Course Structure for Final Year
B. Tech in Artificial Intelligence & Data Science

Semester VII (Term 7)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
PCC9	BTAIC701	Natural Language Processing	3	1	-	20	20	60	100	4
PCC10	BTAIC702	Advanced Computer Vision	3	1	-	20	20	60	100	4
PCC11	BTAIC703	Data Engineering	3	-	-	20	20	60	100	3
PEC-4	BTAIPE704	Professional Elective Course (PEC) -IV	3	1	-	20	20	60	100	4
	BTAIPE704A	1. Time Series Forecasting								
	BTAIPE704B	2. AI Operations								
	BTAIPE704C	3. Autonomous Vehicle								
	BTAIPE704D	4. Full Stack Development								
OEC-3	BTAIOE705	Open Elective Course (OEC) – III	3	1	-	20	20	60	100	4
	BTAIOE705A	1.Data Science Optimization Techniques								
	BTAIOE705B	2. Block chain Technology								
	BTAIOE705C	3. Quantum Computing								
	BTAIOE705D	4. Mobile Application Development								
HSSMEC -6	BTAIHM706	Humanities and Social Sciences including Management Elective Course (HSSMEC) – II	-	-	2	-	-	-	-	Audit
	BTAIOE706A	1. Foreign Language Studies								
	BTAIOE706B	2. Universal Human Value & Ethics								
	BTAIOE706C	3. Intellectual Property Rights								
LC5	BTAIL707	Natural Language Processing & Data Engineering Lab	-	-	4	60	-	40	100	2
PROJ	BTAIM708	Project Work	-	-	4	60	-	40	100	2
Internship	BTAIP608	Field Training / Internship / Industrial Training – III (Evaluation)	-	-	-	-	-	-	-	Audit
			15	**4**	**10**	**220**	**100**	**380**	**700**	**23**

Semester VIII (Term 8)										
Course Category	Couse Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
Project/ Internship	BTAIF801	Project Work/ Internship	-	-	24	60	-	40	100	12
			-	**-**	**24**	**60**	**-**	**40**	**100**	**12**

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

Semester –VII
Natural Language Processing

BTAIC701	**Natural Language Processing**	**PCC9**	**3L- 1T - 0P**	**4 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:
To explore Natural Language Processing (NLP) methods and applications, gaining insights into language understanding, sentiment analysis, and text generation for innovative advancements.

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

CO1	Understand the basics of Natural language processing.
CO2	Analyze the different language models and vector semantics.
CO3	Understand the sequence labelling for text analysis.
CO4	Implement text classification and sentiment analysis systems.
CO5	Implement recurrent network for language models and illustrate the NLP applications.

Course Contents:

Unit No 1: Introduction to NLP [7 Hours]
Definition and scope of NLP, Applications and real-world examples of NLP, Linguistic Fundamentals, Regular Expressions, Words, Corpora, Text Normalization: Tokenization and segmentation, Stop word removal, Stemming and lemmatization, Handling capitalization and punctuation, Minimum Edit distance.

Unit No 2: Language Models and Vector Semantics [8 Hours]
N-gram models, Language model evaluation, Smoothing techniques, Information Retrieval, Vector space models, Term frequency-inverse document frequency (TF-IDF), Pointwise Mutual Information, Applications of the TF-IDF or PPMI vector models, Word2vec, Relevance ranking algorithms.

Unit No 3: Sequence Labeling [7 Hours]
Text Preprocessing, Context-Free Grammars, Part-of-speech tagging, HMM Tagging, CRF, Named entity recognition, Evaluation of Named Entity Recognition. Syntax and Parsing,

Parsing techniques: dependency parsing, constituency parsing, Maximum Entropy Markov Models.

Unit No 4: Text Classification and Sentiment Analysis [7 Hours]

Classifiers for text classification and sentiment analysis, Optimizing Sentiment Analyzer, Other text classification tasks and the Language Model, Text Classification with Logistic Regression Model, Multinomial logistic regression, Cross-entropy loss function, Gradient Descent, Regularization, Interpreting model.

Unit No 5: Deep Learning for NLP Applications [7 Hours]

Simple Recurrent Networks, Applications of RNNs, Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, The Encoder-Decoder Model with RNNs, Words, Characters and Byte-Pairs, Transformers and Pretrained Language Models, Fine-Tuning and Masked Language Models

CASE STUDY: ChatGPT, GPT, AI Powered Tools, Sentiment Classification, Dialog Systems, Chatbots, Movie review system, Text Summarization, Language Translation, Question Answering and Information Retrieval, Automatic Speech Recognition, Text-to-Speech Conversion, Speech to Text Conversion.

Text Books

1. "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" by Daniel Jurafsky and James H. Martin.
2. "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schutze.

Reference Books

1. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper.
2. "Natural Language Processing: Python and NLTK" by Jacob Perkins.
3. “Sentiment Analysis and Opinion Mining” by Bing Liu.

Semester –VII
Advanced Computer Vision

BTAIC702	**Advanced Computer Vision**	**PCC10**	**3L- 1T - 0P**	**4 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic knowledge of linear algebra and calculus, Image processing fundamentals, Programming skills in Python.

Course Objectives:
To acquire a comprehensive understanding of Computer Vision principles and techniques, enabling the development of advanced image processing, recognition systems, and visual perception applications

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

CO1	Demonstrate a solid understanding of fundamental computer vision & image processing concepts.
CO2	Apply various computer vision algorithms and techniques in image processing.
CO3	Apply various computer vision algorithms and techniques to solve real-world engineering problems, such as object recognition, motion analysis, and texture.
CO4	Analyze and interpret results obtained from computer vision algorithms, and critically evaluate their performance and limitations
CO5	Implement and evaluate computer vision algorithms using programming languages and libraries commonly used in the field, such as Python and OpenCV

Course Contents:

Unit No 1: Introduction to Computer Vision & Image Processing [7 Hours]

Introduction to computer vision and its applications, Image representation, image processing operations, Image filtering & convolution.

Image enhancement: Contrast stretching, Histogram specification, Adaptive Histogram Equalization (AHE), Wavelet-based enhancement.

Image Filtering: Smoothing: Linear Filter (Box filter, Gaussian Filter) & Non-linear Filter: Median, Mini. & Max.), Sharpening: Laplacian Filter.

