Department of Artificial Intelligence and Data Science

Minutes of 4th BOS Meeting

GD Hall, Training and Placement Cell
Sri Manakula Vinayagar Engineering College

8th March 2022 & 2:00 P.M

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution &
Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Artificial Intelligence and Data Science
Minutes of 4th Board of Studies

The Fourth Board of Studies meeting for Department of Artificial Intelligence and Data Science was held on 8th March 2022 at 2:00 P.M in the GD Hall, Training and Placement Cell, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS
1	**Dr. J. Madhusudanan,** Professor and Head, Department of AI&DS, SMVEC.	Chairman
2	**Dr. M. Thangaraj,** Professor & Head, Madurai Kamaraj University, Madurai.	Subject Expert (Academic Council Nominee)
3	**Dr. Chandra Mouli P.V.S.S.R,** Associate Professor & Head Central University of Tamil Nadu, Tiruvarur, Tamil Nadu.	Subject Expert (Academic Council Nominee)
4	**Dr. C. Muthu,** Professor & Head, Loyola College, Chennai.	Subject Expert (University Nominee)
5	**Dr. Mohanraj Vengadachalam,** Machine Learning Lead, Standard Chartered GBS, Chennai.	Representative from Industry
6	**Dr. J. Uthayakumar,** Research Head, Genesys Academy, Puducherry.	Postgraduate Alumnus (nominated by the Principal)
7	**Dr. M.Auxilia** Associate Professor, Department of AI&DS, SMVEC	Internal Member
8	**Mr. K.Pragash** Assistant Professor, Department of AI&DS, SMVEC	Internal Member

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9	**Mr. R.Rajan** Assistant Professor, Department of AI&DS, SMVEC	Internal Member
10	**Prof. M. Ganesan** Assistant Professor, Department of CSE, SMVEC	Internal Member
11	**Prof. M. Shanmugam** Assistant Professor, Department of CSE, SMVEC	Internal Member
12	**Dr. T. Gayathri** Professor, Department of Maths, SMVEC	Internal Member
13	**Dr. R. Sivakumar** Associate Professor, Dept. of MBA, SMVEC	Internal Member
14	**Ms. K. Gajalakshmi** Assistant Professor, Dept. of English, SMVEC	Internal Member

Agenda of the Meeting

1. Review of third BoS
2. Approval of profession electives for semester V and VI
3. Approval of syllabi for semester VII
4. Any other suggestions from the BoS Members

Minutes of the Meeting

Dr. J. Madhusudanan, Chairman, BoS opened the meeting by welcoming and introducing the external members, to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

BOS/2022/AIDS/UG/4.1	Discussed and approved the third BoS
BOS/2022/AIDS/UG/4.2	Professional Elective Syllabi from V to VI semesters for the B.Tech – Artificial Intelligence and Data Science have been approved with the following suggestions.

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Sl.No	Regulation	Semester	Subject Name with Code	Unit	Particulars
1	R-2020	V	Business Intelligence U20ADE506	IV	Suggested to consider overlapping of ML in this unit and include necessary topics (Annexure-1)
2	R-2020	V	Java Programming U20ADE507	IV & V	Suggested to remove applets from unit IV and add Java Beans for improved user Design, and also to change the unit V heading as Database Connectivity (Annexure-1)
3	R-2020	V	R Programming U20ADE508	III	Suggested to combine some topics in two units as one unit and also add a new unit as data Visualization and also suggested to change the heading as Lists and Data frames (Annexure-1)
4	R-2020	V	Data Mining and Warehousing (U20ADE509)	All Units	Suggested to remove this subject as it is replaced by data science and include

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					any new elective based on advance concepts and we requested them that the subject will be added and be approved in the next BoS meeting. (Next BoS)
5	R-2020	V	User Interface and User Experience (UI/UX) U20ADE510	Unit V	Suggested to add mean/ full stack in any of the unit (Annexure1)
6	R-2020	VI	C# and .NET Framework U20ADE611	All Units	Suggested to remove this subject and include any new elective based on advance concepts and we requested them that the subject will be added and be approved in the next BoS meeting. (Next BoS)
7	R-2020	VI	Automation Testing Using Selenium U20ADE612	-	New edition text books can be added. (Annexure1)
8	R-2020	VI	Cloud Computing U20ADE613	-	New edition text books can be added. (Annexure1)

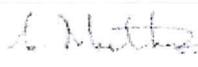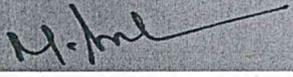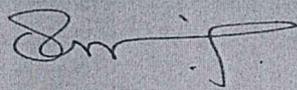| SI.No	Regulation	Semester	Subject Name with Code	Unit	Particulars
9	R-2020	VI	Web Analytics U20ADE614	-	Suggested to add new edition text books contents. (Annexure1)
10	R-2020	VI	Mobile Application Development U20ADE615	Unit IV	Suggested to add iOS on Unit IV and add latest text books. (Annexure1)

BOS/2022/AIDS/UG/4.3	Discussed about the core papers of semester VII and got approval with the following suggestions

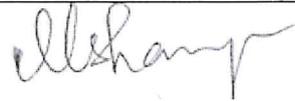| SI.No	Regulation	Semester	Subject Name with Code	Unit	Particulars
1	R-2020	VII	Robotic and Automation U20ADT715	-	Latest edition text books can be included (Annexure1)
2	R-2020	VII	IoT Systems and Analytics U20ADT716	-	Approved with no changes (Annexure1)
3	R-2020	VII	IoT Systems and Analytics Laboratory U20ADP714	-	Approved with no changes (Annexure1)
4	R-2020	VII	Robotic and Automation Laboratory U20ADP715	-	Approved with no changes (Annexure-1)

BOS/2022/AIDS/UG/4.4	Discussed and approved the Certification Course for the III semester as Java Programming under Regulation 2020 for the B.Tech students admitted in the Academic Year 2020-21 (Second Year)

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BOS/2022/AIDS/UG/4.5	Got suggestions from the BoS Members to include advanced concepts in Deep Learning, AWS, Stream Analytics, Reinforcement Learning, Health Analytics, Financial Analytics, Graphical Neural networks, Text Annotations, Video Annotations as the VII and VIII semester Professional Elective papers.

