



**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 Computer Science and Engineering**

### **Minutes of 3<sup>rd</sup> BoS Meeting (UG)**

#### **Venue**

EEE 202 Lecture Hall, Department of CSE,  
Sri Manakula Vinayagar Engineering College  
Madagadipet, Puducherry – 605 107

#### **Date & Time**

21<sup>st</sup> Aug 2021 at 10:45 A.M

**Department of Computer Science and Engineering****Minutes of 3<sup>rd</sup> Board of Studies Meeting (UG)**

The third Board of Studies meeting of Department of Computer Science and Engineering was held on 21<sup>st</sup> Aug 2021 at 10:45 A.M in the EEE 202 Lecture Hall, Department of CSE, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

SI.No	Name of the Member with Designation and official Address	Responsibility in the BoS
1	Dr. K.Premkumar, Professor, Department of CSE, SMVEC	Chairman
2	Dr. S. R. Balasundaram, Professor and Head Department of Computer Applications, National Institute of Technology, Trichy.	Pondicherry University Nominee
3	Dr. Chokkalingam Subramanian, Professor & Head, Department of Information Technology, Saveetha University, Chennai.	Academic Council Nominee
4	Dr.S.Udhayakumar, Professor, Department of Computer Science and Engineering, Saveetha University, Chennai.	Academic Council Nominee
5	S.Diwarhar, M.Tech., Senior Engineer, Dell Technologies, Bangalore	Member
6	R.Sakthi Murugan, Director, Interjet India Pvt. Ltd., Puducherry.	Member
7	Dr. N. Danapaquiame, Professor, Department of CSE, SMVEC.	Member
8	Dr.E.Kodhai, Professor, Department of CSE, SMVEC.	Member
9	Dr.P.Iyappan, Associate Professor, Department of CSE, SMVEC	Member
10	Dr.V.Vijayakumar, Associate Professor, Department of CSE, SMVEC	Member
11	Dr.M.A.Ishrath Jahan Associate Professor, Department of English, SMVEC	Member
12	Dr.T.Jayavarthan Professor, Department of Physics, SMVEC	Member
13	Prof.M.Rajeswari, Assistant Professor, Department of Chemistry, SMVEC	Member
14	Prof.K.Raja, Assistant Professor, Department of Mathematics, SMVEC	Member

## Agenda of the Meeting

### Item No. : BoS / 2021 / CSE / UG / 3.1

Welcome Address, Introduction about the Institution, Department and BoS Members.

### Item No. : BoS / 2021 / CSE / UG / 3.2

Confirmation of minutes of 2<sup>nd</sup> BoS meeting held on 10.04.2021 for the Curriculum Structure and syllabus of B.Tech Computer Science and Engineering of R-2019 and R-2020 Regulations.

### Item No. : BoS / 2021 / CSE / UG / 3.3

To discuss and approve the modification in conducting the Continuous Assessment Test for IV, III year and I year of Regulation R-2013, R-2019 and R-2020 respectively for the students admitted in 2018-2019, 2019-2020 and 2020-2021.

### Item No. : BoS / 2021 / CSE / UG / 3.4

To discuss about any updation needed in B.Tech. Degree curriculum and the syllabus modification for VI and approve the VII semesters under Autonomous Regulations 2019 for the B.Tech – Computer Science and Engineering and the students admitted in the AY 2019-20.

### Item No. : BoS / 2021 / CSE / UG / 3.5

To discuss about any updation needed in B.Tech. Degree curriculum and syllabus modification for V and VI semesters under Autonomous Regulations 2020 for the B.Tech programme and the students admitted in the AY 2020-21.

### Item No. : BoS / 2021 / CSE / UG / 3.6

Consideration of offering of Professional and Open electives in V semester students admitted in the Academic Year 2019-20. The students should have to register one professional and one open elective as per Regulations 2019.

a) The students are registered the following *professional electives* in V semester

Offering Department	Course Code / Course Name	Number of Students registered
CSE	Game Development using Unity (U19CSE53)	58
CSE	Software Project Management (U19CSE55)	119
<b>Total Number of Students</b>		<b>177</b>

b) The students are registered the following *Open electives* in V semester which is offered by other department

Offering Department	Course Name	Number of Students registered
Civil	U19CEO53:Disaster Management	57
Civil	U19CEO54:Air Pollution and Solid Waste Management	120
<b>Total Number of Students</b>		<b>177</b>

### Item No. : BoS / 2021 / CSE / UG / 3.7

To Review the conduct of End Semester Examination in Blended mode i.e. offline/ online proctored mode.

### Item No. : BoS / 2021 / CSE / UG / 3.8

To discuss and recommend the panel of examiners to the Academic Council.

### Item No. : BoS / 2021 / CSE / UG / 3.9

Any other item with the permission of chair

**Minutes of the Meeting**

Dr. K. Premkumar, Chairman, BoS / Computer Science and Engineering officially announced the opening of the meeting. The meeting thereafter deliberated on agenda items that had been approved by the Chairman.

**Item: BoS/ 2021/ CSE/ UG/ 3.1**  
BoS Chairman of Computer Science and Engineering department welcomed the board members. He also thanked them for accepting the invitation and giving us their valuable time.

Confirmation of minutes of II BoS meeting held on 10.04.21 and reviewed about the curriculum Structures and syllabus of B.Tech - Computer Science and Engineering. The following changes are incorporated in the syllabus as per the members' suggestion.

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-19 & R-20	V	U19CST51/ U20BST546 - Probability and Statistics	II	Change the topic "some important distributions" to "distributions"
2	R-19 & R-20	V	U19CST52/ U20CST510 - Handheld Computing: Design and Application Development	IV	Remove Eclipse and include Kotlin.
				V	The name IOS has to be changed as "Mobile Frameworks".
3	R-19 & R-20	V	U19CST53/ U20CST511 - Web Application Development	III	Combine subtopics together such as DLL commands, DML, DCL, class, etc.
				IV	Need to include advance tool kits to design PHP.
				V	Remove AJAX and include Javascript.
4	R-19 & R-20	V	U19CST54/ U20CST512 - Software Engineering and Testing	IV	Include testing tools. Include text books for software testing. Change all the reference books to new books. Change the Web references from youtube links to all your institution faculty video reference links.
5	R-19 & R-20	V	U19CSP51/ U20CSP506 - Handheld Computing Laboratory	-	Include Micro Project as last list of laboratory exercise.

6	R-19 & R-20	V	U19CSP52/ U20CSP507 - Web Application Development Laboratory	-	Exercise number 5 and 6 are the same using form control, therefore combine them and instead of that include one more exercise in XML.
7	R-19 & R-20	V	U19CSP53/ U20CSP508 - Software Testing Laboratory	-	Remove reference book number one.
8	R-19 & R-20	VI	U19CST61/ U20CST613 - Artificial Intelligence and Expert Systems	-	Include either expert systems in the syllabus such as fuzzy logic, etc. or change the title into Artificial Intelligence and Machine Learning.
9	R-19 & R-20	VI	U19CST62/ U20CST614 - C# and .Net Programming	IV	Include C#
				V	Remove J2EE
10	R-19 & R-20	VI	U19CST63/ U20CST615 - Cloud Computing and Big Data	I and II	Combine Unit I and II.
				II and III	Divide Unit III into Unit II and III. From the topic "Virtualization" make it as Unit III. Include more on Virtualization.

The Curriculum and syllabus of Regulation 2019 and Regulation 2020 were revised as per members' suggestions and the same were approved by the academic council and confirmed by the BoS members.

<b>Item:</b> <b>BoS/</b> <b>2021/</b> <b>CSE/</b> <b>UG/ 3.3</b>	Discussed and approved the modification in conducting the Continuous Assessment Test for IV, III year and I year of Regulation R-2013, R-2019 and R-2020 respectively for the students admitted in 2018-2019, 2019-2020 and 2020-2021.
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The B.Tech. Degree curriculum and the syllabus modification for VI and approve the VII semesters under Autonomous Regulations 2019 for the B.Tech – Computer Science and Engineering and the students admitted in the AY 2019-20 were discussed, approved and recommended to Academic council with the following corrections.

Item:  
BoS/  
2021/  
CSE/  
UG/ 3.4

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-19	VII	U19CST72 - Data Science and Digital Marketing Analytics	V	Include Google based digital marketing. It gives practical exposure to students.
2	R-19	VII	U19CSP71 - Business Basics for Entrepreneur	III	Include about major organization in India that helps for startup. Include about CII (Confederation of Indian Industry), Venture capitalization and Angel investors
3	R-19	VII	U19CSP72 - IoT and Edge Computing Laboratory	-	<ul style="list-style-type: none"> <li>Remove 13<sup>th</sup> exercise which is not related to IoT and also it is very complex to do it.</li> <li>Combine exercise 9 &amp;10. Because both are same and they are related to APP development.</li> <li>Remove exercise 11 (Cloudsim) is relevant to cloud computing.</li> <li>Include Google IoT Core relevant basics exercises and also include exercise which uses Cloud/Edge related tools</li> </ul>
4	R-19	VII	U19CSP73 - Data Science and Digital Marketing Analytics Laboratory	-	<ul style="list-style-type: none"> <li>Include exercise relevant to Google Marketing.</li> <li>Combine Scatter plot and 3D exercises.</li> </ul>

It was approved by BoS members and enclosed along with Annexure- I.

Item:  
BoS/  
2021/  
CSE/  
UG/ 3.5

The B.Tech. Degree curriculum and syllabus modification for V and VI semesters under Autonomous Regulations 2020 for the B.Tech programme and the students admitted in the AY 2020-21 were discussed and recommended without any modifications.

Discussed about the offerings of Professional and Open electives in V semester students admitted in the Academic Year 2019-20. The students must register one professional and one open elective as per Regulations 2019.

The B.Tech Degree 2019 Regulation, Professional and Open electives syllabus from Semester VI and VII were approved and recommended to Academic council with the following corrections.