Unit No 2: Image Transformation & Restoration: [7 Hours]

Image Transformation: Definition & its properties (scaling, rotation), DFT, DCT, DST, Walsh-Hadamard Transform, Slant Transform, Haar Transform.

Image Restoration: Noise model, Types of Noise: Gaussian, Rayleigh, Erlang, Exponential, Uniform, salt & Pepper noise. Restoration Filtering: Mean Filter (Arithmetic, Geometric, Hormonic, Contrahamonic), Median Filter, Midpoint Filter.

Unit No 3: Segmentation, Texture & Motion Analysis [8 Hours]

Segmentation: Edge Detection (Prewitt, Sobel, Canny), Optimum Edge Detection, Thresholding techniques, Region-based segmentation.

Texture Analysis: Introduction to texture in images, Statistical texture analysis methods: Gray Level Co-occurrence Matrix (GLCM), Local Binary Patterns (LBP); Filter-based texture analysis methods: Gabor filters, Laws' texture energy measures; Texture-based segmentation.

Motion Analysis: Optical flow estimation, Lucas-Kanade method, Horn-Schunck method, Background subtraction, Dense optical flow using Deep Learning (FlowNet), Motion-based segmentation.

Unit No 4: Feature Matching Algorithms [7 Hours]

Feature Extraction: SIFT (Scale-Invariant Feature Transform), SURF (Speeded-Up Robust Features), BRISK (Binary Robust Invariant Scalable Keypoints).

Feature Representation: Building a dataset with extracted features, feature vector representation by Bag-of-words, vector quantization.

Feature Classification: SVM, KNN, Random forest.

Unit No 5: Computer Vision with Deep Learning [7 Hours]

Image classification: CNN, Attention models, Vision transformation.

Generative Models: GAN.

Object detection: Regions with CNN, Fast R-CNN, Faster R-CNN & Mask R-CNN, SSD, YOLO.

Semantic Segmentation using U-Net, Centroid based object tracking

Text Books / Reference Books

1. Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.
2. Computer Vision: Algorithms & Applications, R. Szeleski, Springer. Computer vision: A modern approach: Forsyth and Ponce, Pearson.
3. Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
4. Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
5. David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.
6. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
7. Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006. ISBN 978-0-387-31073-2
8. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
9. Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
10. Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, 2004.

Semester –VII
Data Engineering

BTAIC703	Data Engineering	PCC11	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic knowledge of Excel and familiarity with data concepts will be beneficial but not mandatory.

Course Objectives:
To learn data engineering concepts, Advanced Excel, Power BI, Tableau, and basic data analysis for effective data manipulation and visualization.

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

CO1	Understand the importance of data engineering and its workflow in managing and integrating data from various sources.
CO2	Apply advanced data manipulation techniques using Excel functions and tools for efficient data processing.
CO3	Utilize Power BI to connect, transform, and model data from diverse sources into meaningful relationships
CO4	Employ Tableau to prepare and transform data through connections, blending, and calculated fields.
CO5	Integrate and automate data pipelines across tools to streamline data workflows and promote collaboration.

Course Contents:

Unit No 1: Introduction to Data Engineering and Data Analysis Fundamental [7 Hours]
Understanding Data Engineering concepts and importance, Workflow and pipeline, Data sources and data integration.
Basic Concepts of Data Analysis: Data types: Categorical, numerical, ordinal, and time-series data, Data distribution: Measures of central tendency and dispersion, Data visualization: Histograms, box plots, scatter plots, etc., Data preprocessing and cleaning, Exploratory Data Analysis (EDA).

Unit No 2: Advanced Excel for Data Manipulation and Analysis [7 Hours]
Excel Data Manipulation Techniques: Sorting and filtering data, Basic Functions (SUMIF and SUMIFS, COUNTIF and COUNTIFS, AVERAGEIF and AVERAGEIFS, IFERROR, CHOOSE, TEXTJOIN, TRANSPOSE, CONCATENATE, SUBTOTAL, INDIRECT, OFFSET, etc.) Advanced functions (VLOOKUP, INDEX, MATCH, etc.), Text-to-columns and data cleansing, Data validation and conditional formatting.
Excel Data Analysis Tools: PivotTables and PivotCharts, What-If analysis and Scenario Manager, Data tables and Goal Seek, Solver add-in for optimization.

Unit No 3: Power BI for Data Transformation and Visualization [7 Hours]

Introduction to Power BI: Power BI components, Power BI Desktop and Power BI Service, Connecting to data sources.

Data Transformation and Modeling in Power BI: Data loading and shaping using Power Query Editor, Data modeling and relationships, Calculated columns and measures, DAX (Data Analysis Expressions) language fundamentals.

Creating Interactive Reports and Dashboards in Power BI: Visualizations and chart types, formatting and customization options, Drill-through and drill-down capabilities, Filters, slicers, and hierarchies.

Unit No 4: Tableau for Data Preparation and Advanced Visualization [7 Hours]

Introduction to Tableau: Tableau Desktop and Tableau Server, Connecting to various data sources, Understanding Tableau workspace and terminology.

Data Preparation and Transformation in Tableau: Data connections and joins, Data blending and data reshaping. Working with metadata and calculations, Tableau data extracts.

Creating Visualizations and Dashboards in Tableau: Building basic charts and graphs, Interactive filters and parameters, advanced visualization techniques, Dashboard design best practices.

Unit No 5: Data sharing and collaboration and Integration [8 Hours]

Explore more complex data engineering challenges and solutions.

Data Integration: Integrating data from different sources, Automating data pipelines.

Excel Automation and Visual Basic for Applications (VBA): Macro recording and editing, User-defined functions (UDFs), Error handling and debugging.

Power BI Sharing and Collaboration: Publishing and sharing reports, Collaboration features and workspaces, Power BI gateways for on-premises data access.

Sharing and Collaboration in Tableau: Publishing and sharing dashboards, User roles and permissions.

Text Books / Reference Books

1. "Excel Bible" by John Walkenbach (For comprehensive Excel reference)
2. "Power Pivot and Power BI: The Excel User's Guide to DAX, Power Query, Power BI & Power Pivot" by Rob Collie and Avichal Singh (For Power BI and DAX)
3. "Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software" by Daniel G. Murray (For Tableau)

Semester –VII

Time Series Analysis & Forecasting

BTAIPE704A	**Time Series Analysis & Forecasting**	**PEC-4**	**3L- 1T - 0P**	**4 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic knowledge of statistics and data analysis concepts. Familiarity with data manipulation and visualization using tools like Python or R.

