Department of Artificial Intelligence and Machine Learning
Structure & Contents for Open Elective

Programme structure for B. Tech. Artificial Intelligence and Machine Learning

Open Electives

Sr.No	Course Code	Open Electives I	Credits
1	U12OE011	Software Model	2
Open Electives II			
2	U12OE021	Introduction to Python	2
Open Electives III			
3	U12OE031	Introduction to Data Analytics	2
Open Electives IV			
4.	U12OE041	Data Visualization using python	2
Open Electives V			
5.	U12OE051	Machine Learning with Python	2
Open Electives VI			
6.	U12OE061	AI for everyone	2

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U12OE011	Software Models	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U12OE011	Software Models	10	-	5	15	40%	35	40%	50

Course Description

This course introduces students to the different software development lifecycle (SDLC) phases used in developing, delivering, and maintaining software products. Students will also acquire basic software development skills and understand common terminology used in the software engineering profession.

Pre-requisites: Computer Basics

Course Objectives

- To understand the various phases of the software development lifecycle.
- To develop collaborative skills by working on group projects.
- To Learn and apply security best practices in software development.
- Consider the ethical and legal aspects of software development, including issues related to privacy, intellectual property, and open-source licensing

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

- **CO1** **Apply**[3] different software development methodologies.
- **CO2** **Design**[6] and implement software solutions using various programming languages.
- **CO3** **Decide**[5] version control systems and development tools.

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- **CO4** **Collaborate**[3] effectively in a software development team

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Software Engineering**	**6**
1	1.1	Introduction, the problem domain, software engineering challenges, software engineering approach, Software Process.	
	1.2	characteristics of Software Process, project management process, inspection process, software configuration management process, requirements change management process	
2.0		**Software Development Model**	**6**
2	2.1	Software development life cycle, Waterfall Model, Prototyping Model,	
	2.2	Iterative model, Time boxing model, Spiral Model, Incremental Model and V Model.	
3.0		**Software Architecture and Design**	**6**
3	3.1	Role of Software Architecture, architecture views, components and connector views, architectural styles, function oriented design,	
	3.2	Design principles, module level concepts, coupling, cohesion, design notation and specification, object oriented design with OO concept.	
4.0		**Software Coding**	**6**
4	4.1	Programming principles and guidelines, coding errors, structural programming, information hiding, programming practices,	
	4.2	Coding standards, coding process, an incremental coding, test driven development, pair programming source control and build.	

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Text Books

1. Software Engineering: A precise Approach - Pankaj Jalote (Wiley India)
2. Software Engineering Principles & Practices by Rohit Khurana ITLESL (2nd Edition)

References

1. Fundamentals of Software Engineering - Rapit Mall (3rd Edition)(PHI)
2. Software Engineering by Jan Sommerville (9th Edition) Pearson

Internal Assessment (T1, T2 and FET)

1. T1 should be based on First to Two modules, for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 7 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U12OE021	Introduction to Python	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U12OE021	Introduction to Python	10	-	5	15	40%	35	40%	50

Course Description

During learning of this course, students will learn the solving of the real- life problem by using python programming language. The learning is expected through the discussion of the real-life problems and their programming solutions through the project based learning activity.

Pre-requisites: Computer Basics

Course Objectives

- To Build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions
- To Decompose a problem into functions and synthesize a complete program..
- To Demonstrate the use of arrays, strings ,pointers & file handlings and structures in C language

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

- **CO1** **Explain**[2] data types and control statements in Python
- **CO2** **Make use of**[3] functions and object oriented concepts to develop basic programs
- **CO3** **Apply3** file handling techniques and CRUD operations for given problems inPython..
- **CO4** **Construct**[3] solutions to different problems using NumPy.
- **CO5** **Construct**[3] solutions to different problems using pandas

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Course Contents

Module	Unit	Description	Hours
1.0		**Basic concepts and functions in Python:**	**6**
1	1.1	Introduction to Python, the application areas of Python, Python Basics, Data types and variables, Data input, Comments, String, List, Tuple, Dictionary, Set, Control Statements, Range, Strings	
	1.2	Introduction to function, define a function, pass arguments, different type for arguments, Local and global variables, return a value from function, Return multiple values, Lambda Functions.	
2.0		**Object Oriented concepts in Python:**	**6**
2	2.1	Class definition, creating objects, Constructors, accessing attributes, Built-in class attributes, Destructors, Inheritance, Overriding, Overloading	
	2.2	What is exception? Python built-in exceptions, Try-Except-Finally, raise exceptions, User defined exception.	
3.0		**File and Database Handling:**	**6**
3	3.1	Reading, Writing, File manipulations, Directories, performing different database operations like Select, Insert, Update, Delete using MySql and Python connectivity.	
4.0		**NumPy**	**6**
4	4.1	Create, access, modify, and sort multidimensional NumPy arrays (ndarrays), Load and save ndarrays, Use slicing, Boolean indexing, and set operations to select or change subsets of an ndarray, understand difference between a view and a copy of ndarray	
5.0		**Pandas**	6
	5.1	perform element-wise operations on ndarrays, Use broadcasting to perform operations on ndarrays of different sizes, Create, access, and modify the main objects in Pandas, Series and DataFrames, Perform arithmetic operations on Series and DataFrames, Load data into a DataFrame, Deal with Not a Number (NaN) values.	