The meeting was concluded at 3.45 PM with vote of thanks by **Dr. J. Madhusudanan**, Head of Department, Artificial Intelligence and Data Science.

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1	**Dr. J. Madhusudanan,** Professor and Head, Department of AI&DS, SMVEC.	Chairman	
2	**Dr. M. Thangaraj,** Professor & Head, Madurai Kamaraj University, Madurai.	Subject Expert	
3	**Dr. Chandra Mouli P.V.S.S.R,** Associate Professor & Head Central University of Tamil Nadu, Tiruvarur, Tamil Nadu.	Subject Expert	
4	**Dr. C. Muthu,** Professor & Head, Loyola College, Chennai.	Subject Expert	
5	**Dr. Mohanraj Vengadachalam,** Machine Learning Lead, Standard Chartered GBS, Chennai.	Industrial Expert	
6	**Dr. J. Uthayakumar,** Research Head, Genesys Academy, Puducherry.	Member	
7	**Dr. M. Auxilia** Associate Professor, Department of AI&DS, SMVEC	Internal Member	
8	**Mr. K. Pragash** Assistant Professor, Department of AI&DS, SMVEC	Internal Member	
9	**Mr.R.Rajan** Assistant Professor, Department of AI&DS, SMVEC	Internal Member	
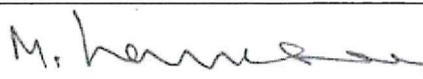
10	**Prof. M. Ganesan** Assistant Professor, Department of CSE, SMVEC	Internal Member	
11	**Prof. M. Shanmugam** Assistant Professor, Department of CSE, SMVEC	Internal Member	
12	**Dr. T. Gayathri** Professor, Department of Maths, SMVEC	Internal Member	
13	**Dr. R. Sivakumar** Associate Professor, Dept. of MBA, SMVEC	Internal Member	
14	**Ms. Gajalakshmi** Assistant Professor, Dept. of English, SMVEC	Internal Member	

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Annexure – I

(Revised V and VI Semester Professional Elective Curriculum

&

Core Papers of VII Semester)

SEMESTER – V		
Sl. No.	**Course Code**	**Course Title**
Professional Elective – II (Offered in Semester V)		
1	U20ADE506	Business Intelligence
2	U20ADE507	Java Programming
3	U20ADE508	R Programming
4	U20ADE509	New Paper1
5	U20ADE510	User Interface and User Experience (UI/UX)
Professional Elective – II (Offered in Semester VI)		
1	U20ADE611	New Paper2
2	U20ADE612	Automation Testing Using Selenium
3	U20ADE613	Cloud Computing
4	U20ADE614	Web Analytics
5	U20ADE615	Mobile Application Development

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SEMESTER – VII		
Sl. No.	Course Code	Course Title
Theory		
1	U20ADT715	Robotic and Automation
2	U20ADT716	IoT Systems and Analytics
Practical		
6	U20ADP714	IoT Systems and Analytics Laboratory
7	U20ADP715	Robotic and Automation Laboratory

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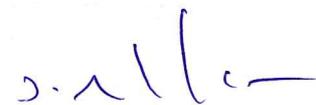
U20ADE506	BUSINESS INTELLIGENCE	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand principles of Business intelligence at conceptual level.
- To gain the knowledge of data integration and data modelling.
- To develop skills for data mining using various mining techniques.
- To understand application areas for implementing Business intelligence.
- To develop skills to design BI projects using data mining and data warehousing concepts

Course Outcomes
After completion of the course, the students will be able to
CO1 - Understand the Business intelligence framework and responsibilities **(K2)**
CO2 - Design the ETL process for handling the data from a given source **(K3)**
CO3 - Design a star / snowflake schema for a given problem. **(K3)**
CO4 - Ability to illustrate the data mining concepts with suitable examples. **(K3)**
CO5 - Ability to apply classification and prediction concepts to various applications **(K2)**

UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE (9 Hrs)
BI Definitions &Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business, Applications of BI, BI best practices

UNIT II BASICS OF DATA INTEGRATION (9 Hrs)
Concepts of data integration, Needs and advantages of using data integration, introduction to common data integration approaches,Meta data - types and sources, Introduction to data quality, data profiling concepts and applications, Introduction to ETL using Pentaho data Integration (formerly Kettle).

UNIT III INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING (9 Hrs)
Data Modelling Introduction to data and dimension modelling, multidimensional data model, ER Modelling vs. multi-dimensional modelling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, Introduction to business metrics and KPIs, Creating cubes using Microsoft Excel.

## UNIT IV WORKING WITH BI TOOLS (9 Hrs)
Overview of managerial, strategic and technical issues associated with Business Intelligence and Data Warehouse design, implementation, and utilization. Critical issues in planning, physical design process, deployment and ongoing maintenance. Dash Boards and Scorecards Creation.

UNIT V FUTURE OF BUSINESS INTELLIGENCE (9 Hrs)
Emerging Technologies, Machine Learning, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

Text Books
1. R N Prasad, Seema Acharya: Fundamentals of Business Analytics, Wiley India, Second Edition, 2016.
2. David Loshin: Business Intelligence: The Savvy Manager's Guide., Latest Edition By Knowledge Enterprise,2018.
3. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2018.
4. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2019.
5. Grossmann W, Rinderle-Fundamental of Business Intelligence 1th Edition, Springer, 2017

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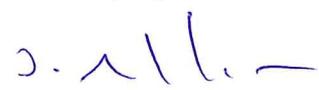
Reference Books

1. J.Han and M. Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition, 2016
2. Larissa Terpeluk Moss, ShakuAtre, "Business Intelligence roadmap", Addison Weseley.2018
3. CindiHowson, "Successful Business Intelligence: Secrets to making Killer BI Application", Tata McGraw Hill, 2018
4. Mike Biere, "Business intelligence for the enterprise", Addison Weseley, Ausgust 2017
5. Dorian Pyle, "Business Modeling and Data Mining", Elsevier Publication, 2016