Course Objectives:
To Gain proficiency in analyzing time-dependent data patterns and using statistical methods to make accurate predictions and forecasts for future trends and events.

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

CO1	Knowledge of basic concepts in time series analysis and forecasting
CO2	Understanding the use of time series models for forecasting and the limitations of the methods.
CO3	Ability to criticize and judge time series regression models.
CO4	Distinguish the ARIMA modelling of stationary and nonstationary time series
CO5	Compare with multivariate times series and other methods of applications

Course Contents:

Unit No 1: Introduction of Time Series Analysis [7 Hours]

Introduction to Time Series and Forecasting -Different types of data-Internal structures of time series- Models for time series analysis-Autocorrelation and Partial autocorrelation.

Examples of Time series Nature and uses of forecasting-Forecasting Process-Data for forecasting – Resources for forecasting.

Unit No 2: Statistics Background For Forecasting [8 Hours]

Graphical Displays -Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments- General Approach to Time Series Modeling and Forecasting- Evaluating and Monitoring Forecasting Model Performance.

Unit No 3: Time Series Regression Model [7 Hours]

Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression- Prediction of New Observations - Model Adequacy Checking -Variable Selection Methods in Regression - Generalized and Weighted Least Squares- Regression Models for General Time Series Data- Exponential Smoothing-First order and Second order.

Unit No 4: Autoregressive Integrated Moving Average (ARIMA) Models [7 Hours]
Autoregressive Moving Average (ARMA) Models - Stationarity and Invertibility of ARMA Models - Checking for Stationarity using Variogram- Detecting Nonstationarity - Autoregressive Integrated Moving Average (ARIMA) Models - Forecasting using ARIMA - Seasonal Data - Seasonal ARIMA Models- Forecasting using Seasonal ARIMA Models Introduction - Finding the "BEST" Model -Example: Internet Users Data- Model Selection Criteria - Impulse Response Function to Study the Differences in Models
- Comparing Impulse Response Functions for Competing Models.

Unit No 5: Multivariate Time Series Models and Forecasting [7 Hours]
Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting.

Text Books

1. Introduction To Time Series Analysis And Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015). https://b-ok.cc/book/2542456/2fa941
2. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek Pal Dr. Pks Prakash (2017) https://b-ok.cc/book/3413340/2eb247
3. Time Series Analysis And Forecasting By ExampleSørenBisgaardMurat Kulahci Technical University Of Denmark Copyright © 2011 By John Wiley & Sons, Inc. All Rights Reserved. https://b-ok.cc/book/1183901/9be7ed

Reference Books

1. Peter J. Brockwell Richard A. Davis Introduction To Time Series And Forecasting Third Edition.(2016). https://b-ok.cc/book/2802612/149485
2. Multivariate Time Series Analysis and ApplicationsWilliam W.S. Wei Department of Statistical Science Temple University, Philadelphia, PA, SA This edition first published 2019 John Wiley & Sons Ltd. https://b-ok.cc/book/3704316/872fbf
3. Time Series Analysis by James D Hamilton Copyright © 1994 by prince town university press. https://b-ok.cc/book/3685042/275c71

Semester –VII

AI Operations

BTAIPE704B	AI Operations	PEC-4	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

1. Fundamental knowledge of programming and data analysis concepts.
2. Familiarity with IT operations and basic understanding of DevOps principles.
3. Some exposure to machine learning concepts and algorithms is beneficial.

Course Objectives:

To acquire a thorough understanding of AI Operations (AIOps) concepts, methodologies, and use cases, gain hands-on experience in implementing AIOps techniques and integrating AIOps with CI/CD pipelines for efficient IT operations and application deployment.

Course Outcomes:

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

CO1	Understand the fundamental principles of AI Operations (AIOps) and its significance in modern IT operations
CO2	Perform exploratory data analysis (EDA) and visualize patterns to gain insights from AIOps data.
CO3	Evaluate industry-standard AIOps frameworks and select suitable approaches for specific IT environments
CO4	Comprehend the principles and benefits of Continuous Integration (CI) and Continuous Deployment (CD) in DevOps practices
CO5	AIOPS Implementation and Best Practices

Course Contents:

Unit No 1: Introduction to AI Operations (AIOps) [7 Hours]

Overview of AIOps: Definition, benefits, and importance in modern IT operations.

Data Sources in AIOps: Collection, preprocessing, and aggregation of data from various IT systems.

AIOps Use Cases: Incident management, anomaly detection, root cause analysis, capacity planning.

Challenges in AIOps Implementation: Addressing data quality, scale, and interpretability.

Unit No 2: AIOps Data Analysis and Machine Learning [8 Hours]

Data Analysis for AIOps: Exploratory data analysis (EDA) and data visualization techniques. Time Series Analysis: Analyzing time-dependent data patterns and trends for predictive insights. Supervised and Unsupervised Machine Learning: Using algorithms for anomaly detection and pattern recognition in AIOps. Model Evaluation and Performance Metrics:

Assessing the effectiveness of AIOps models.

Unit No 3: AIOps Frameworks and Implementation [7 Hours]

AIOps Frameworks: Understanding industry-standard AIOps frameworks and architectures.
AIOps Tools: Hands-on experience with AIOps platforms and tools for real-time monitoring and analysis.
Building AIOps Pipelines: Setting up end-to-end AIOps workflows for different use cases.

Unit No 4: CI/CD Pipeline for DevOps and AIOps [7 Hours]

Introduction to CI/CD Pipeline: Principles, benefits, and its role in the software development lifecycle.
CI/CD Tools: Familiarity with popular CI/CD tools like Jenkins, GitLab CI, or Travis CI.
Implementing CI/CD Pipeline: Building automated testing, staging, and deployment processes.

Unit No 5: AIOPS Implementation and Best Practices [7 Hours]

Setting Up AIOps Pipelines: Building end-to-end AIOps workflows for incident detection and response.
Continuous Deployment in AIOps: Integrating CI/CD pipelines to streamline software deployment.
AIOps Challenges and Best Practices: Addressing scalability, data security, and maintaining interpretability in AI-driven IT operations.