Item:  
BoS/  
2021/  
CSE/  
UG/ 3.6

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-19	VII	U19CSE71 - Network Security	II, V	<ul style="list-style-type: none"> <li>The UNIT V can be pushed into UNIT II.</li> </ul>
				V	<ul style="list-style-type: none"> <li>Change the UNIT V heading as Symmetric and Asymmetric Key Techniques or use common term like Encryption Technique.</li> </ul>
2	R-19	VII	U19CSE72 - Data Mining and Warehousing	II, III	<ul style="list-style-type: none"> <li>Remove the Data Mining concepts from UNIT II and include that into UNIT III.</li> <li>Change the UNIT II title as Data Warehousing and OLAP technology.</li> </ul>
				IV	<ul style="list-style-type: none"> <li>Change the UNIT IV heading as Cluster Analysis instead of Cluster Analysis Introduction.</li> <li>Remove the second Text Book from the list because first Text Book and second Text Book are the same.</li> </ul>
3	R-19	VII	U19CSE74 - Robotics	III	<ul style="list-style-type: none"> <li>Review the syllabus</li> </ul>
				I, II	<ul style="list-style-type: none"> <li>Remove some topics from UNIT I and add that into UNIT II</li> </ul>
4	R-19	VII	U19CSE75 - Haptic Computing	-	<ul style="list-style-type: none"> <li>Review the Text Books.</li> <li>Check and add the opted Text Book for Haptic Computing.</li> </ul>
5	R-19	VII	U19CSO77 - Cloud Technology and its Applications	III	<ul style="list-style-type: none"> <li>Reduce the syllabus for UNIT III. It looks like heavy weight.</li> <li>Review the Text Book.</li> </ul>

It was approved by BoS members and enclosed along with Annexure- I.

Item:  
BoS/  
2021/  
CSE/  
UG/ 3.7

Discussed and recommend the conducting of End Semester Examination through blended mode i.e. offline/ online proctored mode. The BoS members appreciated and approved for the same.

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Item: BoS/ 2021/ CSE/ UG/ 3.8	Discussed and recommend the panel of examiners to the Academic Council. It was approved by BoS members and enclosed in Annexure- II.
Item: BoS/ 2021/ CSE/ UG/ 3.9	Nil


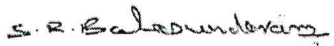
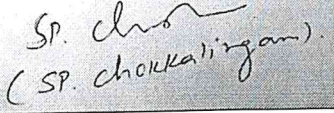

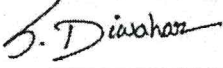
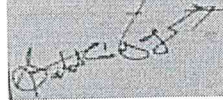



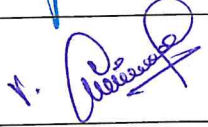



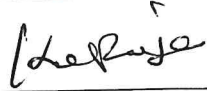
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The meeting for the above Agenda regarding B.Tech – Computer Science and Engineering was concluded by 1:30 pm with by **Dr. K. Premkumar**, Chairman-BoS and Head of Department, Department of Computer Science and Engineering, Sri Manakula Vinayagar Engineering College.



**Dr. K. Premkumar**  
**Chairman/ BoS - CSE**



Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	Dr. K.Premkumar, Professor, Department of CSE, SMVEC	Chairman	
<b>External Members</b>			
2	Dr. S. R. Balasundaram, Professor and Head Department of Computer Applications, National Institute of Technology, Trichy.	Pondicherry University Nominee	
3	Dr. Chokkalingam Subramanian, Professor & Head, Department of Information Technology, Saveetha University, Chennai.	Academic Council Nominee	
4	Dr.S.Udhayakumar, Professor, Department of Computer Science and Engineering, Rajalakshmi College of Engineering, Chennai.	Academic Council Nominee	
5	S.Diwarhar, M.Tech., Senior Engineer, Dell Technologies, Bangalore	Member	
6	R.Sakthi Murugan, Director, Interjet India Pvt. Ltd., Puducherry.	Member	
<b>Internal Members</b>			
7	Dr. N. Danapaquame, Professor, Department of CSE, SMVEC.	Member	
8	Dr.E.Kodhai, Professor, Department of CSE, SMVEC.	Member	
9	Dr.P.Iyappan, Associate Professor Department of CSE, SMVEC	Member	
10	Dr.V.Vijayakumar, Associate Professor, Department of CSE, SMVEC	Member	
<b>Co-opted Members</b>			
11	Dr.M.A.Ishrath Jahan Associate Professor, Department of English, SMVEC	Member	
12	Dr.T.Jayavarthan Professor, Department of Physics, SMVEC	Member	
13	Prof.M.Rajeswari, Assistant Professor, Department of Chemistry, SMVEC	Member	
14	Prof.K.Raja, Assistant Professor, Department of Mathematics, SMVEC	Member	

# **ANNEXURE - I**

**(Semester VII - Curriculum and Syllabi of R-2019)**

<b>SEMESTER – VII (R-2019 Regulations)</b>		
<b>Sl. No</b>	<b>Course Code</b>	<b>Course Title</b>
<b>Theory</b>		
1	U19CST71	IoT and Edge Computing
2	U19CST72	Data Science and Digital Marketing Analytics
3	U19CSE7X	Professional Elective – IV
4	U19XXO7X	Open Elective – IV
<b>Practical</b>		
5	U19CSP71	Business Basics for Entrepreneur
6	U19CSP72	IoT and Edge Computing Laboratory
7	U19CSP73	Data Science and Digital Marketing Analytics Laboratory
8	U19CSP74	Comprehensive Viva-Voce
<b>Project Work</b>		
9	U19CSW71	Project phase – I
10	U19CSW72	Internship / Inplant Training

<b>U19CST71</b>	<b>IOT AND EDGE COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

- To assess the vision and use of Devices in IoT Technology
- To Understand IoT Market perspective.
- To classify Real World IoT Design Constraints using Raspberry Pi.
- To learn about the introduction to Edge Computing
- To know about Physical Servers and Cloud Offerings

**Course Outcomes**

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

**CO1** - Interpret the vision of IoT from a global context along with the uses of IOT devices.(K2)

**CO2** - Determine the Market perspective of IoT.(K5)

**CO3** - Design a portable IOT using Raspberry Pi.(K5)

**CO4** - Describe the importance of edge computing.(K1)

**CO5** - Illustrate the applications in Industrial Automation and identify Real World Design Constraints.(K2)

**UNIT I INTRODUCTION & ENABLING TECHNOLOGIES (9 Hrs)**

Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Communication Models, IoT Communication APIs, Difference between IoT and M2M, SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization, IoT System Management with NETCONF-YANG, Need for IoT Systems Management, Network Operator Requirements, NETCONF, YANG.

**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 IOT PLATFORMS DESIGN METHODOLOGY (9 Hrs)**

IoT Physical Devices and Endpoints– Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

**UNIT IV COMPONENT OF EDGE COMPUTING AND CLOUD COMPUTING (9 Hrs)**

Fog computing vs Edge computing- Need for edge computing - Benefits of Edge computing. Lightweight Container Middleware for Edge Cloud Architectures - Clusters for Lightweight Edge Clouds - Architecture Management – Storage and Orchestration - IoT Integration - Security Management for Edge Cloud Architectures.

**UNIT V PHYSICAL SERVERS & CLOUD OFFERINGS (9 Hrs)**

Physical Servers and Cloud Offerings– Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework, designing a RESTful web API.

**Text Books**

1. Rajkumar Buyya, Satish Narayana Srirama, "Fog and Edge Computing: Principles and Paradigms", 1st Edition, Wiley-Blackwell, 2019.
2. Matt Richardson & Shawn Wallace, O'Reilly (SPD), "Getting Started with Raspberry Pi", 3rd edition, 2016, ISBN: 9781680452457.
3. "Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti", Universities Press, 2015, ISBN: 9788173719547.
4. Vijay Madiseti and Arshdeep Bahga, "Internet of Things: A Hands-On Approach", VPT edition1, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, —"The Internet of Things – Key applications and Protocols", Wiley, 2012 (for Unit 2).

**Reference Books**

1. Donald Norris, —"The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Blackll",Mc.Graw Hill,2015.
2. Jonathan Follett, "Designing for Emerging - UX for Genomics, Robotics, and the Internet of Things Technologies", O'Reilly, 2014.
3. 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, 2014.
4. Charalampos Doukas, — "Building Internet of Things with the Arduinoll, Create space", April 2012.
5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —"Architecting the Internet of Things", Springer, 2011.
6. Michael Margolis," Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects", 2nd Edition, O'Reilly Media, 2011.

**Web Resources**

1. <https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot>
2. <https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/>
3. <https://www.geeksforgeeks.org/edge-computing/>
4. <https://www.i-scoop.eu/internet-of-things-guide/edge-computing-iot/>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1-Low, 2-Medium, 3- High

U19CST72	DATA SCIENCE AND DIGITAL MARKETING ANALYTICS	L	T	P	C	Hrs
		3	0	0	3	45

**Course Objectives**

- To introduce data science and social media.
- To learn about connecting, capturing and cleaning the social data.
- To know about the branding of Facebook.
- To analyse about the sentiments in twitter.
- To Learn how Google Tools using for consumer's reactions

**Course Outcomes**

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

**CO1** – Understand the fundamentals of data science and social media. **(K2)**

**CO2** – Interpret the connecting, capturing and cleaning the social data. **(K3)**

**CO3** – Learn about the promoting of facebook. **(K2)**

**CO4** – Analysis of sentiments in twitter. **(K3)**

**CO5** – Learn how Google Tools using for consumer's reactions. **(K4)**

**UNIT I INTRODUCTION TO DATA SCIENCE AND SOCIAL MEDIA (9 Hrs)**

Introduction of Data science - Scope of Data Science – Data Science with other fields – Relationship between Data Science and Information Science. Data – Data Types – Data collection – Data pre-processing. Introduction to the Latest Social Media Landscape and Importance - Introducing social graph - Delving into social data - Understanding the process - Working environment - Collecting the data - Analyzing the data - Visualizing the data - Getting started with the toolset.

