

**B. Tech.**  
**Honor**  
**in**  
**ARTIFICIAL INTELLIGENCE & DATA SCIENCE**  
**SCHEME OF INSTRUCTION & SYLLABUS**  
**Effective from 2022-23**



**Department of Artificial Intelligence & Data Science**

**VELAGAPUDI RAMAKRISHNA**  
**SIDDHARTHA ENGINEERING COLLEGE**

**(An Autonomous, ISO 9001:2015 Certified Institution)**

**(Approved by AICTE, Accredited by NAAC with 'A' Grade, Affiliated to JNTUK, Kakinada)**

**(Sponsored by Siddhartha Academy of General & Technical Education)**

**Kanuru, Vijayawada**

**Andhra Pradesh - 520007, INDIA.**

**[www.vrsiddhartha.ac.in](http://www.vrsiddhartha.ac.in)**

## **INSTITUTE VISION**

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

## **INSTITUTE MISSION**

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and pro-active nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

## **DEPARTMENT VISION**

The department vision is clearly defined and is in line with the college's vision. The vision of the department is:

"To evolve as a centre of academic excellence, advanced research and innovation in the field of Artificial Intelligence and Data Science discipline."

## **DEPARTMENT MISSION**

This mission of the Department is concise and supports the College's mission. The mission of Artificial Intelligence and Data Science Department is:

"To inculcate students with cognitive skills to perform intelligent data analysis, their application in solving data driven problems, with an inclination towards societal issues, research, professional career and higher studies ."

## **Program Educational Objectives(UG)**

We have program educational objectives for our Artificial Intelligence and Data Science Program. Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

### **Our program educational objectives are:**

- I. The graduates of the Program will have knowledge and skills for data analysis, including mathematics, science and basic engineering.
- II. The graduates of the Program will have in-depth learning skills to function as members of multi-disciplinary teams and to communicate effectively using modern tools.
- III. The graduates of the Program will have extensive knowledge in state-of-the-art frameworks in Artificial Intelligence and be prepared for their careers in the software industry or pursue higher studies and continue to develop their professional knowledge.
- IV. The graduates of the program will practice the profession with ethics, integrity, leadership and social responsibility

## PROGRAM OUTCOMES

**On successful completion of the B.Tech (AI&DS) programme the student will be able to :**

**PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering, data science fundamentals, and artificial intelligence to solve complex engineering problems.

**PO2: Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems to create solutions using the first principles of mathematics, engineering sciences, and data science.

**PO3: Design/development of solutions:** Design solutions Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct investigations of complex problems:** Apply research methods including design of experiments, statistical analysis and business interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern tool usage:** Create, select, and apply appropriate Artificial intelligence principles, techniques, modern engineering and IT tools including prediction and modelling to model complex engineering activities with an understanding of the limitations.

**PO6: The engineer and society:** Apply reasoning using contextual knowledge to assess the needs of societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to data science engineering practice.

**PO7: Environment and sustainability:** Understand the impact of artificial intelligence solutions in societal and environmental contexts, and

demonstrate the knowledge for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and to execute responsibilities and adhere to norms of the engineering profession.

**PO9: Individual and team work:** Execute professional functions effectively as an individual, as well as a leader or member in diverse multidisciplinary teams.

**PO10: Communication:** Communicate effectively with the engineering community and with society in solving complex problems in terms of being able to comprehend and write effective reports, make effective presentations, as well as execute and receive clear instructions.

**PO11: Project management and finance:** Demonstrate an ability to use management principles and apply these to one's own work, as a member and lead projects and build cost models in an interdisciplinary professional setting.

**PO12: Lifelong learning:** Recognize the need for and develop learning mechanisms and inculcate the ability to prepare for lifelong learning in the context of technological change.

### **PROGRAM SPECIFIC OUTCOMES**

**PSO1:** Develop AI based software applications/solutions as per the needs of Industry and society

**PSO2:** Adopt new and fast emerging technologies in Artificial Intelligence and Data Science

## **CURRICULAR FRAMEWORK FOR HONOR PROGRAM**

1. Students of a Department/Discipline are eligible to opt for Honors Program offered by the same Department/Discipline.
2. A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired  $\geq 08$  CGPA without backlogs upto end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required  $\geq 08$  CGPA without backlogs, his/her registration for Honors Program stands cancelled and he/she shall continue with the regular Program.
3. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.
4. In addition to fulfilling all the requisites of a Regular B.Tech Program, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
5. Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.
6. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.
7. The concerned BoS shall decide on the minimum enrolments (20) for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
8. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in the Annexure-2)
9. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the

agencies approved by the BOS with grading or marks or pass/fail in order to earn 1 credit for 4 week course. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the College/academic council.