Text Books / Reference Books

1. "AIOps: An Introduction to AI-Based Algorithmic IT Operations" by Dan Kohn, Chris Novak, and Cory Isaacson
2. "AI for IT Operations (AIOps) for Dummies" by Pete Goldin and James Kobielus
3. "Practical Time Series Analysis: Prediction with Statistics and Machine Learning" by Aileen Nielsen
4. "Machine Learning Yearning" by Andrew Ng
5. "Site Reliability Engineering: How Google Runs Production Systems" by Niall Richard Murphy, Betsy Beyer, Chris Jones, and Jennifer Petoff
6. "The Phoenix Project: A Novel about IT, DevOps, and Helping Your Business Win" by Gene Kim, Kevin Behr, and George Spafford

Semester –VII

Autonomous Vehicles

BTAIPE704C	Autonomous Vehicles	PEC-4	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

1. Solid foundation in programming (Python preferred) and proficiency in data analysis.
2. Basic understanding of machine learning concepts and algorithms.
3. Familiarity with computer vision and image processing will be advantageous.

Course Objectives:

To Develop expertise in AI techniques for autonomous vehicles, covering perception, decision-making, control, and addressing ethical considerations.

Course Outcomes:

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

CO1	Understand the principles and challenges of autonomous vehicles and the role of AI in self-driving technology
CO2	Implement computer vision and deep learning techniques for object detection and recognition on the road.
CO3	Explore end-to-end learning approaches for autonomous vehicle control
CO4	Apply AI techniques for safe and efficient autonomous driving on highways and long-distance routes
CO5	Evaluate security threats and privacy concerns in autonomous systems to ensure data protection

Course Contents:

Unit No 1: Introduction to Autonomous Vehicles [7 Hours]

Overview of Autonomous Vehicles: Evolution, benefits, and challenges.

Sensing and Perception Technologies: Cameras, LiDAR, Radar, and other sensors used in autonomous vehicles. AI in Autonomous Driving: Role of artificial intelligence and machine learning in self-driving cars. Safety and Regulations: Understanding safety standards and legal considerations for autonomous vehicles.

Unit No 2: AI Techniques for Autonomous Driving [8 Hours]

Path Planning and Decision Making: Using AI algorithms for route planning, obstacle avoidance, and decision-making in dynamic environments.

Perception and Object Detection: Applying computer vision and deep learning for object detection and recognition on the road.

Sensor Fusion: Integrating data from multiple sensors to create a comprehensive environment model. Control Systems: Implementing control algorithms to manage vehicle dynamics and movement.

Unit No 3: Machine Learning for Autonomous Vehicles [7 Hours]

Supervised Learning for Perception: Training models to recognize traffic signs, pedestrians, and other vehicles. Reinforcement Learning for Decision Making: Teaching agents to make driving decisions through reinforcement learning. End-to-End Learning: Exploring end-to-end learning approaches for autonomous vehicle control.

Unit No 4: Autonomy in Challenging Environments [7 Hours]

Urban Driving: Handling complex scenarios like traffic, intersections, and pedestrians in urban environments.

Highway and Long-Distance Driving: Techniques for safe and efficient autonomous driving on highways and long-distance routes.

Adverse Weather Conditions: Addressing challenges posed by rain, snow, and other adverse weather conditions.

Edge Cases and Failures: Preparing for and mitigating edge cases and system failures in autonomous driving.

Unit No 5: Ethical and Societal Considerations [7 Hours]

Ethical Challenges: Discussing ethical dilemmas and decision-making in autonomous vehicles. Security and Privacy: Addressing security threats and privacy concerns in autonomous systems. Social Implications: Examining the impact of autonomous vehicles on society, economy, and urban planning.

Text Books / Reference Books

1. "Autonomous Vehicles: Intelligent Transport Systems and Smart Technologies" by Felipe Jiménez, Sara Rodriguez, and J. Andres Diaz-Pace
2. "Self-Driving: Intelligent Transport Systems, Smart Cities, and Artificial Intelligence" by Dimitrios Tzovaras and Petros Ioannou
3. "Reinforcement Learning for Autonomous Vehicles: A Practical Guide with OpenAI Gym, TensorFlow, and TRFL" by Kaushik Balakrishnan
4. "Hands-On AI for Autonomous Vehicles with Unity: Implement Perception, Control, and Navigation for Autonomous Cars and Simulate them with Unity ML-Agents" by Atsushi Sakai and Manisha Biswas
5. "Autonomous Driving: Technical, Legal and Social Aspects" by Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, and Gereon Meyer

Semester –VII

Full Stack Development

BTAIPE704D	Full Stack Development	PEC-4	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic Knowledge of HTML and CSS

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Fundamentals of web essentials and markup languages
2. Use of the Client-side technologies in web development
3. Use of the Server-side technologies in web development
4. Understand the web services and frameworks

Course Outcomes:

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

CO1	Implement and analyze behavior of web pages using HTML and CSS
CO2	Apply the client-side technologies for web development
CO3	Analyze the concepts of Servlet and JSP
CO4	Analyze the Web services and frameworks
CO5	Apply the server side technologies for web development

Course Contents:

Unit No 1: Full Stack Fundamentals [7 Hours]

HTML, Basic, HTML5 Doctype, Some New HTML5 Elements, HTML5 advance feature Canvas Elements, Geolocation API, Responsive Images, Audio and Video Support, Header And Footer, Allow spell check and editable areas, Adding audio, Drag & drop.

CSS Advanced: Advanced Colors: Alpha transparency, At-Rules: Importing style sheets, styles for different media types, specifying the character set of a stylesheet and embedded fonts, CSS3: also known as Cascading Style Sheets Level 3.

Unit No 2: jQuery [8 Hours]

jQuery Introduction, - Overview, Syntax, Selectors, Events, Attributes, jQuery DOM manipulation: - Add Elements, Remove Elements, Replace Elements. jQuery CSS manipulations: CSS Classes, Dimensions, CSS Properties.

Jquery Traversing, Traversing Ancestors, Traversing Descenants.

Unit No 3: Angular JS **[7 Hours]**

Overview, Environment Setup, AngularJS – MVC Architecture, directives, Expressions, controllers, Angular Lifecycle, HTML DOM, Angular Modules, Angular Components, Angular Data Binding, Angular services, Dependency Injection.

Unit No 4: Javascripts Advanced **[7 Hours]**

Arrow Functions, Template Strings, Rest Operator, Spread Operator, Object Literals, Destructuring objects in javascript, inheritance, Getting parts of a value: split & substr, Programming fundamentals: Try...Catch And Throw, Getting the users date and time, Some more complex math, Regular Expressions, Get the users browser (navigator), Add timing: setInterval & setTimeout, Javascript Classes, Async in JavaScript, Error Handling in JavaScript.