**UNIT II HARNESSING SOCIAL DATA (9 Hrs)**

APIs in a nutshell - Different types of API - Advantages and Limitations of social media APIs - Connecting principles of APIs - Introduction to authentication techniques - Parsing API outputs - Twitter - Facebook - GitHub - YouTube. Basic cleaning techniques - MongoDB to store and access social data - MongoDB using Python. Google Tools.

**UNIT III UNCOVERING BRAND ACTIVITY, POPULARITY AND EMOTIONS ON FACEBOOK (9 Hrs)**

Facebook brand page - The Facebook API - Project planning - Analysis - data extraction - data pull - feature extraction - content analysis - Keywords - Extracting verbatim for keywords - Noun phrases - Detecting trends in time series - Maximum shares - Maximum likes - Uncovering emotions - Extract emotions - Brands benefit from Emotions.

**UNIT IV ANALYZING TWITTER USING SENTIMENT ANALYSIS AND ENTITY RECOGNITION (9 Hrs)**

Scope and process - Getting the data - Getting Twitter API keys - Data extraction - REST API Search endpoint - Streaming API - Data pull - Data cleaning - Sentiment analysis - Customized sentiment analysis - Labeling the data - Creating the model - Model performance evaluation and cross-validation - K-fold cross-validation - Named entity recognition - Installing NER - Combining NER and sentiment analysis.

**UNIT V CAMPAIGNS AND CONSUMER REACTION ANALYTICS AND GOOGLE TOOLS (9 Hrs)**

Scope and process - Getting the data - Data pull - Data processing - Data analysis -Sentiment analysis in time - Comments in time - The Next Great Technology – Trends Mining on GitHub - Top technologies. Google Tools: Google Ad Manager - Google Ads - Google Marketing Platform. Digital Marketing Tools: Data Shorts - Test My Site - Grow My Store - Find My Audience - Market Finder - Google Trends..

**Text Books**

- 1.Chirag Shah " A Hands-On Introduction to Data Science" Cambridge University Press, 2020.
- 2.Siddhartha Chatterjee, Michal Krystyanczuk "Python Social Media Analytics ", Packt Publishing, 2017.
- 3.Jesus Rogel-Salazar, "Data science and Analytics", CRC Press, 2017.

**Reference Books**

- 1.Chuck Hemann, Ken Burbary "Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World", Que Publishing, 2013.
2. Wolfgang Jank, "Business Analytics for Managers", Springer, 2011.
- 3.Wes McKinney,"Python for Data Analysis", O'Reilly Press, 2nd Edition, 2017.
- 4.Phil Spector, "Data Manipulation with R", Springer, 2018.
- 5.Christian Ritz, Jens Carl Streibig, "Nonlinear Regression with R", Springer, 2015.

**Web Resources**

- 1.<https://www.analyticsinsight.net/data-science-in-digital-marketing/>
- 2.<https://www.simplilearn.com/pgp-data-science-certification-bootcamp-program?>
- 3.<https://emeritus.sdabocconi.it/big-data-ai-marketing?>
- 4.<https://www.thinkwithgoogle.com/intl/en-apac/?>
- 5.<https://www.upgrad.com/executive-management-in-digital-brand-advertise-mica/?>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1-Low, 2-Medium, 3- High

	L	T	P	C	Hrs
<b>U19CSP71 BUSINESS BASICS FOR ENTREPRENEUR</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

**Course Objectives**

- To develop a clear understanding on Business Plans and their significance.
- To be familiar with various forms of business appropriate for an individual entrepreneur
- To understand various ways of judging a successful opportunity for an entrepreneur
- To know the ways to formulate a successful Operation Plan
- To be aware of things to know to prepare effective financial and marketing plans

**Course Outcomes**

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

**CO1** - Understand the need and significance of Business Plan in the success of an Enterprise. **(K1)**

**CO2** - Demonstrate a comprehensive and comparative understanding on various forms of businesses. **(K2)**

**CO3** - Understand the ways to judge the economic and business viability of proposed venture. **(K1)**

**CO4** - Explain various strategies to formulate an Operational Plan successfully. **(K3)**

**CO5** - Show an understanding on key issues involved in Marketing and Financial Plans. **(K2)**

**UNIT I THE BUSINESS PLAN****(6 Hrs)**

What is a Business Plan? – Need and Significance of a Business Plan – Perils of Not Having a Business Plan – Survey on Enterprises with and without Business Plan at their start-up.

**UNIT II THE BUSINESS FORMS****(6 Hrs)**

Description of the Form of Enterprise – Sole Proprietor – One-man Company – Partnership – Private Limited Company – Comparative Pros and Cons of each of these forms of business – Interview findings from at least 3 of these business forms.

**UNIT III JUDGING THE OPPORTUNITY****(6 Hrs)**

Sensing the Business Opportunity – Measuring the Economic and Business Viability of the Entrepreneurial idea – Findings from Observations of various small firms and ascertaining the causes of their successes and failures with reference to "Business Fitness of the Purpose/Idea".

**UNIT IV STRATEGISING THE IDEA****(6 Hrs)**

Study of the Industry and Market – Preparation of Strategy specific to the proposed enterprise – Identifying the Core Team to work with – Formulating an Operational Plan. Experience-sharing with Entrepreneurs and preparation of summary of their experiences and best practices.

**UNIT V THE FINAL COUNT-DOWN****(6 Hrs)**

Preparation of the Marketing and the Financial Plan – Seeking Funds for Investment – Options available – Exploring Commercial Banks and NBFCs for Loans – Knowing the jargons: Collateral, Security, Margin Money, Working Capital, Term Loan, Interest Rates, EMIs, Loan Tenure, etc. Getting to know the nitty-gritties of Bank Loan Documentation and Procedures through Seminars / Workshops from Practicing Bankers and Industrialists.

**Text Books**

1. Friend, G., & Zehle, S., " Guide to business planning", Profile Books Limited, 2004.
2. Lasher, W., "The Perfect Business Plan Made Simple: The best guide to writing a plan that will secure financial backing for your business", Broadway Books, 2010.



**Reference Books**

1. Alexander Osterwalder and Yves Pigneur – Business Model Generation.
2. Arthur R. DeThomas – Writing a Convincing Business Plan.
3. Ben Horowitz – The Hard Thing about Hard Things.
4. Guy Kawasaki – The Art of Start 2.0
5. Hal Shelton – The Secrets to Writing a Successful Business Plan.
6. Jason Fried and David Hanson – Rework.
7. Jim Horan – The One Page Business Plan.
8. Linda Pinson – Anatomy of a Business Plan.
9. Rhonda Abrams – Successful Business Plan: Secrets & Strategies.

**Web Resources**

1. <https://www.waveapps.com/blog/entrepreneurship/importance-of-a-business-plan>
2. <https://www.entrepreneur.com/article/200516>
3. <https://smallbusinessbc.ca/article/how-to-use-viability-to-test-if-you-should-invest-in-your-business/>
4. <https://www.infoentrepreneurs.org/en/guides/strategic-planning/>
5. <http://www.marketingmo.com/strategic-planning/marketing-plans-budgets/>
6. <https://www.mbda.gov/page/loan-documentation>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1-Low, 2-Medium, 3- High

	L	T	P	C	Hrs
<b>U19CSP72 IOT AND EDGE COMPUTING LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

### Course Objectives

- Learn to analyse the performance of IOT devices
- Design and program IoT devices
- Be exposed to tool kits for cloud environment.
- Transfer IoT data to the cloud and in between cloud providers
- Learn to run virtual machines of different configuration.

### Course outcomes

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

- CO1** - Analyse the performances of IOT devices. **(K2)**  
**CO2** - Design IoT applications in different domain. **(K6)**  
**CO3** - Implement basic IoT applications on embedded platform. **(K6)**  
**CO4** - Use of the cloud tool kits. **(K3)**  
**CO5** - Design and Implement applications on the Cloud. **(K6)**

### List of Exercises

1. Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.
2. Run python programs on Pi
3. Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
4. Access an image through a Pi web cam
5. Implement an intruder system that sends an alert to the given email.
6. Get the status of a bulb at a remote place (on the LAN) through web.
7. Show the virtual machine migration based on the certain condition from one node to the other.
8. Find procedure to install storage controller and interact with it.
9. Install Google App Engine. Create hello world app and other simple web applications using python/java.
10. Find a procedure to transfer the files from one virtual machine to another virtual machine.
11. Find a procedure to launch virtual machine using trystack
12. Install Hadoop single node cluster and run simple applications like wordcount.

### Reference Books

1. Jonathan Follett, "Designing for Emerging - UX for Genomics, Robotics, and the Internet of Things Technologies", O'Reilly, 2014.
2. Charalampos Doukas, — "Building Internet of Things with the Arduinoll", Create space, April 2012.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —"Architecting the Internet of Things", Springer, 2011.
4. Michael Margolis, "Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects", 2nd Edition, O'Reilly Media, 2011.

### Web Resources

1. <https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot>
2. <https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/>
3. <https://www.geeksforgeeks.org/edge-computing/>
4. <https://www.i-scoop.eu/internet-of-things-guide/edge-computing-iot/>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1-Low, 2-Medium, 3- High

U19CSP73	DATA SCIENCE AND DIGITAL MARKETING ANALYTICS LABORATORY				L	T	P	C	Hrs
					0	0	2	1	30

### Course Objectives

- To describe common Python functionality and features used for data science.
- To learn the Query Data Frame structures for cleaning and processing.
- To configure your programming environment to analysis Facebook.
- To analyse about the sentiments in twitter.
- To learn how YouTube promotions and analysis of consumer's reactions are made.