10. The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.

11. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

12. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

13. Honors must be completed simultaneously with a major degree program without exceeding 8 credits per semester. A student cannot earn Honors after he/she has already earned bachelor's degree.

**HONOR DEGREE IN AI&DS****Advanced Data Analytics**

<i>S. No</i>	<i>Course Code</i>	<i>Course Name</i>	<i>Offered in Sem</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
<b>1</b>	20AI&DSH4801A	Advanced Python Programming	IV	3	1	0	4
<b>2</b>	20AI&DSH5801A	High Dimensional Data Analysis	V	3	1	0	4
<b>3</b>	20AI&DSH6801A	Artificial Intelligence for Robotics	VI	3	1	0	4
<b>4</b>	20AI&DSH7801A	AI in security applications	VII	3	1	0	4
02MOOCScourses@2creditseachother than the courses listed above needs to Be taken) (Any CSE/IT related Program Core subject from NPTEL/ SWAYAM course of 8weeks Any other course or platform deemed essential and approved by the Head of the Department							<b>4</b>
<b>Grand Total</b>							<b>20</b>

**HONOR DEGREE IN AI&DS****FullStack Web Development**

<i>S. No</i>	<i>Course Code</i>	<i>Course Name</i>	<i>Offered in Sem</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>Credits</i>
<b>1</b>	20AI&DSH4801B	Frontend Technologies	IV	3	1	0	4
<b>2</b>	20AI&DSH5801B	MEAN Technologies	V	3	1	0	4
<b>3</b>	20AI&DSH6801B	Backend Technologies	VI	3	1	0	4
<b>4</b>	20AI&DSH7801B	Framework & Micro services	VII	3	1	0	4
02MOOCScourses@2creditseachother than the courses listed above needs to Be taken) (Any CSE/IT related Program Core subject from NPTEL/ SWAYAM course of 8weeks Any other course or platform deemed essential and approved by the Head of the Department							<b>4</b>
<b>Grand Total</b>							<b>20</b>

# **SEMESTER IV**

## 20AI&DSH4801A

### ADVANCED PYTHON PROGRAMMING

<b>Course Category:</b>	Honors	<b>Credits:</b>	4
<b>Stream/ Course Type:</b>	Advanced Data Analytics/ Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>	20AI&DS3305: Data Structures & Algorithms	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Apply Python arrays and computer graphics libraries to perform data exploration and visualization.	K3	1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.8.2, 3.5.1, 3.6.1, 3.8.2
<b>CO2</b>	Apply Python packages to solve problems related to file input/output, database access and data analysis.	K3	1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.8.2, 3.5.1, 3.6.1, 3.8.2
<b>CO3</b>	Apply different Python libraries to implement data concurrency, parallelism, asynchronous and network programming.	K3	1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.8.2, 3.5.1, 3.6.1, 3.8.2
<b>CO4</b>	Apply Scipy and SciKit Python libraries to perform scientific computations.	K3	1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.8.2, 3.5.1, 3.6.1, 3.8.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	1	2	2										3	3
<b>CO2</b>	1	2	2										3	3
<b>CO3</b>	1	2	2										3	3
<b>CO4</b>	1	2	2										3	3

## COURSE CONTENT

### UNIT I

**Arrays with Numpy:** Creating an Array, Mathematical Operations, Squaring an Array, Indexing and Slicing, Shape Manipulation

**Computer Graphics:** Introduction to Computer Graphics, Python Turtle Graphics, Creating Computer Art, Introduction to Matplotlib, Graphing with Matplotlib pyplot, Graphical User Interfaces, The wxPython GUI Library, Events in wxPython User Interfaces, PyDraw wxPython Example Application

### UNIT II

**File Input/output :** Introduction to Files, Paths and IO, Reading and Writing Files, Stream IO, Working with CSV Files, Working with Excel Files

**Database Access:** Introduction to Databases, Python DB-API, PyMySQL Module

**Data Analysis with Pandas:** The data structure of Pandas: Series, Data Frame, Panel; Inserting and Exploring data: CSV, XLS, JSON, Database.

### UNIT III

**Concurrency and Parallelism:** Introduction to Concurrency and Parallelism, Threading, Multiprocessing, Inter Thread/Process Synchronisation, Futures, Concurrency with AsyncIO.

**Asynchronous Programming:** Reactive Programming Introduction, RxPy Observables, Observers and Subjects, RxPy Operators

**Network Programming:** Introduction to Sockets, Sockets in Python

### UNIT IV

**Computation Using Scipy:** Optimization and Minimization, Interpolation, Integration, Statistics, Spatial and Clustering Analysis, Signal and Image Processing, Sparse Matrices, Reading and Writing Files.