Unit No 5: Node JS **[7 Hours]**

Introduction to Node JS, What is Node JS, Node.js Process Model, Node JS Modules: Functions, Buffer, Module, Core Modules, Local Modules, Built-in Modules.

File System, Fs.readFile, Writing a File, Opening a file, deleting a file, Other IO Operations Database operations: Database Connectivity, Connecting String, Configuring, Working with Select Command, Updating Records, Deleting Records, MERN: Overview of MERN, Introduction of MERN.

Text Books / Reference Books

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035
2. Robert W Sebesta, “Programming the World Wide Web , 4th Edition, Pearson education, 2008
3. Marty Hall, Larry, “Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.
4. H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429.
5. Chris Bates, “Web Programming Building Internet Applications , 3rd Edition, Wiley India, 2006.
6. Xue Bai et al, “The web Warrior Guide to Web Programming , Thomson, 2003

Semester –VII

Data Science Optimization Techniques

BTAIOE705A	Data Science Optimization Techniques	OEC-3	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Concept of Data Analysis.

Course Objectives:

1. To familiarize the students with some basic concepts of optimization techniques and approaches.
2. To formulate a real-world problem as a mathematical programming model.
3. To develop the model formulation and applications are used in solving decision problems.
4. To solve specialized linear programming problems like the transportation and assignment Problems.

Course Outcomes:

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

CO1	Apply operations research techniques like linear programming problem in industrial optimization problems.
CO2	Solve allocation problems using various OR methods.
CO3	Understand the characteristics of different types of decision making environment and the appropriate decision making approaches and tools to be used in each type.
CO4	To solve specialized linear programming problems like the transportation and assignment Problems.
CO5	Recognize competitive forces in the marketplace and develop appropriate reactions based on existing constraints and resources.

Course Contents:

Unit No 1: Mathematical Foundations [7 Hours]

Functions and Continuity, Review of Calculus, Vectors, Matrix Algebra, Eigenvalues and Eigenvectors, Optimization and Optimality, General Formulation of Optimization Problems Algorithms, Complexity, and Convexity: What Is an Algorithm?, Order Notations, Convergence Rate, Computational Complexity, Convexity, Stochastic Nature in Algorithms.

Unit No 2: Optimization Algorithms [8 Hours]

Unconstrained Optimization, Gradient-Based Methods, Gradient-Free Nelder–Mead Method Constrained Optimization: Mathematical Formulation, Lagrange Multipliers, Slack Variables, Generalized Reduced Gradient Method, KKT Conditions, Penalty Method Optimization Techniques: Approximation Methods: BFGS Method, Trust-Region Method, Sequential

Quadratic Programming, Convex Optimization, Equality Constrained Optimization, Barrier Functions, Interior-Point Methods, Stochastic and Robust Optimization.

Unit No 3: Linear Programming [7 Hours]

Introduction, Simplex Method, Worked Example by 12 Simplex Method, Interior-Point Method for LP Integer Programming: Integer Linear Programming, LP Relaxation, Branch and Bound, Mixed Integer Programming, Applications of LP, IP, and MIP Regression and Regularization: Sample Mean and Variance, Regression Analysis, Nonlinear Least Squares, Over-fitting and Information Criteria, Regularization and Lasso Method, Logistic Regression, Principal Component Analysis.

Unit No 4: Machine Learning Algorithms [7 Hours]

Data Mining, Data Mining for Big Data, Artificial Neural Networks, Support Vector Machines, Deep Learning Queueing Theory and Simulation: Introduction, Arrival Model, Service Model, Basic Queueing Model, Little's Law, Queue Management and Optimization Multiobjective Optimization: Introduction, Pareto Front and Pareto Optimality, Choice and Challenges, Transformation to Single Objective Optimization, The Constraint Method, Evolutionary Approaches.

Unit No 5: Constraint-Handling Techniques [7 Hours]

Introduction and Overview, Method of Lagrange Multipliers, Barrier Function Method, Penalty Method, Equality Constraints via Tolerance, Feasibility Criteria, Stochastic Ranking, Multi-objective Constraint-Handling and Ranking Evolutionary Algorithms: Evolutionary Computation, Evolutionary Strategy, Genetic Algorithms, Simulated Annealing, Differential Evolution Nature-Inspired Algorithms: Introduction to SI, Ant and Bee Algorithms, Particle Swarm Optimization, Firefly Algorithm, Cuckoo Search, Bat Algorithm, Flower Pollination Algorithm, Other Algorithms.

Text Books / Reference Books

1. Optimization Techniques and Applications with Examples Xin-She Yang Wiley 3 rd 2018
2. Optimization Techniques A.K. Malik, S.K. Yadav, S.R. Yadav I.K. International Publishing House 1 st 2012
3. Optimization methods: from theory to design Marco Cavazzuti Springer 1st 2012
4. Optimization Techniques Chander Mohan, Kusum Deep New Age International 1st 2009

Semester –VII

Blockchain Technology

BTAIOE705B	Blockchain Technology	OEC-3	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Digital Communication.

Course Objectives:

1. To understand the cryptographic techniques used in blockchain systems and to introduce the fundamental concepts and principles of blockchain technology.
2. Understand the fundamentals of Ethereum and DApps and implementation Smart contract.

Course Outcomes:

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

CO1	Explain the fundamental characteristics of blockchain using bitcoin.
CO2	Demonstrate the application of hashing and public key cryptography in protecting the blockchain.
CO3	Explain the elements of trust in a Blockchain: validation, verification, and consensus.
CO4	Develop smart contracts in Ethereum framework.
CO5	Blockchain Usecases

Course Contents:

Unit No 1: Introduction to blockchain [7 Hours]

History of blockchain, peer to peer (P2P) network, public ledger, double spend problem, features of blockchain, types of blockchain: public, private and consortium based blockchain and applications of blockchain.

Unit No 2: Cryptographic primitives [7 Hours]

Public key cryptography, hash functions, message digest, secure hash algorithms (SHAS-256), digital signature, elliptic curve digital signature algorithms (ECDSA), merkle tree.

Unit No 3: Bitcoin definition, transactions [8 Hours]

The transaction life cycle, the structure of a block, genesis block, wallet, bitcoin mining, forking: hard and soft fork. Consensus algorithms: proof of work, proof of stake, practical byzantine fault tolerance, proof of burn and prof of elapsed time.