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Text Books

1. Charles R. Severance," Python for Everybody: Exploring Data using Python 3",1st edition, CreateSpace Independent Publishing Platform, 2016, (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf)(chapters 1-13,15)

2. Sandeep Rakshit, "R for beginners", Mcgraw Hill, ISBN: 9789352604555, 9352604555, Edition: 1, 2017, Pages:424, Manav Book Distributors

References

1. Allen B.Downey, "Think python: How to Think like a computer Scientist" 2nd edition,Green Tea Press,2015

Evaluation Scheme

Internal Assessment (T1, T2 and FET)

1.T1 should be based on First to Two modules, for 10 marks.

2.FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 7 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U12OE031	Introduction to Data Analytics	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U12OE031	Introduction to Data Analytics	10	-	5	15	40%	35	40%	50

Course Description

This course is designed to teach students how to analyze different types of data using Python. Students will learn how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations and predict future trends from data

Pre-requisites: statistics, programming language, data

Course Objectives

- To Build basic programs using fundamental programming for data processing & visualization
- To Implement Mathematical and Scientific applications for Data Analysis
- To Apply statistical methods to develop and evaluate the models
- To Becoming an expert in decision making for complex projects.

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

- **CO1** **Apply**[3] Object-Oriented Programming concepts to develop reusable Python code for data analysis
- **CO2** **Explain**[2] data analysis process to generate, import, and clean datasets for analysis
- **CO3** **Analyze**[4] data processing using Pandas for formatting, filtering, and hierarchical indexing.
- **CO4** **Choose**[6] data processing tasks and apply universal functions on arrays.
- **CO5** **Apply**[3] data analysis tools and methods to solve practical problems and gain insights from real-world scenarios.

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Course Contents

Module	Unit	Description	Hours
1.0		**Python Fundamentals for Data Analysis:**	**6**
1	1.1	Python data structures, Control statements, Functions, Object Oriented programming concepts using classes, objects and methods	
	1.2	Exception handling, Implementation of user-defined Modules and Package, File handling in python.	
2.0		**Introduction to Data Understanding and Preprocessing:**	**6**
2	2.1	Knowledge domains of Data Analysis, understanding structured and unstructured data, Data Analysis process, Dataset generation, Importing	
	2.2	Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.	
3.0		**Data Processing and Visualization:**	**6**
3	3.1	Data Formatting, Exploratory Data Analysis, Filtering and hierarchical indexing using Pandas	
	3.2	Data Visualization: Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps.	
4.0		**Mathematical and Scientific applications for Data Analysis:**	**6**
4	4.1	Numpy and Scipy Package, Understanding and creating N-dimensional arrays, Basic indexing and slicing, Boolean indexing, Fancy indexing, Universal functions, Data processing using arrays, File input and output with arrays.	
5.0		**Real-World Case Studies**	6
	5.1	Application of data analytics in various domains (finance, marketing, healthcare), Analysis of real-world datasets and scenarios	

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Text Books

1. "Python for Data Science" – Dr. R. Nageswara Rao
2. Python Data Science Handbook" – V.K. Jain
3. "Python for Data Analysis and Visualization" – Avinash Navlani, Armando Fandango

References

1. Allen Downey ,Jeffrey Elkner ,Chris Meyers,: Learning with Python, Dreamtech Press
2. David Taieb ,"Data Analysis with Python: A Modern Approach " 1st Edition, Packt Publishing

Evaluation Scheme:

Internal Assessment (T1, T2 and FET)

1.T1 should be based on First to Two modules, for 10 marks.

2.FEP shall be assessed for 5 marks separately.

End Semester Examination

1.Question paper will be of 35 marks comprise of 5 questions, each carrying 7 marks

2.The duration of end semester examination shall be Two hours.

3.The students need to solve all questions.

4.Question No.1 will be compulsory and based on entire syllabus.