### Course Outcomes

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

- CO1** – Design programs using Python functionality and features. **(K3)**  
**CO2** – Developing Query Data Frame structures for cleaning and processing. **(K4)**  
**CO3** – Construct programming environment to analysis Facebook. **(K4)**  
**CO4** – Analyse about the sentiments in twitter. **(K4)**  
**CO5** – Learn how Google Tools using for consumer's reactions. **(K5)**

### List of Exercises

1. Demonstrate Aggregation.
2. Demonstrate Indexing and Sorting.
3. Demonstrate handling of missing data.
4. Demonstrate hierarchical indexing.
5. Demonstrate usage of Pivot table.
6. Demonstrate use of eval () and query ().
7. Demonstrate Scatter Plot and 3D plotting.
8. Implement an analytic application for facebook to demonstrate the number of likes, emotions.
9. Implement an analytic application for twitter to demonstrate Sentiment Analysis and Entity Recognition.
10. Implement an analytic application for Google Tools such as Find My Audience - Market Finder - Google? Trends.

### Reference Books

1. Chirag Shah " A Hands-On Introduction to Data Science" Cambridge University Press, 2020.
2. Siddhartha Chatterjee, Michal Krystyanczuk "Python Social Media Analytics ", Packt Publishing, 2017.
3. Jesus Rogel-Salazar, "Data science and Analytics", CRC Press, 2017.

### Web Resources

1. <https://www.searchlaboratory.com/analytics-data-science/>
2. <https://www.analyticsinsight.net/data-science-in-digital-marketing/>
3. <https://www.simplilearn.com/pgp-data-science-certification-bootcamp-program?>
4. <https://emeritus.sdabocconi.it/big-data-ai-marketing?>

### COs/POs/PSOs Mapping

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

Correlation Level: 1-Low, 2-Medium, 3- High

<b>U19CSP74</b>	<b>COMPREHENSIVE VIVA-VOCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>30</b>

The student will be tested for his understanding of basic principles of the core Computer Science and Engineering subjects. The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering acquired over 4 years of study in the undergraduate program.

<b>U19CSW71</b>	<b>PROJECT PHASE - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>	<b>30</b>

**Course Objectives**

- To make literature survey.
- To identify problem definition.
- To build a project design.
- To carry out project implementation.
- To perform project testing and documentation.

**Course Outcomes**

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

**CO1** - State the problem definition clearly. **(K3)**

**CO2** - Prepare SRS for projects. **(K3)**

**CO3** - Prepare SDS for projects. **(K3)**

**CO4** - Develop presentation skills. **(K3)**

**CO5** - Develop project management skills. **(K3)**

**Exercises**

The project group is required to do the following

- literature survey,
- Problem formulation
- Forming a methodology of arriving at the solution of the problem.
- Documentation of each step

**Reference Books**

- Papers published in reputed journals, conferences related to the project

**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
<b>1</b>	3	2	1	1	-	-	-	-	-	-	3	3	2	2	3
<b>2</b>	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3
<b>3</b>	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3
<b>4</b>	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3
<b>5</b>	3	2	1	1	3	-	-	-	-	-	3	3	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19CSW72</b>	<b>INTERNSHIP/ INPLANT TRAINING</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

Inplant training is a short duration training course for students to develop their skills and get industrial knowledge which will help you to understand what is actually happens in industry. Inplant training is important for Engineering students as it gives industry exposure to them while studying. Inplant training adds credits to the students during their placements. They provide inplant training and internships for the students of engineering and arts. Its usefulness varies depending on which branch you are, and which company you did an InPlant Training.

# **PROFESSIONAL ELECTIVES**



<b>U19CSE71</b>	<b>NETWORK SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

- To understand the web security architecture and basics of cyber security.
- To describe Authentication application, IP security.
- To understand about web security model and network protocols.
- To understand the network security and network security defense tools.
- To describe Symmetric Ciphers techniques and Standards and design principles.

### Course Outcomes

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

**CO1** – Analyse various security attacks and select appropriate security mechanisms for designing various security services and classical encryption techniques. **(K3)**

**CO2** – Describe Authentication application, IP security. **(K1)**

**CO3** – Acquire knowledge about web security model and network protocols. **(K3)**

**CO4** – Acquire knowledge about Network Security protocols and defence tools. **(K3)**

**CO5** – Acquire knowledge in symmetric and public key cryptography. **(K3)**

### UNIT I INTRODUCTION

**(9 Hrs)**

The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, a Model for Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

### UNIT II AUTHENTICATION APPLICATIONS AND IP SECURITY

**(9 Hrs)**

Symmetric Key Cryptography: Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm- Security of RSA-Key management.

### UNIT III WEB SECURITY

**(9 Hrs)**

Basic web security model, Web application security, Content Security Policies (CSP), Web workers, and extensions, Session management and user authentication, HTTPS: goals and pitfalls, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

### UNIT IV NETWORK SECURITY AND DEFENSE TOOLS

**(9 Hrs)**

Security issues in Internet protocols: TCP, DNS, and routing Firewalls: Firewall Design Principles, Trusted Systems. Intruders: Intruders, Intrusion Detection, Password Management. Unwanted traffic: denial of service attacks.

### UNIT V SYMMETRIC AND ASYMMETRIC KEY TECHNIQUES

**(9 Hrs)**

Cyber Resilience cyber-attack – Symmetric Key Cryptography - Asymmetric Key Cryptography – Cryptographic algorithms – Authentication & identification – Renowned information security – Diffie – Hellman Key exchange – Security of both key.

**Text Books**

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education; Seventh edition, 2017.
2. Roberta Bragg, "Network Security: The Complete Reference", McGraw Hill Education, 1st edition, 2017.
3. William Stallings, "Network Security Essentials: Applications and Standards", Pearson Education India; 4<sup>th</sup> edition, 2011.

**Reference Books**

1. Atul Kahate, "Cryptography and Network Security", McGraw-Hill; Fourth edition, 2019.
2. Manoj Kumar, "Cryptography and Network Security", Krishan Prakashan, 2014.
3. Prakash C. Gupta, "Cryptography and Network Security", PHI Learning Pvt. Ltd, 2014.
4. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, Second Edition, 2013.
5. Charlie Kaufman, "Network Security: Private Communication in Public World", 2nd Edition. Prentice Hall of India, New Delhi, 2004.

**Web Resources**

1. [https://www.cisco.com/c/en\\_in/products/security/what-is-network-security.html](https://www.cisco.com/c/en_in/products/security/what-is-network-security.html)
2. <https://phoenixnap.com/blog/best-network-security-tools>
3. <https://developer.mozilla.org/en-US/docs/Web/Security>
4. <https://sucuri.net/guides/website-security/>
5. <https://nptel.ac.in/courses/106/105/106105162/>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1-Low, 2-Medium, 3- High

U19CSE72	DATA MINING AND WAREHOUSING	L	T	P	C	Hrs
		3	0	0	3	45

**Course Objectives**

- To understand the Fundamental Concept of Data mining.
- To describe the OLAP technology.
- To understand the Classification Techniques.
- To understand the Cluster Analysis.
- To develop Data Mining Object.

**Course Outcomes**

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

**CO1** - Understand the Data mining and Data warehousing fundamentals. **(K1)**

**CO2** - Describe the OLAP technology for Data Mining. **(K3)**

**CO3** - Understand the Classification Techniques. **(K1)**

**CO4** - Understand the Cluster Analysis. **(K1)**

**CO5** - Develop Data Mining Object. **(K3)**

**UNIT I INTRODUCTION****(9 Hrs)**

Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Pre-processing: Need for Pre-processing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

**UNIT II DATA WAREHOUSING AND OLAP TECHNOLOGY****(9 Hrs)**

Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

**UNIT III CLASSIFICATION AND PREDICTION****(9 Hrs)**

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining. Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods.

**UNIT IV CLUSTER ANALYSIS****(9 Hrs)**

Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

**UNIT V SPATIAL, MULTIMEDIA, TEXT AND WEB MINING****(9 Hrs)**

Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web. Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.

**Text Books**

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Second Edition, Pearson education, 2016.
3. Jared Dean, "Big Data Mining, and Machine Learning: value Creation for Business Leaders and Practitioners", Second Edition, Wiley, 2019.

**Reference Books**

1. Arun K Pujari, "Data Mining Techniques", Second Edition, Universities Press, 2010.
2. Sam Aanhory and Dennis Murray, "Data Warehousing in the Real World", Second Edition, Pearson Edn Asia, 1997.
3. K.P.Soman, S.Diwakar and V.Ajay, "Insight into Data Mining", Second Edition, PHI, 2008.
4. Paulraj Ponnaiah, "Data Warehousing Fundamentals" Third Edition, Wiley student Edition, 2017.
5. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data Mining Theory and Practice", Third Edition, Prentice Hall of India, 2006.

**Web Resources**

1. <https://www.geeksforgeeks.org/difference-between-data-warehousing-and-data-mining/>
2. <https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing>
3. <https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining>
4. <https://nptel.ac.in/courses/106/105/106105174/>
5. <https://www.guru99.com/data-warehousing-tutorial.html>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1-Low, 2-Medium, 3- High

**U19CSE73****VIRTUAL REALITY**

L	T	P	C	Hrs
3	0	0	3	45

**Course Objectives**

- To understand the concept of Virtual Reality.
- To develop Geometry for Virtual Reality.
- To develop Physiology of Human models using VR.
- To create visual perception and rendering with Virtual World.
- To test the audio.

**Course Outcomes**

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

- CO1** - Understand the concept of Virtual Reality. **(K2)**  
**CO2** - Develop Geometry for Virtual Reality. **(K3)**  
**CO3** - Develop Physiology of Human models using VR. **(K3)**  
**CO4** - Create visual perception and rendering with Virtual World. **(K3)**  
**CO5** - Test the audio. **(K4)**

**UNIT I INTRODUCTION****(9 Hrs)**

Virtual Reality: What is Virtual Reality - Modern VR Experiences - History Repeats. Bird's-Eye View: Hardware - Software - Human Physiology and Perception.

**UNIT II GEOMETRY AND LIGHT AND OPTICS****(9 Hrs)**

Geometric Models - Changing Position and Orientation - Axis-Angle Representation of Rotation - Viewing Transformations - Chaining the Transformations.  
 Light and Optics: Basic Behavior - Lenses - Optical Aberrations - The Human Eye - Cameras – Displays.

