

Code Unnati – Centre of Excellence

Course Outline – 2023-24

Content Type		Duration (Hours)			Delivery Type	Delivery Mode
		2 nd Year	3 rd Year	4 th Year		
1	Core Deep Tech offering	~40	~55	~20	Instructor led	Hybrid
2	Industry Specific Modular Offering	~10	~15	~20	Instructor led	Hybrid
3	Employability skills	-	~15	~15	Instructor led	Hybrid
4	Capstone Project	~20	~30	~60	Instructor led	Hybrid
Year wise Total Hours		70	115	115		

Objective

- Enable students to adopt industry 4.0 technologies such as machine Learning, Internet of things, Computer Vision, Deep Learning, SAP Modules etc. and solve some real-life, Industry Specific, Community problems Using Technologies.
- Students should leverage the center of excellence to learn IR 4.0 Technologies to enhance exponential career growth.

Learning outcomes:

- Demonstrate fundamentals of Python tools and its data analytics libraries.
- Apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.
- Analyze the structures and algorithms of a selection of techniques related to machine learning and Artificial Intelligence.
- Able to design and implement various machine learning algorithms in a range of real-world applications.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and unsupervised learning.
- Be able to identify new application requirements in the field of computer vision using Deep Learning.
- Able to solve real life challenges on computer vision technology.
- Design Prototype level solution using IoT.
- Demonstrate Industry Specific Modules, SAP Technical Modules - SAP ABAP, SAP HANA, SAP analytics Cloud

Prerequisites:

- Basic Knowledge of using internet and computer systems.
- Basic understanding of problem solving.
- Introductory understanding of programming.
- Elementary concepts of Probability theory, Statistics & Continuous variable Calculus.

Year – II

Foundation Course

Duration - 50 Hours
Capstone Project - 20 Hours

Foundational skills for I.R 4.0

Python Basic

5 Hours

- Python Programming Language – Basic, Overview
- Python setup – Getting started with programming
- Python object and data structure – Data types, variables
- Python Data structures – Tuples, set, Dictionaries, List, String, Numbers etc.
- Python Comparison operators

Python Advance

10 Hours

- Python Statements – if & elif, else, for loops, while loops
- Python Methods & function
- Python errors and Exception handling
- Python Module and Packages
- Final Capstone Project on Python – Simple application using Python

Python for Advanced Mathematical Operation – NumPy

5 Hours

- Introduction to NumPy
- Statistical analysis using NumPy
- Perform Random Number generation using NumPy
- Perform Mathematical Operation using NumPy
- Matrix Manipulation
- Perform Various operation on Arrays
- Use cases of NumPy

Data Analysis using Pandas

5 Hours

- Introducing Pandas object , Series and DataFrame
- Reading data from files
- Dropping entries from an axis
- Indexing and selection operators
- Perform Arithmetic and conditional alignment using Pandas
- Identify Unique values and value counts
- Handling missing values from Dataset
- Pandas Groupby Methods

Data Visualization using Matplotlib • Introduction to Matplotlib • Various types of plotting and Visualization • Figures and subplot • Colors, Markers and Line styles • Histograms and Binning • Text and Annotation • Line Plots, Bar Plots, Scatter Plots, pie chart • Ticks, Labels and Legends, subplots • Three-Dimensional Plotting in Matplotlib	5 Hours
Data Visualization using Seaborn • Introduction to Seaborn • Distribution plot • Categorical plot • Matrix, Grid, Regression plot • Style and color in seaborn • Heatmap and other plotting styles	5 Hours
Artificial intelligence – Basic • AI – Overview, Market opportunities, Future • AI in different domains, AI in healthcare, AI in education, AI in automobile etc. • Use cases, Demos, Teachable machine, AI duet etc.	5 Hours
Industry Specific tools – SAP • SAP – Overview, various services offered by SAP, SAP products • SAP AI conversational Chatbot application – Hand on • Introduction to chatbot • Deployment of chatbot to third party application	10 Hours
Capstone Project	20 Hours
• Capstone Project is based on learning and students create prototype level solution for real life problems. • Design Thinking – Way to solve problems with creative thinking.	

* **Note** – Final assessment and Capstone Project will be criteria for Course completion certificate.

Year – III

Advance Course

Duration - 70 Hours

Capstone Project - 30 Hours

Statistical modelling and predictive analytics – Machine Learning

25 Hours

- **Introduction – Machine Learning**
- Introduction to Machine Learning
- Real time applications of Machine Learning
- Supervised Vs Unsupervised Machine learning
- Scikit Learn library overview
- Regression vs Classification
- Evaluating Performance – Classification Error Metrics
- Evaluating Performance – Regression Error Metrics.
- Ensemble Techniques for Classification and Regression.