Web Resources

1. https://www.investopedia.com/terms/b/business-intelligence-bi.asp
2. https://www.cio.com/article/272364/business-intelligence-definition-and-solutions.html
3. https://www.javatpoint.com/power-bi

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	1	2	2	-	-	-	-	-	-	-	2	1	1
2	3	2	1	1	2	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	2	-	-	-	-	-	-	-	2	1	1
4	3	2	1	1	2	-	-	-	-	-	-	-	2	1	1
5	3	2	1	1	2	-	-	-	-	-	-	-	2	1	1

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U20ADE507	JAVA PROGRAMMING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To learn about the fundamentals of Java language constructs
- To familiarize the student with inheritance, interface ad Packages
- To expose the student to create exceptions and understand multithreading
- To design and build simple Graphical User Interfaces
- To develop web applications with Java

Course Outcomes
After completion of the course, the students will be able to
CO1 - Create and use Java Objects for applications related to object-oriented concepts. **(K2)**
CO2 - Familiarize with inheritance, interface ad Packages **(K2)**
CO3 - Create exceptions and understand multithreading. **(K2 & K3)**
CO4 - Design and build simple Graphical User Interfaces **(K3)**
CO5 - Develop web applications with Java **(K2)**

UNIT I JAVA FUNDAMENTALS   (9 Hrs)
Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays

UNIT II INHERITANCE AND INTERFACES   (9 Hrs)
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, ArrayLists – Strings, Packages - JavaDoc comments.

UNIT III EXCEPTION HANDLING AND MULTITHREADING   (9 Hrs)
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups.

UNIT IV EVENT PROGRAMMING   (9 Hrs)
Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

UNIT V STREAMS AND DATABASE CONNECTIVITY   (9 Hrs)
Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files, JDBC, RMI, Sample web applications.

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Text Books

1. Y. Daniel Liang, "Introduction to Java Programming and Data Structures, Comprehensive Version", 11th Edition, Pearson Education, 2018.
2. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw-Hill Education,2018.
3. Sachin Malhotra, Sourabh Choudhary, "Programming in Java", Revised 2nd Edition, Oxford University Press, 2018
4. Cay S. Horstmann, "Core Java - Vol. 1, Fundamentals", 11th Edition, Pearson Education, 2018
5. Nathan Clark, "Java: Programming Basics for Absolute Beginners (Step-By-Step Java)",2017

Reference Books

1. Paul Dietel and Harvey Deitel, "Java - How to Program Early Objects", 11th Edition, Pearson Education, 2017.
2. Bruce Eckel, Thinking in Java 4th Edition, 2019
3. Joshua Bloch, "Effective Java", 2017
4. Kathy Sierra, Bert Bates, Elisabeth Robson,"OCA Java SE 8 Programmer I Certification (exam number 1Z0-808)", Tata Mc Graw Hill, 2014
5. Timothy Budd, ―Understanding Object-oriented programming with Javall, Updated Edition, Pearson Education, 2016

Web Resources

1. https://www.geeksforgeeks.org/java/
2. https://www.tutorialspoint.com/java/index.htm /
3. https://www.w3schools.com/java/java_intro.asp

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	3	3	-	-	-	-	-	-	-	2	2	2
2	2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
3	2	3	3	2	2	-	-	-	-	-	-	-	2	2	2
4	2	2	3	2	3	-	-	-	-	-	-	-	2	3	2
5	3	2	2	3	3	-	-	-	-	-	-	-	2	2	2

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U20ADE508	R PROGRAMMING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand and able to use fundamental concepts to solve the real-world problem using R programming language
- To design and implement the solution using scalar, vectors, matrices and statistical problems in R program
- To design and implement the program using data frame, list to provide the solution for various problem
- To study about factors and tables and to solve statistical problems
- To study about Minimize and maximize functions, simulation and visualization and statistical analysis using R

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

CO1 - Study and use basic fundamental concepts to solve the real-world problem using R programming language **(K2)**

CO2 - Design and implement the solution using scalar, vectors, matrices and statistical problems in R program. **(K2)**

CO3 - Design and implement the program using data frame, list to provide the solution for various problem. **(K2)**

CO4 - Study about factors and tables and to solve statistical problems **(K3)**

CO5 - Study Minimize and maximize functions, simulation and visualization and statistical analysis using R. **(K2)**

UNIT I INTRODUCTION (9 Hrs)
Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

UNIT II CONTROL STRUCTURES AND VECTORS (9 Hrs)
Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations.

UNIT III LISTS AND DATA FRAMES (9 Hrs)
Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

UNIT IV FACTORS AND TABLES AND OBJECT-ORIENTED PROGRAMMING (9 Hrs)
UNIT V DATA VISUALIZATION USING R (9 Hrs)
Introduction, Types of Data Visualization, Statistical graphs: Scatter Plots, Box Plots, Scatter Plots and Box and Histograms, Advanced Visualization: Using the ggplot2 package to visualize data, Applying themes from ggthemes to refine and customize charts and graphs, Building data graphics for dynamic reporting, advantages, disadvantages.