**UNIT III PHYSIOLOGY OF HUMAN VISION****(9 Hrs)**

From the Cornea to Photoreceptors - From Photoreceptors to the Visual Cortex - Eye Movements - Implications for VR.

**UNIT IV VISUAL PERCEPTION, VISUAL RENDERING AND MOTION IN REAL AND VIRTUAL WORLD****(9 Hrs)**

Perception: Depth - Motion - Color - Combined sources of Information. Rendering: Ray Tracing and Shading Models - Rasterization - Correcting Optical Distortions. Motion: Velocities and Accelerations - The Vestibular System - Physics in the Virtual World - Mismatched Motion and Vection.

**UNIT V TRACKING, INTERACTION AND AUDIO****(9 Hrs)**

Tracking: Tracking 2D Orientation - Tracking 3D Orientation - Tracking Position and Orientation - 3D Scanning of Environments. Interaction: Motor Programs and Remapping - Locomotion - Social Interaction.  
 Audio: The Physics of Sound - The Physiology of Human Hearing - Auditory Perception - Auditory Rendering - Perceptual Training - Recommendations for Developers.

**Text Books**

1. Stevan M.LaValle, "Virtual Reality", Cambridge University Press, 2020.
2. Burdea, "Virtual Reality Technology", Wiley India, 2nd edition, 2008.
3. John Vince, "Virtual Reality Systems", Pearson Edition, 2012.

**Reference Books**

1. Jonathan Linowes, "Unity Virtual Reality Projects", Packt publications, Second Edition, 2016.
2. Woodrow Barfield, Marc J. Blitz, "Research Handbook on the Law of Virtual Reality and Augmented Reality", Edward Elgar Publishing, 2020.
3. Jeff W Murray, "Building Virtual Reality with Unity and SteamVR", CRC Press, 2nd edition, 2020.
4. Erin Pangilinan, Steve Lukas, Vasanth Mohan, "Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing", O'Reilly Media, 1st edition, 2019.
5. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality", Morgan & Claypool Publishers, 2015.

**Web Resources**

1. <https://www.investopedia.com/terms/v/virtual-reality.asp>
2. <https://www.iberdrola.com/innovation/virtual-reality>
3. <https://www.marxentlabs.com/what-is-virtual-reality>
4. <https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html>
5. <https://arvr.google.com/vr>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1-Low, 2-Medium, 3- High

<b>U19CSE74</b>	<b>ROBOTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

- To understand the fundamental concepts of Robotics
- To outline sensors and vision system
- To design of controlling in robotics
- To extend the robot Actuation systems
- To design and control hardware & interfacing in robot

### Course Outcomes

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

**CO1** - Explain the robotic kinematic and dynamic analysis. **(K2)**

**CO2** - Discover various sensors and vision system. **(K1)**

**CO3** - Apply linear and non-linear controls of robotics. **(K3)**

**CO4** - Make use of various actuators. **(K2)**

**CO5** - Develop robotics using embedded systems and AI. **(K4)**

### UNIT I INTRODUCTION TO ROBOTICS (9 Hrs)

Types and components of a robot, Classification of robots, Kinematics systems; Definition of mechanisms and manipulators, Degrees of Freedom.

Robot Kinematics: Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Forward and inverse kinematics, Jacobian, Singularity, and Statics

### UNIT II ROBOT DYNAMICS, SENSORS AND VISION SYSTEM (9 Hrs)

Dynamic Modelling: Forward and inverse dynamics, Equations of motion using Euler-Lagrange formulation, Newton Euler formulation

Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc., Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations, Vision applications in robotics.

### UNIT III ROBOT CONTROL (9 Hrs)

Basics of control: open loop- closed loop, Transfer functions, Control laws: P, PD, PID, Linear and Non-linear controls

### UNIT IV ROBOT ACTUATION SYSTEMS (9 Hrs)

Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

### UNIT V CONTROL HARDWARE AND INTERFACING (9 Hrs)

Embedded systems: Microcontroller Architecture and integration with sensors, actuators, components, Programming for robot applications. AI in Robotics: Applications in unmanned systems, defense, medical, industries, etc.

### Text Books

1. Craig, J.J., "Introduction to Robotics: Mechanics and Control", 4<sup>th</sup> Edition, Pearson, 2017.
2. Spong, Vidyasagar, "Robot Dynamics and Control", 2<sup>nd</sup> Edition, Wiley India Pvt. Ltd, 2009.
3. R. Klafner, "Robotics Engineering", 3<sup>rd</sup> edition, PHI, 2012.
4. Saha, S.K, "Introduction to Robotics". 2<sup>nd</sup> Edition, McGraw-Hill Higher Education, New Delhi, 2014.
5. M. P. Groover, Ashish Dutta, "Industrial Robotics", 2<sup>nd</sup> edition, McGraw Hill, 2013.

**Reference Books**

1. Steve Heath, "Embedded System Design", 2nd Edition, Newnes, Burlington, 2003
2. NikuSaeed B., "Introduction to Robotics: Analysis, Systems, Applications", 3<sup>rd</sup> edition, PHI, New Delhi, 2008
3. Mittal R.K. and Nagrath I.J., "Robotics and Control", 2<sup>nd</sup> edition, Tata McGrawHill, 2011
4. Mukherjee S., "Robotics and Automation", Khanna Publishing House, Delhi.
5. Mark W. Spong, Sdeth Hutchinson, and M. Vidyasagar, "Robot Modelling and Control", John Wiley and Sons Inc, 2005.

**Web Resources**

1. <http://www.cs.cornell.edu/courses/cs4750>
2. <https://www.coursera.org/specializations/robotics>
3. <https://cmsx.cs.cornell.edu>
4. <https://www.edx.org/>
5. <https://builtin.com/robotics>

**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
<b>1</b>	3	3	2	1	2	2	2	-	-	3	-	3	2	3	2
<b>2</b>	3	2	3	2	3	2	2	-	-	-	-	3	3	3	2
<b>3</b>	3	3	3	2	3	2	2	-	-	2	-	3	3	3	3
<b>4</b>	2	2	2	2	2	2	2	-	-	3	-	2	2	2	2
<b>5</b>	3	3	2	2	2	2	2	-	2	3	3	3	2	3	2



**U19CSE75****HAPTIC COMPUTING**

L	T	P	C	Hrs
3	0	0	3	45

**Course Objectives**

- To understand the basics of Haptics Principles and Applications
- To learn the concept of Human Haptic Perception and Machine Haptics
- To study the Computer Haptics
- To learn the Multimedia Haptics
- To understand the designing purpose of Haptics System

**Course Outcomes**

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

**CO1** – Analyze the basic Principles and Applications of Haptics. **(K3)**

**CO2** – Understand the Human Haptic Perception and Machine Haptics. **(K1)**

**CO3** – Analyze the concept of Computer Haptics. **(K3)**

**CO4** – Make use of the Multimedia Haptics. **(K2)**

**CO5** – Ability to design the Haptic Systems. **(K2)**

**UNIT I HAPTICS: GENERAL PRINCIPLES AND APPLICATIONS****(9Hrs)**

Introduction - Human Senses - Haptics Exploration - Concepts and Terminology - Roadmap to Multimedia Haptics.- Haptic-Audio-Visual Multimedia System. Haptic Evolution: From Psychophysics to Multimedia - Haptics for Medical Applications - Tele-Robotics and Tele-Operation – Media - Mobile Haptics - Haptics and Virtual reality - Education and Learning - Haptics for Security.

**UNIT II HUMAN HAPTIC PERCEPTION AND MACHINE HAPTICS****(9Hrs)**

Introduction - Touch and Cognition - Human Haptic System - Concept of Illusion. Haptic Interfaces - HAVE Sensors - HAVE Actuators - Performance Specifications - State-of-the-Art Haptic Interfaces.

**UNIT III COMPUTER HAPTICS****(9Hrs)**

Haptic Rendering Subsystem - Polygon-Based Representation and Scene Graph - Collision Detection Techniques and Bounding Volumes - Penetration Depth and Collision Response - Haptic Rendering of Surface Properties - Control Methods for Haptic Systems - Benchmarking Haptic Rendering Systems - Haptic Software Frameworks.

**UNIT IV MULTIMEDIA HAPTICS****(9Hrs)**

Haptics as a New Media - HAVE Content Creation - HAVE Content Representation - Haptic Media Transmission - Architectures for C-HAVE - Communication Frameworks for C-HAVE Systems - Quality of Experience in Multimedia Haptics – Haptics Watermarking.

**UNIT V DESIGNING HAPTIC SYSTEMS****(9Hrs)**

Kinematic Design: Basics - Serial Mechanisms - Parallel Mechanisms. Actuator Design: General Facts about Actuator Design - Electrodynamics Actuators - Electromagnetic Actuators - Piezoelectric Actuators – Electrostatic Actuators. Sensor Design: Constraints - Sensing Principles.

**Text Books**

1. Abdulmotaleb El Saddik, Mauricio Orozco, Mohamad Eid, Jongeun Cha, "Haptics Technologies: Bringing Touch to Multimedia, Springer-Verlag Berlin Heidelberg", 1st Edition, 2011.
2. Natalia Roberts, "Haptic Technology and Applications Hardcover – Import", 12 March 2015.
3. Robert Jütte, "Martin Grunwald (eds.), Human Haptic Perception: Basics and Applications", Birkhäuser Base, 1<sup>st</sup> Edition, 2008.

### Reference Books

1. Troy McDaniel and Sethuraman Panchanathan, "Haptic Interfaces for Accessibility, Health, and Enhanced Quality of Life" springer, 2020.
2. Natalia Roberts, "Haptic Technology and Applications Hardcover – Import", 12 March 2015.
3. Robert Jütte, "Martin Grunwald (eds.), Human Haptic Perception: Basics and Applications", Birkhäuser Base, 1<sup>st</sup> Edition, 2008.
4. Haptic Rendering: Foundations, Algorithms, and Applications Hardcover – Import, 25 July 2008 by Ming C. Lin, Miguel Otaduy
5. Human Haptic Perception Basics And Applications by Martin Grunwald, Birkhauser Verlag AG, Publisher Birkhauser Verlag AG, December 2008.

