOC/NPTEL subjects decided / listed by the HOD / Coordinator.

Professional Elective Course-IV		
S.No.	Subject Code	Subject Name
1	AI81D	NPTEL-1
2	AI81E	NPTEL-2
3	AI81F	NPTEL-3

Open Elective Course-III		
S.No.	Subject Code	Subject Name
1	AI82D	NPTEL-4
2	AI82E	NPTEL-5
3	AI82F	NPTEL-6

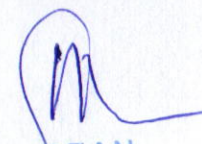
Note: 3. For Major Project/ Internship, evaluation is based on work done, quality of report, presentation and performance in viva-voce through department project supervisor / Industry Project Coordinator.

1 hour lecture (L) = 1 credit

1 hour Tutorial (T) = 1 credit

2 hour Practical (P) = 1 credit

PEC: Professional Elective Course, OEC: Open Elective Course, PI: Project and Internship, DLC: Distance Learning Course


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Bachelor of Technology (B.Tech.)VIII Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2023

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI81A	Financial Engineering	70	20	10	-	-	100	3	1	–	4

Module- I Introduction:

Quantitative Finance- Scope- The Functions of the Financial System- Market Organization and Structure.

Module- II Numerical methods for finance:

Solving systems of linear equations- Solving non-linear equations- Curve fitting Interpolation- Numerical Integration-Finite Difference Methods for Partial Differential Equations.

Module -III Optimization in finance:

Linear Programming- Non-linear programming- Quadratic programming- Dynamic Programming.

Module- IV Financial time series analysis:

Linear Time Series Analysis- Nonlinear Models, Multivariate Time Series Analysis.

Module-V Financial reporting and analysis:

Financial Reporting Standards- Income Statements and Balance Sheet- Cash Flow Statements- Financial Analysis Techniques- Inventories- Long Lived Assets-Income Taxes- Applications.

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References Books:

1. Joerg Kienitz, Daniel Wetterau, "Financial Modelling: Theory, Implementation and Practice with MATLAB Source", John Wiley & Sons
2. Gerard Cornuejols et al., Optimization Methods in Finance, Cambridge University press.
3. Paolo Brandimarte, "Numerical Methods in Finance and Economics ", John Wiley & Sons.

Course Outcomes:

At the end of the course the students will be able to:

CO1	• Use Numerical methods to solve practical problems finance
CO2	• Apply suitable optimization techniques in financial optimization problems
CO3	• Choose an appropriate time series model for a given set of data
CO4	• Describe the tools and techniques used in financial reporting and analysis



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Bachelor of Technology (B.Tech.) VIII Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2023

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
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AI81B	Dev Ops & MLOPs	70	20	10	-	-	100	3	1	-	4

Module- I Introduction: Agile principles–

Improve the quality of data- Analytics insights- AI models

Module- II DevOps: DevOps Process and Lifecycle-

Development – Testing- Configuration Management-Integration and Deployment- Monitoring of the software- DevOps tools ,

Module-III DataOps:

Establish DataOps (Prepare for operation- Optimize for operation) - Iterate DataOps (Know your data, Trust your data, Use your data) - Improve DataOps

Module- IV MLOPs:

Introduction to Machine Learning in Production- Machine Learning Data Lifecycle in Production- Machine Learning Modeling Pipelines in Production- Deploying Machine Learning Models in Production.

Module-V Applications:

Application of DevOps, DataOps and MLOPs- Challenges of DevOps, DataOps and MLOPs- Tools in DevOps, DataOps and MLOPs

References Book:

DataOps, MLOps and DevOps: Outperform Analytics and Software Development with Expert Practices on Process Optimization and Automation. BPB Publications (16 June 2022).

Course Outcomes:

At the end of the course the students will be able to:

CO1	• Understand the benefits of DevOps over other software development processes
CO2	• Get an overview of different DevOps Tools
CO3	• Understand how to enable the organization's business, development and operations to continuously design, deliver and validate new data demands
CO4	• Design an ML production system end
CO5	end: project scoping, data needs, modeling strategies, and deployment requirement.