5.Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U12OE041	Data Visualization using python	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U12OE041	Data Visualization using python	10	-	5	15	40%	35	40%	50

Course Description: This course introduces students to data analysis and visualization in the field of exploratory data science using Python**.**

Pre-requisites: Python

Course Objectives

- To Understand the importance of data visualization in data analysis and interpretation.
- To Learn to pre-process data for visualization, including data cleaning and manipulation.
- To Understand principles of effective visualization design, including choosing the appropriate chart types, colour schemes, and labelling.
- To Learn interactive visualization techniques

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

- **CO1** **Illustrate**[2] data analysis tools in the pandas library.
- **CO2** **Explain**[2] the process of Load, clean, transform, merge and reshape data.
- **CO3** **Analyze**[4] informative visualization and summarize data sets.
- **CO4** **Analyze**[4] and manipulate time series data..
- **CO5** **Develop**[3] real world data analysis problems.

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Course Contents

Module	Unit	Description	Hours
1.0		**Introduction:**	**6**
1	1.1	Introduction to Data Science, Exploratory Data Analysis and Data Science Process. Motivation for using Python for Data Analysis, Introduction of Python shell iPython and Jupyter Notebook.	
	1.2	Essential Python Libraries: : NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels	
2.0		**Getting Started with Pandas:**	**6**
2	2.1	Arrays and vectorized conputation, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics. Data Loading, Storage and File Formats. Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs, Interacting with Databases	
	2.2	Data Cleaning and Preparation. Handling Missing Data, Data Transformation, String Manipulation	
3.0		**Data Wrangling & Data Visualization matplotlib:**	**6**
3	3.1	Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting, 3D Plots ,ANOVA & MENOV	
	3.2	Basics of matplotlib, plotting with pandas and seaborn, other python visualization tools.	
4.0		**Data Aggregation and Group operations & Time Series Data Analysis:**	**6**
4	4.1	Group by Mechanics, Data aggregation, General split-apply-combine, Pivot tables and cross tabulation	
	4.2	Date and Time Data Types and Tools, Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling, Periods and Periods Arithmetic, Resampling and Frequency conversion, Moving Window Functions	
5.0		**Advanced Pandas:**	6

	5.1	Categorical Data, Advanced GroupBy Use, Techniques for Method Chaining	

Text Books

1. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media
2. O'Neil, C., & Schutt, R. (2013). Doing Data Science: Straight Talk from the Frontline O'Reilly Media

References

1. Allen Downey ,Jeffrey Elkner ,Chris Meyers,: Learning with Python, Dreamtech Press
2. David Taieb ,"Data Analysis with Python: A Modern Approach " 1st Edition, Packt Publishing

Evaluation Scheme

Internal Assessment (T1, T2 and FET)

1.T1 should be based on First to Two modules, for 10 marks.

2.FEP shall be assessed for 5 marks separately.

End Semester Examination

1.Question paper will be of 35 marks comprise of 5 questions, each carrying 7 marks

2.The duration of end semester examination shall be Two hours.

3.The students need to solve all questions.

4.Question No.1 will be compulsory and based on entire syllabus.

5.Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U12OE051	Machine Learning with Python	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U12OE051	Machine Learning with Python	10	-	5	15	40%	35	40%	50

Course Description: This course is an introduction to the theoretical aspects of the design of algorithms that enable machines to "learn "from examples (i.e., Machine Learning). This course will provide students an in-depth knowledge to the areas of Supervised and introduction of Unsupervised Machine Learning. The course will cover core Machine Learning algorithms for classification, regression and clustering**.**

Pre-requisites: Python, Linear Algebra, Statistics, Probability Theory.

Course Objectives

- To introduce the foundational concepts of machine learning.
- To provide the necessary mathematical background in linear algebra, calculus, probability, and statistics to understand and implement machine learning algorithms effectively.
- To Teach how to evaluate and validate machine learning models using techniques
- To Illustrate real-world applications of machine learning

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

- **CO1** Define[1] machine learning concepts, recognize types of learning, and identify problem categories.

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- **CO2** **Apply**[3] regularization techniques to prevent overfitting and underfitting in both linear and logistic regression models..
- **CO3** **Apply**[3] Support Vector Machines (SVM) with both linear and non-linear kernels, using soft and hard margin SVMs..
- **CO4** **Develop**[3] clustering techniques and categorize different clustering types for unsupervised learning tasks

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Machine Learning:**	**6**
1	1.1	Machine Learning: Definition, Terminology, Types of learning, Machine Learning Problem categories, Lifecycle, Performance measures, tools and framework and data visualization.	
2.0		**Regression**	**6**
2	2.1	Simple regression, Hypothesis, Gradient Descent for linear regression.polynomial regression	
	2.2	Multivariate Linear Regression – Multiple features,Hypothesis functions, Gradient Descent for multiple variables	
3.0		**Classification**	**6**
3	3.1	Logistic Regression: Definition,cost function, Gradient Descent for Logistic Regression. Multiclass Classification	
	3.2	Regularization - Over fitting & Under fitting, cost function, Regularized Linear Regression, Regularized Logistic Regression and K- Nearest Neighbors Classifier.	
4.0		**Decision Trees and SVM**	**6**
4	4.1	Definition, Terminology, the need, Advantages, and Limitations. Constructing and Understanding Decision Trees, random forest and examples.	
	4.2	Introduction to Support Vector Machines, Linear Support Vector Machines soft margin SVM, hard margin SVM, Kernel Tricks	