**SciKit: Going One Step Further:** Scikit Image: Dynamic Threshold, Local Maxima; Scikit-Learn: Linear Regression and Clustering.

## TEXT BOOKS

[1] Madhavan, S. (2015). Mastering Python for Data Science. Packt Publishing Ltd.

- [2] Hunt, J. (2019). Advanced Guide to Python 3 Programming. Springer.
- [3] Bressert, E. (2012). SciPy and NumPy: an overview for developers. O'REILLY.

## REFERENCE BOOKS

- [1] Jaworski, M., & Ziadé, T. (2016). Expert Python Programming. Packt Publishing Ltd.
- [2] Pichara, K., & Pieringer, C. (2017). Advanced Computer Programming in Python. CreateSpace Independent Publishing Platform.
- [3] Lanaro, G., Nguyen, Q., & Kasampalis, S. (2019). Advanced Python Programming. Packt Publishing Ltd.

## E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] *Advanced Python Programming Training Course / Koenig Solutions*. (z.d.). Koenig-Solutions. -Com. <https://www.koenig-solutions.com/python-programming-training>
- [2] *Advanced Python Programming Training - Accelebrate*. (z.d.). Accelebrate. Geraadpleegd op 21 maart 2022, van <https://www.accelebrate.com/training/python-advanced>
- [3] *Advanced Python with Project work and Internship (Recorded Lectures)*. (z.d.). ICT Academy at IITK. Geraadpleegd op 21 maart 2022, van <https://ict.iitk.ac.in/product/advanced-python/>

## 20AI&DSH4801B FRONTEND TECHNOLOGIES

<b>Course Category:</b>	Honors	<b>Credits:</b>	4
<b>Stream/ Course Type:</b>	Full Stack and Web Development/ Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>	20AI&DS4303: Advanced Java Programming	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	<i>Understand</i> the fundamentals of HTML5 and CSS3.	K1	1.7.1,2.5.1,2.5.2
<b>CO2</b>	<i>Apply</i> XML and Java Script on a given web application.	K3	1.7.1,2.5.1,2.5.2, 2.6.3,2.7.1,3.5.1,
<b>CO3</b>	<i>Create a</i> front end web application using TypeScript.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,
<b>CO4</b>	<i>Develop</i> a front end web application using React.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,4.6.2,5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	2												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	3										2	2
<b>CO4</b>		2	3	2									2	2

## COURSE CONTENT

### UNIT I

**Overview of HTML5:** Internet and Web, Exploring new features of HTML5, HTML5- Next Generation of Web development, Structuring an HTML Document, Exploring Editors and Browsers Supported by HTML5, Creating and Saving an HTML Document, Validating an HTML Document, Viewing an HTML Document, Hosting Web Pages. Fundamentals of HTML, Working with Text, Links and URLs, Creating Tables, Working with Images, Colors and Canvas, Working with Forms, Frames and Multimedia.

**Overview of CSS3:** Discussing the Evolution of CSS, Understanding the Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document Creating and Using a Simple External CSS File

Using the Internal and Inline CSS Styles, Fonts and Text styles, Creating Boxes and Columns Using CSS, Displaying, Positioning and Floating an Element, Effects, Frames and Controls in CSS

### UNIT II

**Working with Basics of XML:** Exploring XML, Comparing XML with HTML, Exploring Advantages and Disadvantages of XML, Describing the Structure of an XML Document, Exploring XML Entity References, Exploring XML Parsers, Describing DTD, Exploring XML Namespaces

Describing an XML Schema, Understanding XML CDATA, Describing Entity References

**JavaScript:** Overview of JavaScript: Exploring the Features of JavaScript, Using JavaScript in an HTML Document, Exploring Programming Fundamentals of JavaScript, JavaScript Functions, Events, Image Maps and Animations, Working with Document object, Document Object Model

### UNIT III

**TypeScript:** The Type System - TypeScript Versus JavaScript, All About Types: Talking About Types, The ABCs of Types - any, unknown, boolean, number, bigint, string, symbol, Objects, Intermission: Type Aliases-Unions Intersections, Arrays, Tuples, null, undefined, void, and never, Enums.

**Functions:** Declaring and Invoking Functions, Optional and Default Parameters, Rest Parameters, call, apply, and bind, Typing this, Generator Functions, Iterators, Call Signatures, Contextual Typing, Overloaded Function Types, Polymorphism, When Are Generics Bound?, Where Can You Declare Generics?, Generic Type Inference, Generic Type Aliases, Bounded Polymorphism, Generic Type Defaults, Type-Driven Development.