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Text Books

1. Wickham, H. & Grolemund, G, "R for Data Science. O'Reilly: New York.,2018
2. ggplot2, Elegant Graphics for Data Analysis (2nd Edition), by Hadley Wickham, Springer, (2016);
3. R for Data Science, Import, Tidy, Transform, Visualize and Model Data, (1st Edition) by Hadely Wickham and Garrett Grolemund, O'Reilly (2016).
4. Geocomputation with R by Robin Lovelace, Jakub Nowosad, Jannes Muenchow (2019).
5. Spatial Data Science with R by Robert J. Hijmans (2019).
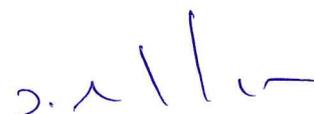
Reference Books

1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations",2018
2. Venables , W.N.,and Ripley,"S programming", Springer, 2019.
3. Roger D. Peng," R Programming for Data Science ", 2016
4. Norman Matloff, "The Art of R Programming- A Tour of Statistical Software Design", 2018
5. Jd long, Paul Teetor, "R Cookbook 2e: Proven Recipes for Data Analysis, Statistics, and Graphics", O'Reilly, 2019

Web Resources

4. https://www.r-project.org/about.html
5. https://www.tutorialspoint.com/r/index.htm
6. https://www.javatpoint.com/r-tutorial

COs/POs/PSOs Mapping

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2	2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
3	2	3	3	2	2	-	-	-	-	-	-	-	2	2	2
4	2	2	3	2	3	-	-	-	-	-	-	-	2	3	2
5	3	2	2	3	3	-	-	-	-	-	-	-	2	2	2

B.Tech. – Artificial Intelligence and Data Science

U20ADE510	USER INTERFACE AND USER EXPERIENCE (UI/UX)	L	T	P	C	Hrs
		3	0	0	3	45

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- To understand principles of Business intelligence at conceptual level.
- To gain the knowledge of data integration and data modelling.
- To develop skills for data mining using various mining techniques.
- To understand application areas for implementing Business intelligence.
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After completion of the course, the students will be able to
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CO3 - Design a star / snowflake schema for a given problem. **(K3)**
CO4 - Ability to illustrate the data mining concepts with suitable examples. **(K3)**
CO5 - Ability to apply classification and prediction concepts to various applications **(K2)**

UNIT I INTRODUCTION TO UI   (9 Hrs)
What is User Interface Design (UI) -The Relationship Between UI and UX , Roles in UI/UX, A Brief Historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content

UNIT II ELEMENTS IN UI   (9 Hrs)
Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual Communication design component in Interface Design

UNIT III INTRODUCTION TO UX   (9 Hrs)
UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience Elements of user Experience, Visual Design Principles

UNIT IV LAYOUT AND DESIGN   (9 Hrs)
Functional Layout, Interaction design, Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design

UNIT V UI/ UX DESIGN TOOLS   (9 Hrs)
User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wire framing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design

Text Books
1. Russ Unger and Carolyn Chandler ."A Project Guide to UX Design: For user experience designers in the field or in the making" (2nd. Ed). New Riders Publishing, USA, 2012.
2. Jesse James Garrett,"The Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition, Pearson Education. 2011.
3. Wilbert O. Galitz ,"The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques", Third Edition, Wiley Publishing, 2007.
4. Don Norman ,"The Design of Everyday Things: Revised and Expanded", Edition 2016
5. Emrah Yayici , UX Design and Usability Mentor Book: With Best Practice Business Analysis and User Interface Design Tips and Techniques ,2017

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Reference Books

1. Rex Hartson and Pardha S. Pyla ,"The UX Book Process and Guidelines for Ensuring a Quality User Experience", Elsevier, 2018
2. Jesse James Garrett ,"The Elements of User Experience: User-Centered Design for the Web", 2018
3. *Travis Lowdermilk,*"User-Centered Design: A Developer's Guide to Building User-Friendly Applications", 2017
4. *Jaime Levy ,*"UX Strategy: How to Devise Innovative Digital Products that People",2017
5. Jeff Johnson, "Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines", Prentice Hall, India, 2017

Web Resources

1. https://www.usertesting.com/blog/ui-vs-ux
2. https://www.interaction-design.org/literature/topics/ui-design
3. https://www.usertesting.com/blog/what-is-ux-design-15-user-experience-experts-weigh-in

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
2	2	3	3	2	2	-	-	-	-	-	-	-	2	2	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	2	2
4	2	2	3	2	2	-	-	-	-	-	-	-	2	2	2
5	3	2	3	2	3	-	-	-	-	-	-	-	2	2	3

B.Tech. – Artificial Intelligence and Data Science

U20ADE612	AUTOMATION TESTING USING SELENIUM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To gain insight into test automation
- To learn tools for web testing
- To learn web driver scripting
- To handle exceptions in test automation
- To understand the procedure of automating software tests

Course Outcomes
After completion of the course, the students will be able to
CO1 - Conduct automated software testing. **(K2)**
CO2 - Test a web application using Selenium. **(K3)**
CO3 - Test a web application using Twil. **(K3)**
CO4 - Understand selenium and automation process. **(K3)**
CO5 - Learn testing iOS and Android applications. **(K2)**

UNIT I INTRODUCTION   **(9 Hrs)**
Automation lifecycle and Automation goals - Test Automation Frameworks – Types – Types of Automation Tools

UNIT II SELENIUM - IDE   **(9 Hrs)**
Selenium IDE – Selenium versions and their capabilities - Selenium Test scripting – Cucumber Behavior Driven Development

UNIT III SELENIUM WEB DRIVER   **(9 Hrs)**
Selenium Web Driver – Web Elements – Interactions and Features of Web Driver – Web Driver Events – Remote Web Driver

UNIT IV SELENIUM 1 (SELENIUM RC) &TEST DESIGN CONSIDERATIONS   **(9 Hrs)**
Functional web testing : using Twill, using Selenium - Testing simple web applications with Twill and Selenium Selenium web driver based test automation frameworks – selenium WebDriver scripting Test NG scripting – Test Automation Results Management – Selenium Exceptions Guide

UNIT V Z SELENIUM-GRID   **(9 Hrs)**
Selenium Grid - Selenium IDE Selenium IDE scripting – Advanced Selenium IDE -Selenium Web Driver Page Object Model – Selenium Automation Framework in Agile Projects Testing iOS and Android Apps