5.0		**Clustering and ML Applications**	6
	5.1	Introduction to Clustering, Types of Clustering, Use cases based on supervised ML, unsupervised ML, reinforcement, recommendation engine, IPL prediction, weather forecast prediction, house price prediction, Market Basket Analysis,sentiment analysis, forecast product demand and inventory	

Text Books

1. Machine Learning, Anuradha Srinivasa raghavan, and Vincy Joseph ,Kindle Edition, 2020, WILEY.
2. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, 2010, Prentice Hall of India.
3. Practical Machine Learning Sunila Gollapudi Packt Publishing Ltd..

References:

1.Machine Learning by Tom M.Mitchell, International Edition 1997,McGraw Hill Education

Evaluation Scheme

Internal Assessment (T1, T2 and FET)

1.T1 should be based on First to Two modules, for 10 marks.

2.FEP shall be assessed for 5 marks separately.

End Semester Examination

1.Question paper will be of 35 marks comprise of 5 questions, each carrying 7 marks

2.The duration of end semester examination shall be Two hours.

3.The students need to solve all questions.

4.Question No.1 will be compulsory and based on entire syllabus.

5.Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U12OE061	AI for everyone	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U12OE061	AI for everyone	10	-	5	15	40%	35	40%	50

Course Description

This course aims to introduce the fundamental concepts of artificial intelligence (AI) to individuals from all academic backgrounds. Participants will develop a broad understanding of AI technologies, their implications, and their potential applications in various fields. The course will emphasize practical examples and real-world case studies to facilitate comprehension and inspire innovative thinking.

Pre-requisites: Computer Basics

Course Objectives

- To understand the basics of artificial intelligence and its subfields.
- To explore real-world applications of AI across different industries.
- To Gain insights into the ethical, social, and economic implications of AI.
- To develop an appreciation for the potential of AI to drive innovation and transformation.

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

- **CO1** **Define**[1] and explain the fundamental concepts and subfields of AI..
- **CO2** **Illstrate**[2] real-world applications of AI across various industries.
- **CO3** **Analyze**[4] the ethical, social, and economic implications of AI.
- **CO4** **Assess**[5] the potential of AI to drive innovation and transformation in different domains.

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Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Artificial Intelligence**	**6**
1	1.1	What is data, Definition and scope of AI,The terminology of AI Historical overview and key milestones, Differentiating AI from human intelligence.	
	1.2	Types of AI:Narrow AI vs. General AI, Reactive machines, limited memory, theory of mind, and self-aware AI	
2.0		**AI Subfields and Technologies**	**6**
2	2.1	Machine learning: Supervised, unsupervised, and reinforcement learning, Deep learning and neural networks, Natural language processing (NLP) and computer vision	
3.0		**Applications of AI**	**6**
3	3.1	AI in healthcare: Diagnosis, treatment, and medical imaging AI in finance: Fraud detection, algorithmic trading, and risk assessment AI in transportation: Autonomous vehicles and traffic optimization AI in customer service and chatbots AI in education: Personalized learning and intelligent tutoring systems	
4.0		**Ethical and Social Implications of AI**	**6**
4	4.1	Bias and fairness in AI systems, Privacy and data protection concerns, Impact of AI on employment and the workforce, AI and social inequality	
5.0		**Other Important Issues & Career Opportunities in AI**	
	5.1	Ethical guidelines and responsible AI practices, AI and Innovation, Emerging trends and future directions in AI, AI and creativity: Generative models and artistic applications	
	5.2	Roles: Data Analyst, AI Specialist, Product Manager, etc.	

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Text Books

1. Artificial Intelligence: A Guide to Intelligent Systems-Michael Negnevitsky
2. AI For Everyone: Business Applications and Societal Implications-Vin Vashishta

References

1. Artificial Intelligence: A Modern Approach-Stuart Russell, Peter Norvig
2. AI Superpowers: China, Silicon Valley, and the New World Order-Kai-Fu Lee

Internal Assessment (T1, T2 and FET)

1.T1 should be based on First to Two modules, for 10 marks.

2.FET shall be assessed for 5 marks separately.

End Semester Examination

1.Question paper will be of 35 marks comprise of 5 questions, each carrying 7 marks

2.The duration of end semester examination shall be Two hours.

3.The students need to solve all questions.

4.Question No.1 will be compulsory and based on entire syllabus.

5.Remaining question (Q.2 to Q.5) will be selected from all the modules.

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