### Web Resources

1. <https://www.azosensors.com/article.aspx?ArticleID=1435>
2. <https://www.sciencedirect.com/topics/neuroscience/haptic-perception>
3. <https://electronics.howstuffworks.com/everyday-tech/haptic-technology.htm>
4. <https://www.rfwireless-world.com/Terminology/haptic-sensor.html>
5. [https://www.architectmagazine.com/technology/the-role-of-haptics-in-design\\_o](https://www.architectmagazine.com/technology/the-role-of-haptics-in-design_o)

### COs/POs/PSOs Mapping

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

Correlation Level: 1 - Low, 2 - Medium, 3 - High

## **Open Elective Courses offered to other Department students**

**U19CSO76****ARTIFICIAL INTELLIGENCE**

(Common to EEE, ICE, CIVIL, CCE, MECH, FT)

L	T	P	C	Hrs
3	0	0	3	45

**Course Objectives**

- To cover fundamentals of Artificial Intelligence,
- To understand various knowledge representation techniques.
- To provide knowledge of AI systems and its variants
- To understand the planning and different learning.
- To understand the communication process of language translator.

**course outcomes**

*On successful completion of this course students will be able to*

**CO1** - Understand the basics of Artificial Intelligence. **(K1)**

**CO2** - Apply AI problem solving techniques, knowledge representation, and reasoning methods in Knowledge based systems **(K3)**

**CO3** - Develop simple intelligent / expert system using available tools and techniques of AI to analyze and interpret domain knowledge. **(K3)**

**CO4** - Become familiar with planning and different learning methods. **(K3)**

**CO5** - Understanding the human language to Machine language and Robotics. **(K1)**

**UNIT I INTRODUCTION****(9 Hrs)**

Introduction - Foundations of AI – History of AI –Structure of AI agents, Problem solving - Informed and uninformed search techniques.

**UNIT II KNOWLEDGE REPRESENTATION AND REASONING****(9 Hrs)**

Logical Agents –Propositional logic - First-Order Logic - Forward and backward chaining - Knowledge Representation

**UNIT III UNCERTAIN KNOWLEDGE AND REASONING****(9 Hrs)**

Basic probability notations - Bayes rule – Wumpus world revisited - Bayesian network.

**UNIT IV PLANNING AND LEARNING****(9 Hrs)**

Introduction to planning, Planning in situational calculus - Representation for planning – Partial order planning algorithm- Learning from examples- Knowledge in Learning - Statistical Learning Methods - Reinforcement Learning.

**UNIT V COMMUNICATING, PERCEIVING AND ACTING****(9 Hrs)**

Natural Language Processing – Natural Language for communication – Perception - Robotics.

**Text Books**

1. Stuart Russel, Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
2. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill 2008.
3. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, Books Third edition, 2000.

**Reference Books**

1. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, Books Third edition, 2000.
2. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
3. George F Luger, Artificial Intelligence, Pearson Education, 6th edition, 2009.
4. EngeneCharniak and Drew Mc Dermott, "Introduction to Artificial intelligence, Addison Wesley 2000.
5. Nils J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 2000.

### Web Resources

- [https://www.tutorialspoint.com/artificial\\_intelligence/index.htm](https://www.tutorialspoint.com/artificial_intelligence/index.htm)
- <https://www.javatpoint.com/artificial-intelligence-tutorial>
- <https://www.w3schools.com/ai/>
- <https://www.mygreatlearning.com/blog/artificial-intelligence-tutorial/>
- <https://nptel.ac.in/courses/112/103/112103280/>

### COs/POs/PSOs Mapping

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

<b>U19CSO77</b>	<b>CLOUD TECHNOLOGY AND ITS APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
	(Common to EEE, ICE, MECH, CIVIL, BME, CCE, Mechatronics)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

- To define the fundamental ideas behind Cloud Computing.
- To classify the basic ideas and principles in cloud information system.
- To Relate cloud storage technologies and relevant distributed file systems.
- To Explain the Cloud Applications.
- To Define the Future of Cloud.

**Course Outcomes**

*After completion of the course, the students should be able to*

- CO1** - Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing. **(K1)**
- CO2** - Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacentres to build and deploy cloud applications that are resilient, elastic and cost-efficient. **(K3)**
- CO3** - Illustrate the fundamental concepts of Cloud Applications. **(K4)**
- CO4** - Explain the Applications of cloud. **(K3)**
- CO5** - Advancing towards a Cloud. **(K3)**

**UNIT I INTRODUCTION****(9 Hrs)**

Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization - Web Services Deliver from the Cloud – Communication-as-a-Service – Infrastructure-as-a-Service – Monitoring-as-a-Service – Platform-as-a-Service – Software-as-a-Service – Building Cloud Network.

**UNIT II CLOUD INFORMATION SYSTEMS****(9 Hrs)**

Federation in the Cloud - Presence in the Cloud - Privacy and its Relation to Cloud-Based Information Systems – Security in the Cloud - Common Standards in the Cloud – End-User Access to the Cloud Computing.

**UNIT III CLOUD INFRASTRUCTURE****(9 Hrs)**

Introduction– Evolving IT infrastructure – Evolving Software Applications –Service Oriented Architecture – Interoperability Standards for Data Center Management - Virtualization – Hyper Threading – Blade Servers - Automated Provisioning - Policy Based Automation – Application Management – Evaluating Utility Management Technology - Virtual Test and development Environment.

**UNIT IV CLOUD APPLICATIONS****(9 Hrs)**

Software Utility Application Architecture - Characteristics of a SaaS - Software Utility Applications - Cost Versus Value - Software Application Services Framework - Common Enablers – Conceptual view to Reality – Business Profits - Implementing Database Systems for Multitenant Architecture - Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

**UNIT V FUTURE OF CLOUD****(9 Hrs)**

Other Design Considerations - Design of a Web Services Metering Interface - Application Monitoring Implementation - A Design for an Update and Notification Policy - Transforming to Software as a Service - Application Transformation Program - Business Model Scenarios - Virtual Services for Organizations - The Future.

**Text Books**

1. Sandeep Bhowmik, & quot; Cloud Computing & quot;, Cambridge University Press; First edition, 2017..
2. Erl, 'Cloud Computing: Concepts, Technology & Architecture', Pearson Education India, 1st edition (1 January 2014).
3. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

**Reference Books**

1. Sanjiva Shankar Dubey, 'Cloud Computing and Beyond', Dreamtech Press 2 edition, 2019.
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
3. George Reese, "Cloud Application Architectures", O'reilly Publications, 2009.
4. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
5. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd. 2006.

**Web Resources**

1. [www.coltdatacentres.net/Cloud Technology](http://www.coltdatacentres.net/Cloud%20Technology).
2. [www.zdnet.com](http://www.zdnet.com).
3. <https://www.cloudbakers.com/blog/what-is-a-cloud-application>
4. <https://www.cloudbakers.com/blog/what-is-a-cloud-application>
5. <https://blog.servermania.com/what-is-a-cloud-application/>

**COs/POs/PSOs Mapping**

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

Correlation Level: 1 - Low, 2 - Medium, 3 - High

# **OPEN ELECTIVES**



	<b>IOT AND ITS APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19ECO75</b>	(Common to EEE, ICE, CSE, MECH, IT, CIVIL, CCE and FT)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

- To impart necessary and practical knowledge of components of Internet of Things.
- To attain the knowledge about different types of architecture and their elements of IoT.
- To understand the concepts of integration of devices and data's.
- To acquire the knowledge about remotely monitor data and control devices.
- To develop skills required to build real-time IoT based projects.

**Course Outcomes**

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

- CO1**-Understand internet of Things and its hardware and software components. **(K2)**  
**CO2**-Demonstrate the Interfacing of I/O devices, sensors & communication modules. **(K3)**  
**CO3**-Understand the concepts of remotely monitor data and control devices. **(K2)**  
**CO4**-Build and deploy an various architecture with their elements. **(K3)**  
**CO5**-Can develop real time IoT based projects. **(K3)**

**UNIT I INTRODUCTION TO INTERNET OF THINGS****(9 Hrs)**

The technology of the internet of things, making the internet of things, Elements of an IoT ecosystem, design principles for connected devices, Web thinking for connected devices.

**UNIT II ARCHITECTURE OF IoT****(9 Hrs)**

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

**UNIT III ELEMENTS OF IoT****(9 Hrs)**

Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces.  
 Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols- MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

**UNIT IV IoT APPLICATION DEVELOPMENT****(9 Hrs)**

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices

**UNIT V IoT APPLICATIONS****(9 Hrs)**

IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in Business to Master IoT, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

**Text Books**

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things, A Hands on Approach", University Press ,3rd/e ,Aug 2018.
2. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill ISBN: 9789352605224, 9789352605224, 2<sup>nd</sup> edition, May 2017.
3. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs 2014.

**Reference Books**

1. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2012.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2007.
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013.
4. CunoPfister, "Getting Started with the Internet of Things", O Reilly Media, 2015.
5. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.

**Web Resources**

1. <https://www.i-scoop.eu/internet-of-things-guide/>
2. <https://www.theinternetofthings.eu/>
3. <https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/>
4. <https://www.coursera.org/learn/iot>
5. [https://onlinecourses.nptel.ac.in/noc21\\_ee85/preview](https://onlinecourses.nptel.ac.in/noc21_ee85/preview)

**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	3	2	-	-	-	-	-	-	-	-	1	-	1
2	3	-	3	2	-	-	-	-	-	-	-	-	1	-	1
3	2	3	2	-	-	-	-	-	-	-	-	-	1	-	1
4	2	2	2	-	-	-	-	-	-	-	3	-	1	-	1
5	2	3	2	-	3	-	-	-	-	-	3	-	1	-	1

Correlation Level: 1-Low, 2-Medium, 3-High

<b>U19ECO76</b>	<b>SENSORS FOR INDUSTRIAL APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

(Common to EEE, ICE, CSE, MECH, IT,  
CIVIL, CCE, BME and Mechatronics)

**Course Objectives**

- To study principles of sensor and calibration
- To understand different types of motion sensors
- To demonstrate force, magnetic and heading sensors with its application to the learners
- To enhance students to understand the concept of optical, pressure and temperature sensor
- To select suitable sensor for industrial application

**Course Outcomes**

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

- CO1** - Explain principles of sensor and illustrate the calibration (K2)  
**CO2** - Demonstrate different types of range and sensors (K3)  
**CO3** - Determine the principles of Force, magnetic and heading sensors (K3)  
**CO4** - Describe different optical and thermal sensors (K2)  
**CO5** - Select suitable sensor for real time applications (K3)

**UNIT I INTRODUCTION****(9 Hrs)**

**Principles of Physical and Chemical Sensors:** Sensor classification, Sensing mechanism of Mechanical, Electrical, Thermal, Magnetic, Optical, Chemical and Biological Sensors.