Text Books
1. Sandeep Desai & Abhishek Srivatsava, "Software Testing : A Practical Approach", PHI Learning Pvt. Ltd, 2016, Second Edition
2. Satya Avasarala, "Selenium WebDriver Practical Guide", Packt Publishing Ltd, 2017
3. Narayanan Palani, "Software Automation Testing Secrets Revealed" Revised Edition Part 1, Educreation Publishing, 2017 Edition.
4. Daniel J. Mosley and Bruce A. Posey ,"The Just Enough Software Test Automation" ,2018
5. Mark Fewster and Dorothy Graham, "Software Test Automation: Effective Use of Test Execution Tools", June 2018

B.Tech. – Artificial Intelligence and Data Science
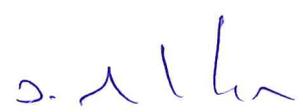
Reference Books

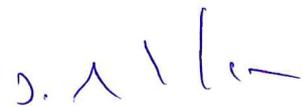1. Experiences of Test Automation: Case Studies of Software Test Automation by Dorothy Graham and Mark Fewster,2017
2. Titus Brown C., Gheorghe Gheorghiu, Jason Huggins, "An Introduction to Testing Web Applications with twill and Selenium", O'Reilly Media, Inc., 2017
3. Ashish Bhargava, Designing and Implementing Test Automation Frameworks with QTP, Packt Publishing Ltd, 2018
4. Complete Guide to Test Automation: Techniques, Practices, and Patterns for Building and Maintaining Effective Software Projects 1st ed. Edition,2016
5. Narayanan Palani, "Selenium Webdriver: Software Automation Testing Secrets Revealed", Part 2, Educreation Publishing, 2016 Edition.

Web Resources

1. https://www.browserstack.com/guide/login-automation-using-selenium-webdriver
2. https://www.simplilearn.com/tutorials/selenium-tutorial/selenium-automation-testing
3. https://www.guru99.com/introduction-to-selenium.html

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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2	2	2	3	2	3	-	-	-	-	-	-	-	2	2	2
3	3	2	3	2	3	-	-	-	-	-	-	-	2	2	2
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	2	3	2	3	-	-	-	-	-	-	-	2	2	3

B.Tech. – Artificial Intelligence and Data Science

U20ADE613	CLOUD COMPUTING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn the concepts of cloud computing
- To provide an in-depth knowledge of the cloud computing fundamentals, technologies, applications, and implementations.
- To expose the students to the cloud working methodology through virtualization, and networking techniques including SDN and NFV.
- To motivate students to do programming and experiment with the various cloud computing environments and platforms
- To appreciate the emergence of the next generation computing paradigm based on cloud.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Articulate the main concepts, key technologies, strengths, and limitations of cloud computing. **(K2)**

CO2 - Learn the key and enabling technologies that help in the development of cloud. **(K3)**

CO3 - Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models. **(K4)**

CO4 – understand Cloud management. **(K2)**

CO5 - Install and use current cloud technologies and establish their own cloud environment using OpenStack and work on it. **(K3)**

UNIT I INTRODUCTION TO CLOUD COMPUTING (9 Hrs)

Introduction to Cloud Computing- Roots of Cloud Computing -; System Models for Distributed and Cloud Computing-Layers and Types of Clouds -Desired Features of a Cloud -Cloud Infrastructure Management Infrastructure as a Service Providers -Platform as a Service Providers -Challenges and Risks-Architectural Design of Compute and Storage Clouds

UNIT II VIRTUALIZATION (9 Hrs)

Implementation Levels of Virtualization -Virtualization Structures and Mechanisms – Full Virtualization, ParaVirtualization and Hardware-assisted Virtualization -Virtualization of CPU, Memory and I/O Devices-Understanding Hypervisors

UNIT III CLOUD STORAGE AND CONTAINERS (9 Hrs)

Introduction to Cloud Storage, Definition, Provisioning -Unmanaged and Managed cloud storage Creating cloud storage systems --Cloud Backup types, Features -Cloud attached backup -Cloud Storage Interoperability, CDMI, OCCI-Introduction to containers -Overview of Dockers

UNIT IV CLOUD MANAGEMENT (9 Hrs)

Administrating the Clouds – Management Responsibilities & lifecycle Management-Distributed Management of Virtual Infrastructures -SLA – An Inspiration-Traditional Approaches to SLO Management -Types of SLA -Life Cycle of SLA -SLA Management in Cloud -Automated Policy-based Management -Cloud Management Standards

UNIT V CASE STUDY: CLOUD PLATFORMS IN INDUSTRY (9 Hrs)

Parallel Programming Paradigm -Apache Hadoop and Map-Reduce -MapReduce Programming Model -Major MapReduce Implementations for the Cloud -Public Cloud Platforms: GAE, AWS, and Azure-Programming Google App Engine-Programming on EC2, S3 -Best Practices in Architecting Cloud Applications in the AWS Cloud

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B.Tech. – Artificial Intelligence and Data Science

Text Books

1. Lizhe Wang, Rajiv Ranjan, Jinjun Chen, Boualem Benatallah, "Cloud Computing', O'Reilly, CRC Press,2017
2. Kai Hwang, Geoffrey C Fox and Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2018.
3. Buyya R., Broberg J. and Goscinski A., "Cloud Computing: Principles and Paradigm", First Edition, John Wiley & Sons, 2017.
4. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Securityll, CRC Press, 2017.
5. Douglas Comer, "The Cloud Computing Book "The Future of Computing Explained", Taylor & Francis Group, 2021

Reference Books

1. Stephen Baron, "Complete Beginners Guide to Mastering AWS", Amazon,2019
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi,"Mastering the Cloud Computing", Morgan Kaufmann,2018
3. Barrie Sosinky,"Cloud Computing Bible", Wiley Publishing Inc,2017
4. Tobe Velte, Anthony Velte, Robert C. Elsenpeter,"Cloud Computing, A Practical Approach (NETWORKING & COMM - OMG)", McGraw Hill Companies, 2019
5. Sanjoy Das, Ram Shringar Rao, Indrani Das, Vishal Jain, Nanhay Singh, "Cloud Computing Enabled Big-Data Analytics in Wireless Ad-hoc Networks", Taylor & Francis Group, 2022