Unit No 4: Smart contracts, Ethereum basics [7 Hours]

Introduction to Ethereum & Ether, Gas, the world state, transactions, Ethereum virtual machine (EVM), types of accounts, block structure, ether, DApps. Ethereum vs bitcoin.

Unit No 5: Blockchain Use Cases **[7 Hours]**

Land Registry Records, Cross-border payments over blockchain, Project Ubin, Food Security, Supply chain financing, Voting system and Identity on Blockchain, Supply chain management, Healthcare and electronic medical records, Blockchain and Metaverse.

Text Books / Reference Books

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, A Beginner's Guide to Building Blockchain Solutions, Apress, 2018.
2. Ritesh Modi, Solidity Programming Essentials-A Beginner's Guide to Build Smart Contractsfor Ethereum and Blockchain, 2018, Packt Publishing Ltd.
3. Melanie Swan, Blockchain: Blueprint for a New Economy, O'Reilly, 2015
4. William Stallings, Cryptography and Network Security, eighth edition, Pearson, 2020.
5. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O Dowd, Venkatraman Ramakrishna, Hands-On Block Chain with Hyperledger: Building Decentralized Applicationswith Hyperledger Fabric and Composer , Import, 2018.
6. Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Packt Publishing,2020, ISBN:9781839213199, book website:https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199

Semester –VII

Quantum Computing

BTAIOE705C	Quantum Computing	OEC-3	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Nil.

Course Objectives:

1. Design and create quantum circuits for quantum algorithms to run on quantum computers..
2. Analyze quantum information protocols using the basic mathematical structure of quantum mechanics, including states, operations and measurements to validate performance claims..

Course Outcomes:

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

CO1	Basics of complex vector spaces.
CO2	Quantum mechanics as applied in Quantum computing.
CO3	Understand quantum information theory, quantum computation, quantum cryptography and related topics
CO4	Fundamentals of Quantum computations.
CO5	Architecture and algorithms

Course Contents:

Unit No 1: Introduction to Quantum Computation and Present State of Affairs [7 Hours]

Basics of Quantum theory, Mathematical Model of Quantum Computing, Introduction to quantum computers, Linear operators and spectral decomposition. Latest developments in quantum computing – Information only.

Unit No 2: Background Mathematics and Physics [7 Hours]

Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Unit No 3: Quantum Circuits [8 Hours]

Quantum bits, Bloch sphere representation of a qubit, multiple qubits Bits, Classical gates versus quantum gates, single qubit gates, multiple qubit gates, design of quantum circuits, Quantum error correcting codes, Quantum fault tolerance.

Unit No 4: Quantum Information and Cryptography [7 Hours]

Classical Cryptography, RSA algorithm , Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning

theorem. Mathematical models of quantum computation, their relationships to each other, and to physical systems, Quantum Cryptography – BB 84 protocol.

Unit No 5: Quantum Algorithms Classical computation on quantum computers [7 Hours]
Relationship between quantum and classical complexity classes. Deutsch;s algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search. Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation, Quantum algorithms, Simon's algorithm, The prime factorization algorithm.

Text Books / Reference Books

1. Nielsen, Michael A., and Isaac L. Chuang. Quantum Computation and Quantum Information. Cambridge, UK: Cambridge University Press, September 2000. ISBN: 9780521635035.
2. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008
3. Peres, Asher. Quantum Theory: Concepts and Methods. New York, NY: Springer, 1993. ISBN: 9780792325499.
4. Pittenger A. O., An Introduction to Quantum Computing Algorithms
5. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.

Semester –VII

Mobile Application Development

BTAIOE705D	Mobile Application Development	OEC-3	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Data Structures, Object Oriented, Java Programming.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Overall life cycle of Android programming
2. Essential Components of an Android Application

Course Outcomes:

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

CO1	Understand Android architecture, activities and their life cycle
CO2	Apply the knowledge to design user interface using Android UI and Component
CO3	Describe Memory and File operations in Android
CO4	Manage system database, remote database operations using web services and Firebase
CO5	Apply knowledge of map, location services, Graphics, android system and background services

Course Contents:

Unit No 1: Introduction to Android [7 Hours]

Background about mobile technologies, Android – An Open Platform for Mobile development, Native Android Application, Android SDK Features, Android Architecture, Application Frameworks, Android Libraries, Android Runtime, Dalvik Virtual Machine. Creating First Android Application. Creating Configurations. Android Project Structure. Testing the application (AVD, Active device), Android Manifest file. Running and Debugging.

Unit No 2: User Interface, Activities [7 Hours]

Introduction, Android Application Life Cycle, Activity, Layouts, Application Priority and process states, Fundamental Android UI Design, Study of different layouts, Introducing Views, Creating new Views, Draw able Resources. Designing fragments: Fragments lifecycle, Fragment management and integration. Advanced UI: Adapters, Complex UI components, Menus and Dialogs, Tabbed Activities, Navigation Drawer, Animations, Create activity layouts programmatically. Android Material Design: introduction, properties, Material Styling / Animations, Material Patterns.

Unit No 3: Intents, Broadcast Receivers and Files [8 Hours]

Introducing Intents, Intents and Intent filters, What are Pending Intents, Adapters, Internet Resources, Notifications, Introducing Dialogs, Saving Application Data in external and internal memory, Creating and saving preferences, Retrieving shared preferences, Creating a standard preference activity, Saving Activity State, Saving and Loading Files, Including static files as Resources, File management tools.

Unit No 4: Database and Content Providers [7 Hours]

Introducing Android Databases, Introducing SQLite, Cursors and content values, working with SQLite Database, Creating new content Provider. SQLite Open Helper and creating a database. Opening and closing a database, working with cursors, Inserts, updates, and deletes. Native Content Providers: Content provider types, searching for content, Adding, changing, and removing content, Native Android Content Providers, Accessing Contact Book, Calendar. Custom Content Providers: Custom Content Provider classes, Publishing content providers. Introduction to Firebase, Real time/Cloud, Authentication in firebase.
Connecting to MySQL using JSON (Web services).