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AI81C	Advanced AI Algorithms-Gen-AI	70	20	10	-	-	100	3	1	-	4

Module-I Introduction And Generative Text:

Introduction to Generative AI, Prompt, Elements of a Prompt, Designing Prompt, Example prompts for various use cases, Introduction to AI Chatbots, Working of AI Chatbots, Popular AI Chatbots,, For example like ChatGPT and its working, Use cases of ChatGPT for various users.

Module- II Generative Image, Video and Codes:

Role of AI in Image Generation, Popular AI tools for Image Generation. Midjourney for Image Generation, working of midjourney, Advantages and disadvantages of Midjourney, Use cases of Midjourney. AI Tools in Video Making, Working of AI Video Makers, Benefits of AI Video Makers, Popular AI Video Makers, Introduction to Synthesia, Features of Synthesia, Compatibility of Synthesia, Pros and Cons of Synthesia. Role of AI Tools in Programming, Copilot by Github, Advantages and Drawbacks of Copilot, Auto filling Repetitive Code using Copilot, Running Tests using Copilot, Navigating Unfamiliar Territory with Copilot, Creating an Application Entirely With Copilot. All live examples on computer vision.

Module- III OpenAI APIs:

Understanding OpenAI APIs, OpenAI playground, creating API keys, Authentication, making requests build chatbots, integration with OpenAI API keys.

Module-IV Neural Network, Transformer and LLM:

Applied problems From simple perceptron to multi-layer perceptron and its training, Introducing deep learning and architectures such as CNN, RNN, GAN and transformers, Detailed description of transformer architecture, use cases and various models for natural language processing, Training LLM: Training, fine tuning, evaluation and feedback through reinforcement learning.

Module –V Generative Adversarial Networks (GAN):

Detailed description of GAN architecture, its training and variants and industrial applications, standards and ethics for AI applications.

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Reference Books

Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT and other LLMs, Ben Auffarth, 2023

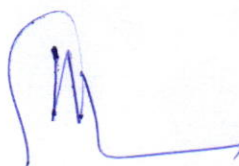
Generative AI in Practice, Barnard Marr, 2024

Generative AI with Python, Raghav Bali, 2021

Generative AI in Higher Education, Cecilla Ka Yuk Chan, 2024

Course Outcomes: At the end of the course the students will be able to:

CO1	Understand Recent trends of AI and about Generative AI
CO2	Implement all Algorithms for GenAI
CO3	Design & Application Of Gen AI solutions for Industrial applications



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AI82A	Computer Vision	70	20	10	-	-	100	3	1	-	4	

Module-I BASICS OF COMPUTER VISION

Introduction-Image Formation-Image Representation-Linear Filtering-Image in frequency domain- Image Sampling-Edge Detection-Feature detection - SIFT and its variants- Image Segmentation-Feature matching

Module- II MOTION ANALYSIS

Background Subtraction and Modeling-Optical Flow- KLT- Spatio-Temporal Analysis- Dynamic Stereo- Motion parameter estimation

Module- III ARCHITECTURES FOR COMPUTER VISION

CNN Architectures – Convolution – Pooling Layers – Back propagation in CNN- Transfer Learning -RNN,LSTM,GRU, Encoder/Decoder Architectures – Autoencoders –Variational Autoencoders – Adversarial Generative Networks – Self Attention Mechanism

Module-IV MODELS FOR COMPUTER VISION

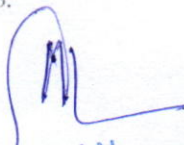
Object Classification-VGGNET, RESNET, ALEXNET, DENSENET, EFFICIENT NET, MOBILENET, INCEPTION V3, Object Detection-R-CNN, F-RCN, SSD, Retinanet, YOLO, CornerNet, Image Segmentation- UNet, SegNet, Mask-RCNN, Attention Models- Transformers

Module-V APPLICATIONS AND RECENT TRENDS IN COMPUTER VISION

Applications- Image Editing, Inpainting, Superresolution, 3D Object Generation, Security, Surveillance-Object Tracking-Automatic Image Captioning. Recent Trends- Zero-shot, One-shot, Few-shot Learning-Self-supervised Learning and Reinforcement Learning in Vision

Reference Books:

- 1.Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 2016.
- 2.Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
- 3.Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
- 4.Yoshua Bengio, Learning Deep Architectures for AI, 2009.
- 5.Michael Nielsen, Neural Networks and Deep Learning, 2016.