Web Resources

1. https://www.javatpoint.com/cloud-computing-tutorial
2. https://www.javatpoint.com/cloud-computing-tutorial
3. https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	3	3	-	-	-	-	-	-	-	2	2	2
2	2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
3	2	3	3	2	2	-	-	-	-	-	-	-	2	2	2
4	2	2	3	2	3	-	-	-	-	-	-	-	2	3	1
5	3	2	2	3	3	-	-	-	-	-	-	-	2	2	2

B.Tech. – Artificial Intelligence and Data Science

U20ADE614	WEB ANALYTICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To covers fundamental concepts of web analytics and dives deep into web, social and content and   analytics.
- To use popular web analytics tools used by marketers across the major industry domains.
- To enables web analytics from a strategic and practical perspective, showcasing techniques for using Google Web analytics and other platforms and tools.
- To gain good knowledge in web and digital analytics.
- To Students understand the knowledge of Google analytics to emerging techniques concepts

Course Outcomes

After completion of the course, the students will be able to

CO1 – Demonstrate the fundamental concepts of web analytics. **(K2)**
CO2 – Illustrate various competitive intelligence analysis in web analytics. **(K2)**
CO3 – Analyze and Examine Social, Mobile and Video Emerging Analytics **(K3)**
CO4 – Examine working of Google Analytics and creating an Implementation Plan. **(K3)**
CO5 – Develop Google Analytics Accounts and Profiles. **(K3)**

UNIT I THE BOLD NEW WORLD OF WEB ANALYTICS 2.0 (9 Hrs)

State of the Analytics Union, State of the Industry, Rethinking Web Analytics: Meet Web Analytics2.0 The Awesome World of Clickstream Analysis: Metrics, Eight Critical Web Metrics: Visits and Visitors, Time on Page and Time on site, Bounce Rate, Exit Rate, Conversion rate, Engagement, Web Metrics Demystified, Strategically-aligned Tactics for Impactful Web Metrics

UNIT II COMPETITIVE INTELLIGENCE ANALYSIS (9 Hrs)

CI Data Sources: Toolbar Data, Panel Data, ISP (Network) Data, Search Types and Secrets, Website Traffic Analysis: Comparing Long Term Traffic Trends, Analyzing Competitive Sites Overlap and Opportunities, Analyzing Referrals and Destinations, Search and Keyword Analysis: Top Keywords Performance Trend, Geographic Interest and Opportunity Analysis, Related and Fast Rising searches, Share-of Shelf Analysis, Competitive Keyword Advantage Analysis, Keyword Expansion Analysis.

UNIT III EMERGING ANALYTICS: SOCIAL, MOBILE AND VIDEO (9 Hrs)

Measuring the New Social Web: The Data Challenge, The Content Democracy Evaluation, The Twitter Revolution, Analyzing mobile customer Experience: Mobile Data Collection, Mobile Reporting and Analysis, Measuring the success of Blogs: Raw Author Contribution, Holistic Audience growth, Citations and Ripple Index, Cost of Blogging, Benefit (ROI) from Blogging, Quantifying the Impact of Twitter: Growth in Number of Followers, Message Amplification, Click-Through Rates and Conversions, Conversation Rate, Emerging Twitter Metrics, Analyzing Performance of Videos: Data Collection for Videos, Key Video Metrics and Analysis

UNIT IV CASE STUDY: GOOGLE ANALYTICS- PART 1 (9 Hrs)

Defining Web Analytics, What Google Analytics Contributes How Google Analytics Fits in the Analytics Ecosystem, Creating an Implementation Plan: Gather Business Requirements, Analyze and Document Website Architecture, Create an account and configure your profile, Configure the tracking code ad tag pages, Tag Marketing Campaigns, Create Additional User Accounts and Configure Reporting, Perform operational Configuration Steps.

UNIT V   CASE STUDY: GOOGLE ANALYTICS- PART 2   **(9 Hrs)**

Tracking Visitor Clicks, Outbound Links and Non HTML Files, About the Tracking Cookies, Google Analytics Accounts and Profiles, Google Analytics Accounts, Creating a Google Analytics Account: Creating Additional Profiles, Access Levels, All about Profiles: Basic Profile Settings, Profile Name, Website URL, Time Zone, Default Page, Exclude URL Query Parameters, E-commerce settings, Tracking On-site Search, Applying Cost Data.

Text Books
1. Nilanjan Dey, Samarjeet Borah, Rosalina Babo, Amira Ashour, "Social Network Analytics Computational Research Methods and Techniques", 2019.
2. Toshiaki Ejiri (Author), Hiroyuki Kikuchi, Yamato Abe, Keiko Iikawa,"Web Analytics Consultant" Official Textbook 2019 9th Edition
3. Jonathan Weber, "Web Analytics (German Edition)", 2015
4. Matthew Ganis and Avinash Kohirkar,"Social Media Analytics",Pearson 1st Edition September 2016
5. Gerardus, Blokdyk, "Google Analytics Complete Self-Assessment Guide", Wiley Publishing, 2018

Reference Books
1. Noah Gray, Mastering Google AdWords: Step-by-Step Instructions for Advertising Your Business (Including Google Analytics) , 2018
2. Himanshu Sharma, "Attribution Modelling in Google Analytics and Beyond", 2021
3. Mikhail Klassen , Matthew A. Russell, "Mining the Social Web", 3rd Edition, ,O'Reilly Media, Inc,2019
4. Eric Fettman, Shiraz Asif, FerasAlhlou "Google Analytics Breakthrough", John Wiley & sons, 2016
5. Grigor Yovov, "Google Analytics Kickstarter Guide", August 2020

Web Resources
1. https://www.techtarget.com/searchbusinessanalytics/definition/Web-analytics
2. https://www.usability.gov/what-and-why/web-analytics.html
3. https://www.tutorialspoint.com/online_marketing/web_analytics.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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2	2	2	2	-	1	-	-	-	-	-	-	-	2	2	-
3	3	2	2	-	2	-	-	-	-	-	-	-	2	2	1
4	3	2	2	-	2	-	-	-	-	-	-	-	2	2	1
5	3	3	2	-	2	-	-	-	-	-	-	-	2	2	1