**Sensor Characterization and Calibration:** Study of Static and Dynamic Characteristics, Sensor reliability, aging test, failure mechanisms and their evaluation and stability study.

**UNIT II MOTION, PROXIMITY AND RANGING SENSORS****(9 Hrs)**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

**UNIT III FORCE, MAGNETIC AND HEADING SENSORS****(9 Hrs)**

Strain Gage, Load Cell and Magnetic Sensors – types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclometers.

**UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS****(9 Hrs)**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement. Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

**UNIT V APPLICATIONS OF SENSORS****(9 Hrs)**

Applications of Sensors for Industry Automation - Design of smart Industry using Temperature, Humidity and Pressure sensors - Applications of Flow sensors in Industries - Applications of Gyro sensor. Applications of Position sensors.

**Text Books**

1. Patranabis D., "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., second edition 2005(revised).
2. Renganathan S., "Transducer Engineering", Allied Publishers (P) Ltd., 2005(revised).
3. Ernest O. Doebelin, "Measurement systems Application and Design", International Student Edition, VI Edition, Tata McGraw-Hill Book Company, 2012.

**Reference Books**

1. Kr.Iniewski, "Smart Sensors for Industrial Applications", CRC Press, 2017
2. Bolton W, "Mechatronics", Thomson Press, third edition, 2004.
3. Ian R Sinclair, —Sensors and TransducersI, Third Edition, Newnes publishers, 2001.
4. Robert B. Northrop, "Introduction to Instrumentation and Measurement", 3rd Edition", CRC – Press –Taylor and Francis Group, 2005
5. Curtis D. Johnson, "Process Control Instrumentation Technology", Prentice Hall International Edition, 2015.

**Web Resources**

1. <https://www.first-sensor.com/en/applications/industrial/>
2. <https://www.finoit.com/blog/top-15-sensor-types-used-iot/>
3. <https://www.iaasiaonline.com/smart-sensors-for-industrial-applications-2/>
4. <https://www.plantautomation-technology.com/articles/types-of-sensors-used-in-industrial-automation>
5. <https://www.thomasnet.com/articles/instruments-controls/sensors/>

**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	3	1	1	-	-	-	-	-	-	-	-	1	1	-	1
2	3	-	3	-	-	-	-	-	-	-	-	1	1	-	1
3	2	2	3	-	-	-	1	-	-	-	-	-	1	-	1
4	2	2	3	-	-	-	1	-	-	-	-	1	1	-	1
5	2	2	3	-	-	-	1	-	-	-	-	1	1	-	1

**Correlation Level: 1-Low, 2-Medium, 3- High**

	<b>AUTOMATION TECHNIQUES &amp; TOOLS - DEVOPS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19IT076</b>	(Common to EEE, ECE, ICE, CSE, MECH, CIVIL, CCE, BME and Mechatronics)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

- The Background and mindset of Devops
- To enable students appreciate the agile led development environment.
- To give the students a perspective to grasp the need for Minimum viable product led development using Sprints.
- To enable students acquire fundamental knowledge of CI/CD and CAMS.
- To enable learners realize various aspects of DevOps Ecosystem.

**Course Outcomes**

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

- CO1** - Explain traditional software development methodologies like waterfall.  
**CO2** - Apply the Agile Methodology and comparing various other software development models with agile.  
**CO3** - Explain implementing Continuous Integration and Continuous Delivery.  
**CO4** - Explain CAMS for DevOps (Culture, Automation, Measurement and Sharing).  
**CO5** - Create quick MVP prototypes for modules and functionalities.

**UNIT I TRADITIONAL SOFTWARE DEVELOPMENT (9 Hrs)**

The Advent of Software Engineering - Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation - Developers vs IT Operations conflict.

**UNIT II RISE OF AGILE METHODOLOGIES (9 Hrs)**

Agile movement in 2000 - Agile Vs Waterfall Method - Iterative Agile Software Development - Individual and team interactions over processes and tools - Working software over comprehensive documentation - Customer collaboration over contract negotiation - Responding to change over following a plan

**UNIT III INTRODUCTION DEVOPS (9 Hrs)**

Introduction to DevOps - Version control - Automated testing - Continuous integration - Continuous delivery - Deployment pipeline - Infrastructure management – Databases

**UNIT IV PURPOSE OF DEVOPS (9 Hrs)**

Minimum Viable Product- Application Deployment- Continuous Integration- Continuous Delivery.

**UNIT V CAMS (CULTURE, AUTOMATION, MEASUREMENT AND SHARING) (9 Hrs)**

CAMS – Culture, CAMS – Automation, CAMS – Measurement, CAMS – Sharing, Test-Driven Development, Configuration Management-Infrastructure Automation- Root Cause Analysis- Blamelessness- Organizational Learning

**Text Books**

1. Dev Ops – Volume 1 , Pearson and Xebia Press
2. Grig Gheorghiu, Alfredo Deza, Kennedy Behrman, Noah Gift, Python for DevOps,2019

**Reference Books**

1. The DevOps Handbook - Book by Gene Kim, Jez Humble, Patrick Debois, and Willis Willis
2. What is DevOps? - by Mike Loukides
3. Joakim Verona, Practical DevOps ,2016.

**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	1	-	-	2	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	2	-	-	-	-	-	-	-	3	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	3	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	2	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

	<b>AUGMENTED AND VIRTUAL REALITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19IT077</b>	(Common to EEE, ICE, MECH, CIVIL, CCE and BME)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

- To learn basics of VR and AR systems
- To know about basic Augment reality functions
- To know about basic Virtual reality functions
- To know about Virtual reality environment and steps to work on it
- To learn various application on AR and VR

**Course Outcomes**

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

- CO1** - Understand the concepts of VR  
**CO2** - Work on different VR modelling Process  
**CO3**- Learn applications of virtual reality environment  
**CO4**- Understand and work on Augmented Reality environment  
**CO5** - Work on applications related to VR and AR

**UNIT I VIRTUAL REALITY AND 3D COMPUTER GRAPHICS (9Hrs)**

Introduction - Benefits of virtual reality - The Virtual world space – Positioning the virtual observer – Stereo perspective projection – 3D clipping – Color Theory – Simple 3D modeling – Illumination models – Reflection models – Shading algorithms

**UNIT II VR MODELLING PROCESS (9Hrs)**

Geometric modeling – kinematics modeling- physical modeling – behaviour modeling – model Management.

**UNIT III CONTENT CREATION CONSIDERATIONS FOR VR (9Hrs)**

Methodology and terminology - user performance studies - VR health and safety issues – Usability of virtual reality system - cyber sickness -side effects of exposures to virtual reality environment

**UNIT IV AUGMENTED REALITY (AR) (9Hrs)**

Introduction – Benefits of AR – Key players of AR technology - Understanding Augmented reality - Working with AR and System structure

**UNIT -V APPLICATIONS ON VR (9Hrs)**

Medical applications- robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations

**Text Books**

1. Kelly S. Hale , Kay M. Stanney," Handbook of Virtual Environments: Design, Implementation, and Applications", Human Factors and Ergonomics ,Second Edition , 2014.
2. C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Gregory, John Wiley and Sons, Inc., Second Edition, 2008.
3. Jason Jerald, "The VR Book: Human-Centred Design for Virtual Reality". Association for Computing Machinery and Morgan and Claypool, New York, 2015.

### Reference Books

1. Dieter Schmalstieg and Tobias Hollerer , "Augmented Reality: Principles and Practice (Usability) " , Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
2. Steve Aukstakalnis , "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)", Addison-Wesley Professional; 1 edition, 2016.
3. Tony Parisi , "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", OReilly Media, 1<sup>st</sup> edition, 2015.
4. Tony Parisi , "Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages", OReilly Media, 1<sup>st</sup> edition, 2014.

### Web References

1. <https://www.coursera.org/courses?query=augmented%20reality>
2. <https://nptel.ac.in/courses/106/106/106106138/>
3. <http://www.vrmedia.it/en/xvr.html>
4. <http://www.hitl.washington.edu/artoolkit/>

### 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	1	-	-	2	-	-	-	-	2	-	2	1	2	3
2	2	1	-	-	2	-	-	-	-	2	-	2	1	2	3
3	2	1	-	-	2	-	-	-	-	2	-	2	1	2	3
4	2	1	-	-	2	-	-	-	-	2	-	2	1	2	3
5	2	1	-	-	2	-	-	-	-	2	-	2	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High



U19IC075

**INDUSTRIAL AUTOMATION**

L	T	P	C	Hrs
3	0	0	3	45

(Common to EEE, ECE, CSE, MECH, IT,  
CIVIL, CCE, BME and Mechatronics)

**Course Objectives**

- To know about the design of a system using PLC.
- To study about PLC Programming
- To study knowledge on application of PLC
- To have an exposure SCADA architecture
- To know about the fundamentals of DCS.

**Course Outcomes**

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

- CO1-** Know the fundamentals of data networks and Understand working of PLC,I/O modules of PLC, automation and applications in industry.
- CO2-** Know about the design of systems using PLC and PLC programming.
- CO3-** Acquire knowledge on application of PLC
- CO4-** Know about the SCADA architecture, communication in SCADA, develop any application based on SCADA along with GUI using SCADA software.
- CO5-** Know the fundamentals of DCS.