**Classes and Interfaces:** Classes and Inheritance, super, Using this as a Return Type, Interfaces, Declaration Merging, Implementations, Implementing Interfaces Versus Extending Abstract Classes, Classes Are Structurally Typed, Classes Declare Both Values and Types, Polymorphism, Mixins, Decorators, Simulating final Classes, Design Patterns, Factory Pattern, Builder Pattern, Handling Errors

## UNIT IV

**JQuery:** Introduction to JQuery, Syntax, Selectors, Events, Effects, JQuery with HTML, Traversing, AJAX.

**JSON:** Introduction, Syntax, Data types, Parse, Stringify, Objects and Arrays

**Overview of React:** React Introduction, React ES6, Render HTML, React JSX, React Components, React Props, React Events, React Conditionals, Lists, Forms.

## TEXT BOOKS

[1] DT Editorial Services, "**HTML5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, Second Edition**", DreamTech Publishers, January 2016. ( Unit I and II)

[2] Boris Cherny "Programming TypeScript - Making Your JavaScript Applications Scale" First Edition, O'REILLY Publications, May 2019. (UNIT-III )

### Web References:

[1] Web Reference: <https://www.w3schools.com/> (UNIT-IV Chapter 1&2&3)

## REFERENCE BOOKS

[1] Julie C Meloni, "HTML, CSS and JavaScript All in One", Second Edition, SAMS Publishers USA.

[2] Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India

[3] Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson

[4] Ethan Brown "Web Development with Node & Express (Leveraging the Java Script Stack), First Edition, O'Reilly Publications.

## **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Courseera: Jogesh K. Muppala, Associate Professor, The Hong Kong University of Science and Technology Full-Stack Web Development ,The Hong Kong University of Science and Technology

<https://www.coursera.org/specializations/full-stack-react#about>

[2] Udemy : Brad Traversy, Full Stack Web Developer & Instructor at Traversy Media, MERN Stack Front To Back: Full Stack React, Redux & Node.js

<https://www.udemy.com/course/mern-stack-front-to-back/>

# **SEMESTER V**

## 20AI&DSH5801A

### HIGH DIMENSIONAL DATA ANALYSIS

<b>Course Category:</b>	Honors	<b>Credits:</b>	4
<b>Stream/ Course Type:</b>	Advanced Data Analytics/ Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>	20AI&DS4302 Design and Analysis of Algorithms	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand classical High Dimensional problems and Principal Component Analysis	K2	1.2.1, 1.6.1
<b>CO2</b>	Apply factor analysis and grouping techniques on real world problems	K3	1.2.1, 1.7.1, 2.7.1, 2.8.1
<b>CO3</b>	Analyze Non Gaussian analysis	K4	1.2.1, 2.8.1
<b>CO4</b>	Understand Independent component and Feature Selection	K2	1.2.1, 1.6.1

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	1													
<b>CO2</b>	2	2												2
<b>CO3</b>	2	2												
<b>CO4</b>	1													2

## COURSE CONTENT

### UNIT I

**Classical Methods:** Classical method, Multivariate and High dimensional problems, Visualization ,Multi variant Random vector and data.

**Discriminant Analysis:** Visualizing principal component analysis, Properties of principal component, Standardized data and high dimensional data, Asymptotic results, Number of components and regression, Canonical correlation analysis, Population, Sample and properties of canonical correlation, Asymptotic consideration ,Canonical correlation and regression.

### UNIT II

**Factoring and Grouping:** Norms proximities, features, and dualities ,Vectors and matrix norms, measure of proximity ,Features and feature maps, dualities of X and X Transpose ,Cluster analysis ,Hierarchal agglomerative clusters ,3k means clustering, Principal component and cluster analysis ,Factor Analysis, population k factor model, Sample k factor model, Multidimensional scaling, classical scaling, metric scaling and nonmetric scaling.

### UNIT III

**Non-Gaussian Analysis:** Factor Analysis, Population k factor model, Sample k factor model, Multidimensional scaling, Towards Non-Gaussianity, Independent component Analysis, Projection pursuit, Kernal and more independent component methods.

### UNIT IV

**Feature Selection:** Introduction, Independent component and feature selection, Variable Ranking and statistical learning, Sparse principal component analysis, Consistency of principal component analysis as dimension grows.