B.Tech. – Artificial Intelligence and Data Science

U20ADE615	MOBILE APPLICATION DEVELOPMENT	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in marketplace for distribution

Course Outcomes
After completion of the course, the students will be able to
CO1 - Understand the technologies and business trends impacting mobile applications. **(K2)**
CO2 - Understand and remember the components of android, iOS and Windows mobile applications. **(K2)**
CO3 - Learn the programming languages and techniques for developing mobile applications. **(K3)**
CO4 – Develop mobile applications with compelling user interface and database connectivity for real time applications for iOS and Windows OS. **(K3)**
CO5 - Develop and deploy mobile applications using Silverlight **(K3)**

UNIT I INTRODUCTION (9 Hrs)
Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II BASIC DESIGN (9 Hrs)
Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability

UNIT III ADVANCED DESIGN (9 Hrs)
Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV TECHNOLOGY I – ANDROID (9 Hrs)
Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications

UNIT V TECHNOLOGY II – IOS (9 Hrs)
Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace

Text Books
1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2016
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2018
3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2016
4. Brian Fling," Mobile Design and Development", O'Reilly Media, 2016.
5. Maximiliano Firtman, "Programming the Mobile Web", 2nd ed., O'Reilly Media, 2018

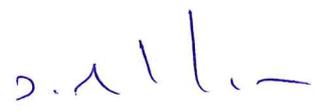B.Tech. – Artificial Intelligence and Data Science

Reference Books

1. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
2. Reto Meier, "Professional Android Application Development", Wrox, 2013.
3. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", Big Nerd Ranch LLC, 3rd edition, 2017
4. Christian Keur and Aaron Hillegass, "iOS Programming: The Big Nerd Ranch Guide", *6th edition*, 2015
5. Valentino Lee, Heather Schneider, and Robbie Schell, "Mobile Applications: Architecture, Design, and Development", Prentice Hall, 2019

Web Resources

1. https://www.techtarget.com/searchapparchitecture/definition/mobile-application-development
2. https://www.ibm.com/cloud/learn/mobile-application-development-explained
3. https://www.openxcell.com/mobile-app-development/

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	2	3	2	3	-	-	-	-	1	1	1	3	3	2
3	3	3	3	2	3	-	-	-	-	1	1	1	2	2	3
4	3	3	3	3	3	-	-	-	-	1	1	1	3	3	3
5	3	2	3	3	3	-	-	-	-	1	1	1	3	3	3

B.Tech. – Artificial Intelligence and Data Science

SI. No.	Course Code	Course Title
SEMESTER – VII		
Theory		
1	U20ADT715	Robotic and Automation
2	U20ADT716	IoT Systems and Analytics
Practical		
6	U20ADP714	IoT Systems and Analytics Laboratory
7	U20ADP715	Robotic and Automation Laboratory

B.Tech. – Artificial Intelligence and Data Science

U20ADT715	ROBOTIC AND AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand the basics of robots
- To understand the basic elements to automate a robot
- To understand concepts in kinematics and dynamics of robotic system.
- To introduce control strategies of simple robotic system.
- To study the applications of computer based control to integrated automation systems.

Course Outcomes
After completion of the course, the students will be able to
CO1 – Understand the basic concept of robotics and automation. **(K2)**
CO2 – Understand the basics of automation. **(K2)**
CO3 – Understand the mechanical requirement for robot **(K3)**
CO4 – Understand the design of control system for robot. **(K3)**
CO5 – Applications of robots in various domains. **(K3)**

UNIT I INTRODUCTION (9 Hrs)
Robot definitions – Laws of robotics – Robot anatomy – History – Human systems and Robotics – Specifications of Robots – Flexible automation versus Robotic technology – Classification applications

UNIT II ROBOTIC SYSTEMS (9 Hrs)
Basic structure of a robot – Robot end effectors – Manipulators – Classification of robots – Accuracy – Resolution and repeatability of a robot – Drives and control systems – Mechanical components of robots – Sensors and vision systems – Transducers and sensors – Tactile sensors – Proximity sensors and range sensors – Vision systems – RTOS – PLCs – Power electronics

UNIT III ROBOT KINEMATICS, DYNAMICS, AND PROGRAMMING (9 Hrs)
Matrix representation – Forward and reverse kinematics of three degree of freedom – Robot Arm – Homogeneous transformations – Inverse kinematics of Robot – Robo Arm dynamics – D-H representation of forward kinematic equations of robots – Trajectory planning and avoidance of obstacles – Path planning – Skew motion – Joint integrated motion – Straight line motion – Robot languages- Computer control and Robot programming/software

UNIT IV CONTROL SYSTEM DESIGN (9 Hrs)
Open loop and feedback control – General approach to control system design – Symbols and drawings – Schematic layout – Travel step diagram, circuit and control modes – Program control – Sequence control – Cascade method – Karnaugh-Veitch mapping – Microcontrollers – Neural network – Artificial Intelligence – Adaptive Control – Hybrid control

UNIT V ROBOT APPLICATIONS (9 Hrs)
Material handling – Machine loading, Assembly, inspection, processing operations and service robots – Mobile Robots – Robot cell layouts – Robot programming languages

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B.Tech. – Artificial Intelligence and Data Science

Text Books

1. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019).
2. S. B. Niku, Introduction to Robotics – Analysis, Contro, Applications, 3rd edition, John 8. Wiley & Sons Ltd., (2020)
3. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, 2016.
4. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and sons, 2018.
5. S. R. Deb and S. Deb, 'Robotics Technology and Flexible Automation', Tata McGraw Hill Education Pvt. Ltd, 2019

Reference Books

1. Saeed B. Niku, 'Introduction to Robotics',Prentice Hall of India, 2016
2. Mikell P. Grooveret. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2018
3. Mary C. Lacity Leslie P. Willcocks, "Robotic Process and Cognitive Automation: The Next Phase",2019
4. Stuart Russell, "Human Compatible: Artificial Intelligence and the Problem of Control", 2020
5. A.K.Guptha, S.K.Arora, J.R.WestCott, "Industrial Automation and Robotics",2020