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6. David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.

Course Outcomes: After the completion of the course, the students will be able to -

CO1	Implement AI based fundamental image processing techniques required for computer vision
CO2	Employ the motion analysis techniques for solving real life problem
CO3	Apply the deep learning architectures to various problems
CO4	Create their own advanced deep learning models Develop applications of computer vision using deep learning techniques



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AI82B	Bio Informatics	70	20	10	-	-	100	3	1	-	4

Module-I Introduction:

Introduction to bioinformatics, objectives of bioinformatics, Basic chemistry of nucleic acids, structure of DNA & RNA, Genes, structure of bacterial chromosome, cloning methodology, Data maintenance and Integrity Tasks.

Unit-II Bioinformatics Databases & Image Processing:

Types of databases, Nucleotide sequence databases, Protein sequence databases, Protein structure databases, Normalization, Data cleaning and transformation, Protein folding, protein function, protein purification and characterization, Introduction to Java clients, CORBA, Using MYSQL, Feature Extraction.

Unit-III Sequence Alignment and database searching:

Introduction to sequence analysis, Models for sequence analysis, Methods of optimal alignment, Tools for sequence alignment, Dynamics Programming, Heuristic Methods, Multiple sequences Alignment

Unit-IV Gene Finding and Expression:

Cracking the Genome, Biological decoder ring, finding genes through mathematics & learning, Genes prediction tools, Gene Mapping, Application of Mapping, Modes of Gene Expression data, mining the Gene Expression Data.

Unit -V Proteomics & Problem solving in Bioinformatics:

Proteome analysis, tools for proteome analysis, Genetic networks, Network properties and analysis, complete pathway simulation: E-cell, Genomic analysis for DNA & Protein sequences, Strategies and options for similarity search, flowcharts for protein structure prediction.

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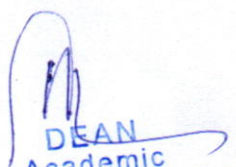
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Recommended Books:

1. Gopal & Jones, BIOINFORMATICS with fundamentals of Genomics & Proteomics, TMH Pub
2. Rastogi, Bioinformatics –Concepts, skills & Applications, CBS Pub
3. Claverie, Bio informatics, Wiley pub
4. Stekel, Micrarray Bio Informatics, Cambridge

Course Outcomes : Upon completion of the course, the students will be able to:

CO1	Understanding of Bio Informatics
CO2	Creating Bioinformatics data retrieval and techniques
CO3	Applying different techniques for bioinformatics and problem solving
CO4	Design new solutions to different case study.



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AI82C	Design Thinking	70	20	10	-	-	100	3	1	—	4

Module- I Design Thinking –

Introduction - What - How - Why - Design Process - Four Questions - Ten Tools - Identify an Opportunity - Scope your opportunity - Draft your design brief.

Module-II Visualizations

Three visualizations - Visualization basics - Journey mapping - Value Chain analysis - Mind mapping.

Module- III Design Criteria

Design thinking brainstorming - Concepts development - develop concepts - napkin pitches.

Module-IV Assumption testing –

Rapid Prototyping - Surface Key assumptions - make prototypes.

Module- V Customer co-creation–

learning launch - Feedback from stake holders - Design the on-ramp - Case study.

Reference Books

1. Jeanne Liedtka, Tim Ogilvie, Rachel Brozenske, "The Designing for Growth Field Book: A Step-by Step Project Guide", New York: Columbia University Press, 2014.
2. Jeanne Liedtka, Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", New York: Columbia University Press, 2011.

Course Outcomes

Upon completion of the course, the students will be able to:

CO1	Convert real-life problems into methodical problems
CO2	Apply various visualization principles for problem and solution representation
CO3	Design solutions by applying an integrated approach to design thinking
CO4	Justify and prototype solutions to problems
CO5	Understanding customer feedback and design new model with case study.

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