## TEXT BOOKS

[1] Inge Koch , “Analysis of Multivariate and High-Dimensional Data”, Cambridge University Press , 2014

## REFERENCE BOOKS

[1] Fatemeh Emdad, Seyed Zekavat , “High Dimensional Data Analysis: Overview, Analysis, and Applications, VDM Verlag, 2008

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] <https://www.edx.org/course/high-dimensional-data-analysis>

## 20AI&DSH5801B MEAN TECHNOLOGIES

<b>Course Category:</b>	Honors	<b>Credits:</b>	4
<b>Stream/ Course Type:</b>	Full Stack and Web Development/ Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>	20AI&DS4303: Advanced Java Programming	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

COURSE OUTCOMES		BTL	POI
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	<i>Understand</i> an interactive web application using Node.js	K2	1.7.1,2.5.1,2.5.2
<b>CO2</b>	<i>Apply</i> Express.js concepts to develop a dynamic web application	K3	1.7.1,2.5.1,2.5.2, 2.6.3,2.7.1,3.5.1,
<b>CO3</b>	<i>Apply</i> MongoDB platform <i>concepts to create</i> a web application and connect to database	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,
<b>CO4</b>	<i>Apply</i> Angular 2 to <i>create</i> a mean stack web application	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,4.6.2,5.4.2

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2												
<b>CO2</b>	2	2	2										2	2
<b>CO3</b>	2	2	2										2	2
<b>CO4</b>	2	2	3	2	2								2	2

## COURSE CONTENT

### UNIT I

**Getting Started with Node.js:** Introduction to Node.js, Installing Node.js, io.js and the Node.js foundation, Node.js LTS support, Node.js ES6 support, JavaScript event driven programming, Node.js event driven programming.

**Node modules:** CommonJS modules, Node.js core modules, Node.js third party modules, Node.js file modules, Node.js Folder modules.

**Developing Node.js web applications:** Meet the Connect module, connect middleware, Understanding the order of Connect middleware, Mounting Connect middleware.

### UNIT II

**Building an Express Web Application:** Introduction Express, Installing Express, Creating your first Express application, The application, request and response objects, External middleware, **Implementing the MVC pattern:** The application folder structure, vertical folder structure, File-naming conventions, Implementing the horizontal folder structure, Handling request routing, Adding the routing file, Configuring an Express application, Rendering views, serving static files, Configuring sessions.

### UNIT III

**Introduction to MongoDB:** Introducing MongoDB, Key Features of MongoDB, MongoDB shell, MongoDB databases, CRUD Operations.

**Introduction to Mongoose:** Introducing Mongoose, Understanding Mongoose schemas, Creating the user schema and model, Registering the User model, Creating new users using save(), Finding multiple user documents using find(), Reading a single user document using findOne(), Updating an existing user document, Deleting and existing user document.

### UNIT IV

**Introduction to Angular:** Introducing Angular 2, Angular 2 Architecture, Angular 2 Modules, Angular 2 Components, Angular 2 Templates.

**Angular 2 data binding:** Interpolation binding, Property binding, Event binding, Angular 2 Directives, Angular 2 Dependency Injection, Angular 2 Routing.

**TEXT BOOKS**

- [1] Amos Q. Haviv , "MEAN Web Development", Second Edition, Packt Publishing, December 2016.

**Web Reference:**

<https://www.w3schools.com/> (UNIT-IV Chapter: 2&3)

**REFERENCE BOOKS**

- [1] Brad Dayley, Brendan Dayley, Caleb Dayley, “Node.js, MongoDB and Angular Web Development,” Pearson, 2nd Edition, 2018.
- [2] Simon Holmes , "Getting MEAN with Mongo, Express, Angular, and Node", Second Edition, Manning Publications, First Edition (31 October 2015).
- [3] Jeff Dickey, “Write Modern Web Apps with Mean Stack , Peachpit press, 2015
- [4] Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson
- [5] Ethan Brown “Web Development with Node; Express (Leveraging the Java Script Stack), First Edition, OReilly Publications.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1] Courseera: Jogesh K. Muppala, Associate Professor, The Hong Kong University of Science and Technology Full-Stack Web Development ,The Hong Kong University of Science and Technology  
<https://www.coursera.org/specializations/full-stack-react#about>
- [2] Udemy : Brad Traversy, Full Stack Web Developer & Instructor at Traversy Media, MERN Stack Front To Back: Full Stack React, Redux & Node.js  
<https://www.udemy.com/course/mern-stack-front-to-back/>