Unit No 5: Telephony, Hardware and Network Services [7 Hours]

Telephony, Reading Phone device details, Reading Sims Details, Incoming and outgoing call monitoring, Tracking Service Change, Introducing SMS and MMS, Sending SMS and MMS, Sending SMS messages manually, Use of Bluetooth, Managing Network Connectivity, Managing Wi-Fi. Google Map - Layout file, Google Map – Android Manifest file, Customizing Google Map, Adding Marker, Changing Map Type.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books / Reference Books

1. John Horton, “Android Programming for Beginners”, 2nd Edition Packt Publishing
2. Pradeep Kothari “Android Application Development Black Book” , DreamTech
3. Dawn Griffiths, “Headfirst Android Development”, 1st Edition, O′Reilly
4. Lauren Darcey, “Android Wireless Application Development”, Shane Conder, Pearson
5. Wei Meng Lee “Beginning Android 4 Application Development”, Wrox

Semester –VII

Natural language Processing Lab and Data Engineering Lab

BTAIL707	**Natural language Processing Lab and Data Engineering Lab**	**LC5**	**0L-0T-4P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 04 hrs./week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks End Semester Examination: 40 Marks

Natural language Processing Lab

List of Practical/Tutorial

Experiment No.	**Title of the Experiment**
1	Convert the text into tokens. Find the word frequency.
2	Find the synonym /antonym of a word using WordNet.
3	Demonstrate a bigram / trigram language model. Generate regular expression for a given text
4	Perform Lemmatization and Stemming. Identify parts-of Speech using Penn Treebank tag set.
5	Implement HMM for POS tagging. Build a Chunker
6	Implement Named Entity Recognizer.
7	Implement semantic role labelling to identify named entities.
8	Implement text classifier using logistic regression model.
9	Implement a movie reviews sentiment classifier.
10	Implement RNN for sequence labelling.
11	Implement POS tagging using LSTM.
12	Word sense disambiguation by LSTM/GRU.

Note:

1. Open-Source tools and technology use for programs
2. Lab should be in scope of hands of experience and practice related program must
3. Add case study and Live project experience if any related contents.
4. Conduct any 10 practical.

Data Engineering Lab

List of Practical

Excel -

1. To study and demonstrate fundamentals in Microsoft excel.
2. To study and demonstrate Entering and editing text and formulas.

Advanced Excel –

3. To study and demonstrate working with basic excel functions, modifying an excel worksheet.
4. To study and demonstrate data formatting in an excel worksheet.

Power BI –

5. To study and demonstrate introduction to Power BI, basic charts in Power BI, working with maps, Tables and Matrix in Power BI.
6. To study and demonstrate other charts in Power BI, cards and filters, slicers in Power BI, Advanced charts in Power BI.
7. To study and demonstrate objects in Power BI, Power BI service introduction, power query [text, Date functions].
8. To study and demonstrate Number functions, append files, merge files, conditional columns, power query [imp topics, M language introduction].

Tableau –

9. To study and demonstrate Introduction to Tableau, Data in Tableau, Sets, sorting and filtering in Tableau, parameters.
10. To study and demonstrate Groups, folders and hierarchies, marks card, views and highlighting, formatting in Tableau.
11. To study and demonstrate Lines and bands, Tableau worksheets, charts in Tableau part -1, calculated fields.
12. To study and demonstrate charts in Tableau part -2, aggregation and granularity, database functions, box and whisker plot, time series and forecasting.

Note:

1. Open-Source tools and technology use for programs (Advanced Excel, Power BI & Tableau).
2. Lab should be in the scope of hands of experience and practice related programs.
3. Add case study and Live project experience if any related content.
4. Conduct any 10 practical.

Semester –VII

Project

BTAIM708	**PROJECT**	**PROJ**	**0L-0T-4P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 024hrs./week	Continuous Assessment : 60 Marks End Semester Examination: 40 Marks

Guidelines for Project

The students shall study in group of max. three members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Artificial Intelligence, Data Science, Cyber security, Computer Vision, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring the current technical journal or reference books, under the guidance of the teacher.

In this subject head, it is expected that the student should complete the following tasks.

1. Identify problem statement / idea which is solving one problem preferably localproblem may bein their University / College / nearby vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement solution using latest technology
5. Write 35-40 pages report and submit with hard binding (use of latex is more suitable).
6. Present / demonstrate the solution in front of faculty member

The students shall prepare his report and execution of project for other students of his class inthe presence of his guide and examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:

The Continues Assessment for this head will consists of the report written in a technical reporting manner and execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Semester –VIII

Project Work / Internship

BTAIF801	**Project Work/ Internship**	**Project/ Internship**	**0L-0T-24P**	**12 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 24 hrs./week	Continuous Assessment : 60 Marks End Semester Exam: 40 Marks Total : 100 Marks

Guidelines for Project

It is recommended to complete industry or industry sponsored project. The students shall study in group of max. three members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Artificial Intelligence, Data Science, Machine learning or inter discipline branch from current literature, by referring the current technical journal or reference books, under the guidance of the teacher.

In this subject head, it is expected that the student should complete the following tasks.

1. Identify problem statement / idea which is solving one problem preferably local problem may being their University / College / nearby vicinity.
2. Do the literature survey,
3. Design the solutions,
4. Implement solution using latest technology,
5. Write 60-70 pages report and submit with hard binding (use of latex is more suitable),
6. Present / demonstrate the solution in front of faculty member.

The students shall prepare his report and execution of project for other students of his class inthe presence of his guide and examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:

The Continues Assessment for this head will consists of the report written in a technical reporting manner and execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