Web Resources

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.workfusion.com/blog/the-difference-between-robotics-and-automation/
3. https://degreesandcareers.info/stem/what-is-automation-and-robotics-engineering/

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3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	3	-	-	-	-	-	-	-	3	3	3

B.Tech. – Artificial Intelligence and Data Science

U20ADT716	IOT SYSTEMS AND ANALYTICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols.
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT.
- To develop IoT infrastructure for popular applications

Course Outcomes
After completion of the course, the students will be able to
CO1 - Explain the concept of IoT. **(K2)**
CO2 - Analyze various protocols for IoT. **(K2)**
CO3 - Design a PoC of an IoT system using Rasperry Pi/Arduino**(K3)**
CO4 - Apply data analytics and use cloud offerings related to IoT. **(K3)**
CO5 - Analyze applications of IoT in real time scenario**(K4)**

UNIT I FUNDAMENTALS OF IoT   (9 Hrs)
Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack — Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS   (9 Hrs)
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN AND DEVELOPMENT   (9 Hrs)
Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES   (9 Hrs)
Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS s for IoT – System Management with NETCONF-YANG

UNIT V   CASE STUDIES/INDUSTRIAL APPLICATIONS   (9 Hrs)
Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

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B.Tech. – Artificial Intelligence and Data Science

Text Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Jean Philippe Vasseur and Adam Dunkels, "Interconnecting Smart Objects with IP, The Next Internet", Morgan Kaufmann, Elsevier, 2016.
3. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approachll, Universities Press, 2018.
4. Andy King, "Programming the Internet of Things" Oreilly Publications, 2020
5. Rajkumar Buyya, Amir Vahid Dastjerdi "internet of Things: Principles and Paradigms".Morgan Kaufmann,2016

Reference Books

1. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocolsll, Wiley, 2016 (for Unit 2).
2. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2018.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Thingsll, Springer, 2018.
4. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2017
5. Vlasios Tsiatsis, Stamatis Karnouskos "Internet of Things: Technologies and Applications for a New Age of Intelligence",Academic Press,2018

Web Resources

1. https://www.sciencedirect.com/science/article/pii/S1877050916316428
2. https://www.tibco.com/reference-center/what-is-iot-analytics
3. https://mite.ac.in/wp-content/uploads/2021/04/iot_module4.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	2	2	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	3	-	-	-	-	-	-	-	3	3	3

B.Tech. – Artificial Intelligence and Data Science

U20ADP715	**ROBOTIC AND AUTOMATION LABORATORY**	L	T	P	C	Hrs
		0	0	2	2	30

Course Objectives
- To introduce different types of robotics
- To demonstrate robots to identify different parts
- To demonstrate robots to identify different components.
- To write programming for simple operations.
- To simulate multi-processing capability of robots

Course Outcomes
After completion of the course, the students will be able to
CO1 – Understand different types of robots. **(K2)**
CO2 – model robot to identify different parts. **(K2)**
CO3 – Model robot to identify different components **(K3)**
CO4 – Write programming for simple operations. **(K3)**
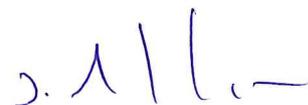CO5 – Simulate multi-processing capability of robots. **(K3**

List of Exercises

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Colour identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

Reference Books
1. Saeed B. Niku, 'Introduction to Robotics',Prentice Hall of India, 2016
2. Mikell P. Grooveret. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2018
3. Mary C. Lacity Leslie P. Willcocks, "Robotic Process and Cognitive Automation: The Next Phase",2019
4. Stuart Russell, "Human Compatible: Artificial Intelligence and the Problem of Control", 2020
5. A.K.Guptha, S.K.Arora, J.R.WestCott, "Industrial Automation and Robotics",2020

Web Resources
1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.workfusion.com/blog/the-difference-between-robotics-and-automation/
3. https://degreesandcareers.info/stem/what-is-automation-and-robotics-engineering/

B.Tech. – Artificial Intelligence and Data Science

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	2	2	2	-	-	-	-	-	-	-	2	3	3
2	2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	3	-	-	-	-	-	-	-	3	3	3

B.Tech. – Artificial Intelligence and Data Science

U20ADP714	IOT SYSTEMS AND ANALYTICS LABORATORY	L	T	P	C	Hrs
		0	0	2	2	30

Course Objectives

- To use microcontroller based embedded platforms in IOT.
- To use microprocessor based embedded platforms in IOT.
- To use wireless peripherals for exchange of data
- To make use of Cloud platform to upload and analyze any sensor data
- To use devices, Gateways and Data Management in IoT

Course Outcomes

After completion of the course, the students will be able to
CO1 – Use microcontroller based embedded platforms in IOT. **(K2)**
CO2 – Use microprocessor based embedded platforms in IOT. **(K2)**
CO3 – Use wireless peripherals for exchange of data **(K3)**
CO4 – Make use of Cloud platform to upload and analyse any sensor data **(K3)**
CO5 – Use of Devices, Gateways and Data Management in IoT. **(K3)**

List of Exercises

11. Introduction to Arduino platform and programming
12. Interfacing Arduino to Zigbee module
13. Interfacing Arduino to GSM module
14. Interfacing Arduino to Bluetooth Module
15. Introduction to Raspberry PI platform and python programming
16. Interfacing sensors to Raspberry PI
17. Communicate between Arduino and Raspberry PI using any wireless medium
18. Setup a cloud platform to log the data
19. Log Data using Raspberry PI and upload to the cloud platform
20. Design a real time IOT based system.

Reference Books

1. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols‖, Wiley, 2016 (for Unit 2).
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B.Tech. – Artificial Intelligence and Data Science

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3	2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	3
5	2	3	2	2	3	-	-	-	-	-	-	-	3	3	3

B.Tech. – Artificial Intelligence and Data Science