# **SEMESTER VI**

**20AI&DSH6801A****ARTIFICIAL INTELLIGENCE FOR ROBOTICS**

<b>Course Category:</b>	HONOR	<b>Credits:</b>	4
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>	20AI&DS4302 Design and Analysis of Algorithms	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand the concepts of Artificial Intelligence used in robotics	K2	1.7.1,2.5.1,2.5.2
<b>CO2</b>	Apply different searching strategies for a given application	K3	1.7.1,2.5.1,2.5.2, 2.6.3,2.7.1,3.5.1
<b>CO3</b>	Apply LISP and Prolog programming for a given application	K3	1.7.1,2.5.1,2.5.2, 2.6.3,2.6.4,3.5.1
<b>CO4</b>	Understand the basic concepts of Expert Systems	K2	2.5.1,2.5.2,2.6.3, 2.6.4, 3.5.1.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>	2	2												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	2										2	2
<b>CO4</b>		2	3										2	2

## Course Content

### UNIT I:

**Introduction** – History, Definition of AI, Emulation of human cognitive process, Intelligent agents – The concept of rationality, the nature of environments, the structure of agents.

### UNIT II:

**Problem – Solving Agents:** Problem Definitions, Formulating Problems, searching for solutions – Measuring Problem – Solving Performance with examples. Search Strategies: Uninformed search strategies – Breadth – first Search, Uniform – Cost Search, depth –first search, depth – limited search, Iterative deepening depth – first search, bidirectional search, comparing uninformed search strategies. Informed search strategies – Heuristic information, Hill climbing methods, best – first search, branch and – bound search, optimal search and A\* and Iterative deepening A\*.

### UNIT – III

**LISP and other programming languages** – Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics – properties of WERS, non-deductive inference methods.

### UNIT – IV

**Expert system** – Introduction, difference between expert system and conventional programs, basic activities of expert system – Interpretation, Prediction, Diagnosis, Design, Planning, Monitoring, Debugging, Repair, Instruction, Control. Basic aspects of expert system – Acquisition module, Knowledge base – Production rules, semantic net, frames. Inference engine – Backward chaining and forward chaining. Explanatory interface.

## TEXT BOOKS

[1] Russell Stuart, Norvig Peter, “*Artificial Intelligence Modern Approach*”, Pearson Education series in AI, 3rd Edition, 2010.

**REFERENCE BOOKS**

- [1] Dan.W.Patterson, “*Introduction to Artificial Intelligence and Expert Systems*”, PHI Learning, 2009.
- [2].Donald.A.Waterman, “*A guide to Expert Systems*”, Pearson, 2002.

**E-RESOURCES AND OTHER DIGITAL MATERIAL**

- [1]. <https://www.udacity.com/course/artificial-intelligence-for-robotics--cs373>
- [2]. <https://omscs.gatech.edu/cs-7638-artificial-intelligence-robotics>

## 20AI&DSH6801B BACKEND TECHNOLOGIES

<b>Course Category:</b>	Honors	<b>Credits:</b>	4
<b>Stream/ Course Type:</b>	Full Stack and Web Development/ Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>	20AI&DS3304 Java Programming	<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	Understand Django framework, MVT architecture	K2	1.7.1,2.5.1,2.5.2
<b>CO2</b>	Apply Django framework to develop dynamic web application connecting database	K3	1.7.1,2.5.1,2.5.2,2.6.3, 2.7.1,3.5.1,
<b>CO3</b>	Apply Django to Create a web application.	K3	1.7.1,2.5.1, 2.5.2,2.6.3, 2.6.4 3.5.1,
<b>CO4</b>	Apply PHP to create an interactive web application	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,4.6.2,5.4.2

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2												
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	2										2	2
<b>CO4</b>	2	2	3	2	2								2	2

## COURSE CONTENT

### UNIT 1

**What is Django:** Introduction, Django overview, What is a framework, why do we need a framework, What are some famous web frameworks?, What is a virtual environment?, How to create and use a virtual environment?, How to install Django?, How to create a Django Project?, Overview of your Django project files

**Overview of MVT Architecture:** What is architecture?, What is MVT?, What are models in Django's MVT?, What are views in Django MVT?, What are Templates in Django's MVT?

**The Django Admin Utility:** Introduction, Admin page of your Django project, Creating an app, Editing models.py, settings.py, and admin.py, Adding data to your database, Editing data in your database.

### UNIT II

**Interacting with the Database using Query Sets:** Introduction, ORM overview, Query sets, Adding elements to your database, Manipulating elements of your database, Deleting elements of your database,

**Understanding Models:** Introduction to models, Model fields, Meta options, Model methods, Relationship between models, Connecting models

**Django Views and Templates:** Introduction, Types of views, Built-in class-based views, Introduction to templates, configuration, template inheritance, Django templating language.

### UNIT III

**URLs and Regex:** Introduction, Functions available in URLconfs, Regex, Writing a regex for different url-functions

**Forms in Django:** Introduction, building basic forms, fetching data entered in the forms, Form fields and arguments, Form validation and model forms.