COURSE CURRICULUM MAPPING WITH MOOC PLATFORM NPTEL

Sr. No	Course Title	Course Code	Semester	SWAYAM/ NPTEL Course And Web Link	Name of Institute offering	Relevance	Duration
1	Natural Language Processing	BTAIC701	VII	**NPTEL:** https://onlinecourses.nptel.ac.in/noc23_cs45/preview	IIT Kharagpur	85%	12 Week
2	Advanced Computer Vision	BTAIC702	VII	**NPTEL:** https://onlinecourses.nptel.ac.in/noc19_cs58/preview	IIT Kharagpur	75%	12 Week
3	Data Engineering	BTAIC703	VII	**NPTEL:** https://onlinecourses.nptel.ac.in/noc21_cs69/preview	IIT Madras	85%	8 Week
4	**Professional Elective Course (PEC)-BTAIPE704**						
	1. Time Series Forecasting	BTAIPE704A	VII	**NPTEL** https://onlinecourses.nptel.ac.in/noc21_ch28/preview	IIT Madras	65%	12 Week
	2. AI Operations	BTAIPE704B	VII	**NPTEL:** https://onlinecourses.nptel.ac.in/noc22_cs56/preview	IIT Delhi	75%	12 Week
	3. Autonomous Vehicle	BTAIPE704C	VII	**NPTEL:** https://nptel.ac.in/courses/108106170	IIT Madras	65%	8 Week
	4. Full Stack Development	BTAIPE704D	VII	-	-	-	-
5	**Open Elective Course (OEC) – BTAIOE705**						
	1.Data Science Optimization Techniques	BTAIOE705A	VII	**NPTEL:** https://nptel.ac.in/courses/106106245	IIIT Delhi	85%	8 Week
	2. Block chain Technology	BTAIOE705B	VII	**NPTEL:** https://onlinecourses.nptel.ac.in/noc20_cs01/preview **Coursera:** https://www.coursera.org/specializations/blockchain	IIT Kanpur	85%	8 Week
	3. Quantum Computing	BTAIOE705C	VII	**NPTEL:** https://onlinecourses.nptel.ac.in/noc19_cy31/preview **Coursera:** https://www.coursera.org/learn/introduction-to-quantum-information	IIT Kanpur	80%	12 Week
	4. Mobile Application Development	BTAIOE705D	VII	**NPTEL:** https://archive.nptel.ac.in/courses/106/106/106106156/	IIT Madras	75%	8 Week
6	**Humanities and Social Sciences including Management Elective Course (HSSMEC) :BTAIHM706**						
	1. Foreign Language Studies	BTAIOE706A	VII	**NPTEL (German):** https://nptel.ac.in/courses/109106166	IIT Madras	45%	12 Week
				NPTEL (Japanese) https://nptel.ac.in/courses/121104005	IIT Kanpur	45%	12 Week
	2. Universal Human Value & Ethics	BTAIOE706B	VII	**NPTEL:** https://nptel.ac.in/courses/109104068	IIT Kanpur	65%	12 Week
	3. Intellectual Property Rights	BTAIOE706C	VII	**NPTEL:** https://onlinecourses.nptel.ac.in/noc22_hs59/preview	IIT Madras	75%	12 Week

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

COURSE CURRICULUM MAPPING WITH MOOC PLATFORM COURSERA

Sr. No	Course Title	Course Code	Semester	SWAYAM/ NPTEL Course And Web Link	Name of Institute offering	Relevance	Duration
1	Natural Language Processing	BTAIC701	VII	https://shorturl.at/hmIWZ	DeepLearning.AI	50%	3 Month
2	Advanced Computer Vision	BTAIC702	VII	https://shorturl.at/biBJ6	DeepLearning.AI	60%	19 week
3	Data Engineering	BTAIC703	VII	https://www.coursera.org/learn/introduction-to-data-engineering	IBM		4 Week
4	**Professional Elective Course (PEC)-BTAIPE704**						
	1. Time Series Forecasting	BTAIPE704A	VII	https://www.coursera.org/learn/tensorflow-sequences-time-series-and-prediction	DeepLearning.AI	50%	4 week
	2. AI Operations	BTAIPE704B	VII	https://www.coursera.org/learn/introduction-to-ai	IBM	60%	4 week
	3. Autonomous Vehicle	BTAIPE704C	VII	-	-	-	-
	4. Full Stack Development	BTAIPE704D	VII	https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer	IBM	85%	3-6 Month
5	**Open Elective Course (OEC) – BTAIOE705**						
	1.Data Science Optimization Techniques	BTAIOE705A	VII	-	-	-	-
	2. Block chain Technology	BTAIOE705B	VII	**Coursera:** https://www.coursera.org/specializations/blockchain	University of Buffalo	65%	2 Months
	3. Quantum Computing	BTAIOE705C	VII	**Coursera:** https://www.coursera.org/learn/introduction-to-quantum-information	KAIST	60%	10 Hrs
	4. Mobile Application Development	BTAIOE705D	VII	https://www.coursera.org/learn/introduction-to-android-mobile-application-development	Meta	75%	4 Week
6	**Humanities and Social Sciences including Management Elective Course (HSSMEC) :BTAIHM706**						
	1. Foreign Language Studies	BTAIOE706A	VII	-	-	-	-
				-	-	-	-
	2. Universal Human Value & Ethics	BTAIOE706B	VII	https://www.coursera.org/learn/ethical-use-of-technology	The University of NOTRE DAME		4 week
	3. Intellectual Property Rights	BTAIOE706C	VII	https://www.coursera.org/specializations/introduction-intellectual-property	Penn University	80%	1 month 10 hrs

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Sr. No	Course Title	Course Code	Semester	SWAYAM/ NPTEL Course And Web Link	Name of Institute offering	Relevance	Duration
1	Natural Language Processing	BTAIC701	VII	https://shorturl.at/ekxDP	**University of Canterbury**	60%	6 Week
2	Advanced Computer Vision	BTAIC702	VII	https://shorturl.at/jkMZ1	IBM	50%	3 week
3	Data Engineering	BTAIC703	VII	https://www.edx.org/professional-certificate/ibm-data-engineering	IBM	50%	2 Month
4	**Professional Elective Course (PEC)-BTAIPE704**						
	1. Time Series Forecasting	BTAIPE704A	VII	-	-	-	-
	2. AI Operations	BTAIPE704B	VII	-	-	-	-
	3. Autonomous Vehicle	BTAIPE704C	VII	-	-	-	-
	4. Full Stack Development	BTAIPE704D	VII	-	-	-	-
5	**Open Elective Course (OEC) – BTAIOE705**						
	1.Data Science Optimization Techniques	BTAIOE705A	VII	-	-	-	-
	2. Block chain Technology	BTAIOE705B	VII	-	-	-	-
	3. Quantum Computing	BTAIOE705C	VII	https://www.edx.org/course/quantum-computing	University of Chicago	60%	5 week
	4. Mobile Application Development	BTAIOE705D	VII	-	-	-	-
6	**Humanities and Social Sciences including Management Elective Course (HSSMEC) :BTAIHM706**						
	1. Foreign Language Studies	BTAIOE706A	VII	-	-	-	-
				-	-	-	-
	2. Universal Human Value & Ethics	BTAIOE706B	VII	-	-	-	-
	3. Intellectual Property Rights	BTAIOE706C	VII	https://www.edx.org/course/intellectual-property-rights-a-management-perspect	IIM Bangalore	80%	6 week