- **Supervised Machine Learning Model**
- Linear Regression – Concept
- Linear Regression using Python – Scikit Learn library
- Cross Validation and bias-Variance trade-off
- Logistic Regression – Concept
- Logistic Regression using Python – Scikit Learn library
- K-Nearest Neighbors – concept
- K-NN using Python – Scikit Learn library
- Decision Tree and Random Forest
- Introduction to Tree Methods
- Decision Tree and Random Forest using Python – Scikit Learn library
- Support vector Machine Using Python

- **Unsupervised Machine Learning Model**
- Evaluating Metrics – Unsupervised Model
- K-Means Clustering – Concept
- K-Means Clustering using Python – Scikit Learn library
- Dimensionality Reduction Techniques – PCA, LDA, GDA

- **Machine Learning with IoT**
- Data Collection using sensors*
- Predictive Modelling using data collected from Sensors*.

Internet of Things

20 Hours

- **Internet of Things – Market opportunities and use cases**
- Internet Usage and Population Statistics.
- What is Internet of Things?
- Why IoT?
- Internet of Things Architecture.
- Application of IoT in Various Domain, Healthcare, Automobile etc.
- Industrial Internet of Things and its applications in real life.

- **Various types of Sensors and Actuators**
- Introduction to sensors and its working principles
- Rotary angle sensor, Light Sensor, Led
- Ultrasonic sensor, Temperature and Humidity sensor
- Sound sensor, Relay
- 16x2 LCD
- Servo Motor and Stepper Motor, DC Motor

- **IoT Protocol and Cloud integration**
- Wi-Fi, Bluetooth, BLE, LoRa, Sigfox
- IFTTT Protocol and its working.
- CoAP, MQTT Protocol
- Cloud Integration IoT services – Thingspeak, Blynk

- **IoT Hardware and Software & implementation**
- Introduction to raspberry Pi 4B
- Installation of operating system on Raspberry Pi
- Hardware connection for GrovePi+ with Rpi

- **Hands on with Raspberry pi and GrovePi+**
- Interface Sound Sensor, Light Sensor with raspberry Pi
- Interface LCD with Raspberry Pi
- Interface Temperature & Humidity Sensor with Raspberry Pi
- Interface Relay with Raspberry Pi
- Interface Ultrasonic with Raspberry Pi
- Various data collection using various types of sensors

• Creating GUI interfaces to communicate with sensor and displays
• Real life use case and solve problem using IoT
• Mini Project

Deep Learning and Computer Vision OpenVINO Toolkit	15 Hours
• Fundamentals of Deep Learnings • What is Deep Learning? • Concept of Neural Networks • Neurons, Weights and Bias • Forward and Backward Propagation • Multilayer Perceptron	
• Computer Vision Basics • Image Fundamentals: Pixels • Grayscale vs Color • Computer Vision – With Open cv and Keras • Canny Edge Detection – Hands On • Convolutional Neural Network	
• Hands on session on Computer vision • Viola-Jones Algorithm for face detection • Face detection • Face Blurring in live video detection • Number plate detection	
• Computer Vision with OpenVINO • Introduction OpenVINO • Open VINO Toolkit Components • Working with Model Optimizer • Optimizing TensorFlow, Keras and PyTorch model using Model Optimizer (P) • Exploring Model Zoo for Pretrained Model • OpenVINO™ Deep Learning Workbench • Utilizing OpenVINO for inference at the edge • Face detection using raspberry Pi and OpenVINO (P)	

SAP Technical Module		10 Hours
SAP Essential • Introduction to SAP Ecosystem • Introduction to Technical ERP module		
SAP BTP ABAP Environment • ABAP Language Basics and class • Understanding the basic features of SAP ABAP • Basic Data Object and data types • Processing data • Internal tables • Defining local class • Creating instant of class • Defining method		
ABAP on Business Technology Platform • Introduction to BTP • ABAP on BTP		
Hands-on ABAP • LAB-1 Create BTP ABAP Environment • LAB-2 Create ABAP Package • LAB-3 Create ABAP class • LAB-4 Create Database Table • LAB-5 Perform various ABAP data types of operation • LAB-6 ABAP IF-Else statement • LAB-7 Loops in ABAP • LAB-8 – Insert Data Table Entries and print them on the console		

Capstone Project		30 Hours
• Capstone Project is based on learning and students create prototype level solution for real life problems. • Design Thinking – Way to solve problems with creative thinking.		

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Year – IV

Advance Course

Duration - 40 Hours
Capstone Project - 60 Hours

Cyber Security in IoT	20 Hours
• What is IoT security? • Various security concerns with IoT • IOT vulnerabilities and security issues • Tools and methods to secure IoT devices. • IoT Attacks, Risks and Countermeasures • Lightweight Cryptography, challenges in Designing IoT Applications • Important cyber security terminologies	
SAP Analytics cloud	20 hours
• Introduction to SAC • Navigating in SAP Analytics Cloud • SAC Architecture • Creating New Story • Introduction to different Chart Types and Styling • Conditional Formatting and Linking Models/Dimensions • Data Explorer, Exporting the stories, Introduction to Comments, Bookmarks • Enhancing Chart visualization and interactions	
Capstone Project	60 Hours
• Capstone Project is based on learning and students create prototype level solution for real life problems. • Design Thinking – Way to solve problems with creative thinking.	

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