### UNIT IV

**PHP :** Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form

processing, Files,

Advance Features: Cookies and Sessions, Object Oriented Programming with PHP

**PHP and MySQL :** Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs

### **TEXT BOOKS**

[1] Awanish Ranjan,"Building Websites with Django", First Edition, BPB Publications, India, 2021.

[2] Robin Nixon, "Learning PHP, MySQL, JavaScript, and CSS", 2nd Edition, O'Reilly Media, Inc. 2012

### **REFERENCE BOOKS**

[1] Allen B. Downey, "Think Python: How to Think Like a Computer Scientist.", O'Reilly Media, Inc.

[2] William S Vincent,"Django for Beginners: Build websites with Python and Django", Independently Published, 2018.

[3] Jeff Forcier ; Paul Bissex; Wesley Chun, "Python Web Development with Django", First Edition, Pearson Education; 2009.

### **E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Courseera: Prof. Charles Russell Severance, University of Michigan , Django for Everybody Specialization ,The

<https://www.coursera.org/specializations/django#instructors>

[2] Udemy : Volkan Atış, Python Software Developer and Teacher, Django 3.0 MasterClass - Learn How To Create Django Apps

<https://www.udemy.com/course/django-30-masterclass-learn-how-to-create-django-apps/#instructor-1>

# **SEMESTER VII**

## 20AI&DSH7801B

### FRAMEWORK AND MICROSERVICES

<b>Course Category:</b>	HONOR	<b>Credits:</b>	4
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>	20AI&DS4303: Advanced Java Programming 20ES2103C: Programming Essentials in Python 20AI&DSH4801B: Frontend Technologies 20AI&DSH6801B: Backend Technologies	<b>Continuous Evaluation:</b> <b>Semester end Evaluation:</b> <b>Total Marks:</b>	30 70 100

COURSE OUTCOMES		BTL	POI
<b>Upon successful completion of the course, the student will be able to:</b>			
<b>CO1</b>	<i>Understand</i> the Microsoft .NET Framework Architecture and Fundamentals of C#.	K2	1.7.1,2.5.1, 2.5.2,3.5.1
<b>CO2</b>	<i>Apply</i> an OOP principles and ASP.NET to create dynamic web applications.	K3	1.7.1,2.5.1,2.5.2, 2.6.3,2.7.1,3.5.1,
<b>CO3</b>	<i>Apply</i> ASP.NET Core Razor pages to create a web application.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4 3.5.1,
<b>CO4</b>	<i>Apply</i> .NET Core to create microservices.	K3	1.7.1,2.5.1, 2.5.2,2.6.3,2.6.4, 3.5.1,

#### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	2	2	3											
<b>CO2</b>	2	2	3										2	2
<b>CO3</b>	2	2	2										2	2
<b>CO4</b>		2	3										2	2

## Course Content

### UNIT I

**Understanding .NET 6 Framework and Introducing C#:** Introduction, .NET Framework Architecture, Components of Framework, CTS, The Common Language Runtime, The Common Language Specification, The Common Type System, Object orientation, Type Safety, Memory management, Platform support, A brief history of C#.

**C# Language Basics:** A First C# Program, Syntax, Type basics, Numeric Types, Boolean type and operators, Strings and Characters, Arrays, Variables and Parameters, Expressions and Operators, Null operators, Statements, Namespaces.

### UNIT II

**Creating Types in C#:** Classes, Inheritance, The object type, Structs, Access modifiers, Interfaces, Enums, Nested types, Generics.

**Introduction to ASP.NET:** ASP.NET Basics, ASP.NET Page Structure, Page Life Cycle. Controls: HTML Server Controls, Web Server Controls, Web User Controls, Validation Controls, Custom Web Controls.

### UNIT III

**Building Websites using ASP.NET Core:** New features in ASP.NET Core, Understanding web development, Understanding HTTP, Using Google Chrome to make HTTP requests,

**Understanding ASP.NET Core:** Classic ASP.NET versus modern ASP.NET Core, Creating an empty ASP.NET Core project, Testing and securing the website, Controlling the hosting environment, Separating configuration for services and pipeline, Enabling a website to serve static content

### UNIT IV

**Working with Data Using Entity Framework Core:** Understanding modern databases, Understanding Entity Framework Core, Creating a console app for working with EF Core, Using a sample relational database, Using Microsoft SQL Server for Windows, Setting up EF Core, Defining EF Core Models, Querying EF Core models, Loading patterns with EF Core, Manipulating data

with EF Core, Using Entity Framework Core with ASP.NET Core

**Designing a Web API:** Difficulty with Traditional services, Building a Web API services with ASP.NET Core, Designing a RESTful Interface, REST at a glance, REST in ASP.NET Core.

## TEXT BOOKS

- [1] Joseph Albahari, "C# 10 in a Nut Shell", Oreilly Publications. Nov 2021.
- [2] Mark J. Price, "C# 10 and .NET 6 – Modern Cross-Platform Development - Sixth Edition", Oreilly Publications. Nov 2021.
- [3] Dino Esposito, "Programming ASP.NET Core", Microsoft, PHI Publications, 2019

## REFERENCE BOOKS

- [1] Kemal Birer, "ASP.NET Core for Jobseekers" bpb publications 2021.
- [2] Andreas Helland, "ASP.NET Core 5 for Beginners", Packt, 2021.
- [3] Kogent Learning Solutions, "ASP.NET 4.5 PROGRAMMING", Black Book, Dreamtech Press, 2016.
- [4] Adam Freeman, "Pro ASP.NET MVC 5", Fifth Edition, APress, 2020

## E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] Scott Hanselman, Maira Wenzel, Modern Web Development with .NET 6  
Ep1: Create a web UI with ASP.NET Core <https://docs.microsoft.com/en-us/shows/learn-live/modern-web-development-net6-ep01-create-web-ui-aspnet-core>
- [2] Rehan Saeed, Upgrading ASP.NET Core to .NET 6 & C# 10,  
<https://techcommunity.microsoft.com/t5/web-development/upgrading-asp-net-core-to-net-6-amp-c-10/m-p/2927530> and  
<https://www.youtube.com/watch?v=T6iP7QPWmPI> (Microsoft) (16-05-2022)
- [3] Cam Sopar, Getting Started with Entity Framework Core,  
<https://docs.microsoft.com/en-us/shows/entity-framework-core-101/getting-started-with-entity-framework-core>
- [4] Kaushik Roy Chowdhury, ASP.NET 6.0 - Build Hands-On Web Projects,  
<https://www.udemy.com/course/aspnetcore-31-build-hands-on-web-projects/>

## 20AI&DSH7801A AI in security applications

<b>Course Category:</b>	HONOR	<b>Credits:</b>	4
<b>Course Type:</b>	Theory	<b>Lecture -Tutorial-Practice:</b>	3-1-0
<b>Prerequisites:</b>		<b>Continuous Evaluation:</b>	30
		<b>Semester end Evaluation:</b>	70
		<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>	<b>BTL</b>	<b>POI</b>
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**Upon successful completion of the course, the student will be able to:**

<b>CO1</b>	To know the different AI techniques and their applications to computer security.		
<b>CO2</b>	To analyze the applicability of AI strategies for different security problems.		
<b>CO3</b>	To use intelligent algorithms for improving software security.		
<b>CO4</b>	To apply AI tools for automatic intrusion detection		

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>CO1</b>														
<b>CO2</b>														
<b>CO3</b>														
<b>CO4</b>														

## **Course Content**

### **UNIT I**

Introduction: Role of AI in Cyber Security and Security Framework: Artificial Intelligence in Cyber Security, Challenges and Promises, Security Threats of Artificial Intelligence

Use-Cases: Artificial Intelligence Email Observing, Programming in Python and Basics of manipulation of Data.

### **UNIT II**

Machine Learning in Security: Introduction to Machine Learning, Applications of Machine Learning in Cyber Security Domain, Machine Learning: tasks and Approaches, Anomaly Detection, Privacy Preserving Nearest Neighbour Search, Machine Learning Applied to Intrusion Detection, Online Learning Methods for Detecting Malicious Executables

### **UNIT III**

Deep Learning in Security: Introduction to deep learning, Cyber Security Mechanisms Using Deep Learning Algorithms, Applying deep learning in various use cases, Network Cyber threat Detection

### **UNIT IV**

Artificial Intelligence in Cyber Security: Model Stealing & Watermarking, Network Traffic Analysis, Malware Analysis

## **TEXT BOOKS**

Tsai, Jeffrey JP, and S. Yu Philip, eds. Machine learning in cyber trust: security, privacy, and reliability. Springer Science & Business Media, 2009.

## **REFERENCE BOOKS**

[1] Gupta, Brij B., and Quan Z. Sheng, eds. Machine learning for computer and cyber security: principle, algorithms, and practices. CRC Press, 2019

[2] Artificial Intelligence and Data Mining Approaches in Security Frameworks

Editor(s):Neeraj Bhargava, Ritu Bhargava, Pramod Singh Rathore, Rashmi Agrawal, 2021.

## **E-RESOURCES AND OTHER DIGITAL MATERIAL**