**UNIT I PLC ARCHITECTURE****(9 Hrs)**

Introduction and overview of Industrial automation – Block diagram of PLC – different types of PLC – Type of input and output – Introduction to relay logic- Application of PLC.

**UNIT II PLC PROGRAMMING****(9 Hrs)**

Introduction to Ladder logic programming – Basic instructions – Timer and Counter instruction Arithmetic and logical instruction – MCR, PID controller and other essential instruction sets - Case studies and examples for each instruction set.

**UNIT III APPLICATION OF PLC****(9 Hrs)**

Introduction to high level PLC language – Programming of PLC using simulation software – Real time interface and control of process rig/switches using PLC.

**UNIT IV INTRODUCTION OF SCADA****(9 Hrs)**

Introduction to DCS and SCADA - Block diagram – function of each component – Security objective – Operation and engineering station interface – Communication requirements.

**UNIT V DISTRIBUTED CONTROL SYSTEM****(9 Hrs)**

Development of different control block using DCS simulation software – Real time control of test rigs using DCS. Introduction to HART, Field bus and PROFIBUS – Application and case studies of large scale process control using DCS.

**Text Books**

1. John W. Webb and Ronald A Reis, Programmable Logic Controllers - Principles and Applications, Prentice Hall Inc., New Jersey, 5<sup>th</sup> Edition, 2002.
2. Lukcas M.P, Distributed Control Systems, Van Nostrand Reinhold Co., New York, 1986.
3. Frank D. Petruzella, Programmable Logic Controllers, McGraw Hill, New York, 4<sup>th</sup> Edition, 2010.

**Reference Books**

1. Deshpande P.B and Ash R.H, Elements of Process Control Applications, ISA Press, New York, 1995.
2. Curtis D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi, 8th Edition, 2005.
3. Krishna Kant, Computer-based Industrial Control, Prentice Hall, New Delhi, 2 nd Edition, 2011.

**Web Resources**

1. <https://nptel.ac.in/courses/108105063/>
2. <https://www.google.com/amp/s/controlstation.com/what-is-a-distributed-control-system/amp/>
3. <https://nptel.ac.in/courses/108/105/108105088/>
4. [https://onlinecourses.nptel.ac.in/noc20\\_me39/preview](https://onlinecourses.nptel.ac.in/noc20_me39/preview)
5. [https://nptel.ac.in/content/syllabus\\_pdf/108105088.pdf](https://nptel.ac.in/content/syllabus_pdf/108105088.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	3	3	1	-	-	1	-	-	-	1	1	2	2	3	2
2	3	3	1	-	-	1	-	-	-	1	1	2	2	3	2
3	3	2	1	-	-	1	-	-	-	1	1	2	2	3	2
4	2	3	1	-	-	1	-	-	-	1	1	2	2	3	2
5	3	2	1	-	-	1	-	-	-	1	1	3	2	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

	<b>GLOBAL WARMING AND CLIMATE CHANGE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19CE076</b>	(Common to EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS and FT)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

*This course should enable the students to*

- Understand the basics and importance of global warming.
- Gain adequate knowledge about the characteristic of atmosphere components.
- Gain knowledge about impact of climate change.
- Gain knowledge about the Changes in Climate and Environment
- Impart knowledge about the mitigation measures

**Course Outcomes**

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

- CO1** - Understand the concept and effects of global warming **(K2)**
- CO2** - Understand Climate system, earth's atmosphere and its components. **(K2)**
- CO3** - Analyze the Impacts of Climate Change on various sectors **(K4)**
- CO4** - Assess the concept about carbon credit and clean development mechanism. **(K3)**
- CO5** - Understand climate changes, its impact and mitigation activities. **(K2)**

**KNOWLEDGE LEVEL: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze and K5 – Evaluate**

**UNIT I EARTH'S CLIMATE SYSTEM****(9 Hrs)**

Ozone layer-Role of ozone in environment-ozone depleting -Green House gases- Effects of Greenhouse Gases- Global Warming -Hydrological Cycle – Radiative Effects and Carbon Cycle.

**UNIT II ATMOSPHERE AND ITS COMPONENTS****(9 Hrs)**

Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.

**UNIT III IMPACTS OF CLIMATE CHANGE****(9 Hrs)**

Causes of Climate change : Change of Temperature in the environment-Melting of ice Pole-sea level rise- Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

**UNIT IV OBSERVED CHANGES AND ITS CAUSES****(9 Hrs)**

Climate change and Carbon credits- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks –The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India .

**UNIT V CLIMATE CHANGE AND MITIGATION MEASURES****(9 Hrs)**

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels —Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices–Carbon sequestration – Carbon capture and storage (CCS) – International and Regional cooperation- Remedial measures.

**Text Books**

1. Joan Fitzgerald "Greenovation: Urban Leadership on Climate Change, Oxford University Press 2020.
2. J. David Neelin" Climate change and climate modelling" Cambridge University press (2011).
3. Robin Moilveen "Fundamentals of weather and climate" Oxford University Press (2nd Edition) (2010),
4. Andrew Dessler and Edward A. Parson "The Science and Politics of Global Climate Change" 2009
5. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

**Reference Books**

1. Bill McKibben(2012), The Global Warming Reader: A Century of Writing About Climate Change, Penguin.
2. Jason Smerdon(2009) Climate Change: The Science of Global Warming and Our Energy Future, Columbia University
3. Adaptation (2006) and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge.
4. J.M. Wallace and P.V. Hobbs (2006) Atmospheric Science, Elsevier / Academic Press.
5. Jan C. van Dam,(2003) Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press,.

**Web References**

1. <https://nptel.ac.in/courses/105102089/>
2. <https://www.warmheartworldwide>
3. <https://nptel.ac.in/content/storage>

**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	3	3	3	3	3	3	3	3	3	3	2	2	3
2	3	3	2	3	3	3	3	3	3	2	3	3	3	3	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	2	3	3	2	3	3	3	3	3	3	3	3	2	3	3
5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

	<b>DATA SCIENCE APPLICATION OF NLP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19ADO73</b>	(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME and Mechatronics)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

### Course Objectives

- To introduce the fundamental concepts and techniques of Natural language Processing(NLP)
- To analyzing words based on Text processing.
- To analyzing words based on Morphology.
- To examine the syntax and language modeling
- To get acquainted with syntax and semantics

### Course Outcomes

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

- CO1** - Understand the principles and process the Human Languages such as English using computers. **(K2)**  
**CO2** - Creating CORPUS linguistics based on digestive approach (Text Corpus method). **(K2)**  
**CO3** - Demonstrate the techniques for text-based Processing of NLP with respect to morphology. **(K4)**  
**CO4** - Perform POS tagging for a given natural language. **(K3)**  
**CO5** - Check the syntactic and semantic correctness of sentences using grammars and labelling. **(K3)**

**(9 Hrs)**

### UNIT I INTRODUCTION TO NLP

Introduction to various levels of natural language processing, Ambiguities and computational challenges in processing various natural languages. Introduction to Real life applications of NLP such as spell and grammar checkers, information extraction, and machine translation.

**(9 Hrs)**

### UNIT II TEXT PROCESSING

Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis.

**(9 Hrs)**

### UNIT III MORPHOLOGY

Inflectional and Derivation Morphology, Morphological Analysis and Generation using finite state transducers.

**(9 Hrs)**

### UNIT IV LEXICAL SYNTAX AND LANGUAGE MODELING

Introduction to word types, POS Tagging, Maximum Entropy Models for POS tagging, Multi-word Expressions - The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.

**(9 Hrs)**

### UNIT V SYNTAX AND SEMANTICS

Introduction to phrases, clauses and sentence structure, Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, Word Sense. Disambiguation, WordNet, Thematic Roles, Semantic Role Labelling with CRFs. Applications of NLP.

### Text Books

1. Dan Jurafsky, James H. Martin, "Speech and Language Processing", Third Edition, Prentice Hall, 2018.
2. Emily Bender, "Linguistics Fundamentals for NLP", Morgan Claypool Publishers, 2013.
3. Jacob Eisenstein, "Introduction to Natural Language Processing", MIT Press, 2019.

**Reference Books**

1. Chris Manning, Hinrich Schuetze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
2. Cole Howard, Hobson Lane, Hannes Hapke, "Natural Language Processing in Action" Manning Publication 2019.
3. Li Deng, Yang Liu "Deep Learning in Natural Language Processing" Springer, 2018.
4. Tom Hoobyar, Tom Dotz, Susan Sanders, "NLP The Essential Guide to Neuro-Linguistic Programming", William Morrow Paperbacks, 2013.
5. Kate Burton, "Coaching With NLP For Dummies", Wiley, 2011.

**Web Resources**

1. <https://machinelearningmastery.com/natural-language-processing/>
2. <https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1>
3. <https://www.nlp.com/what-is-nlp/>

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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	–	1	-	-	-	-	-	-	-	2	1	-
2	2	2	1	–	–	-	-	-	-	-	-	-	1	1	1
3	2	2	1	2	–	-	-	-	-	-	-	-	-	1	1
4	1	2	2	2	1	-	-	-	-	-	-	-	1	-	2
5	2	1	2	2	1	-	-	-	-	-	-	-	1	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

<b>ARTIFICIAL INTELLIGENCE APPLICATIONS</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs</b>
<b>U19ADO74</b>	(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE and BME)	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>45</b>

**Course Objectives**

- To study the basic design concept of AI.
- To understand the Machine learning concepts.
- To learn the concept of Deep learning and its applications
- To learn the concept of RPA.
- To acquire the skill to design a chatbot using NLP.

**Course Outcomes**

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

- CO1** - Apply the concept of data science. **(K3)**  
**CO2** - Understand the concept of Machine learning. **(K2)**  
**CO3** - Understand the concept of Deep Learning. **(K2)**  
**CO4** - Apply the design ideas in RPA. **(K3)**  
**CO5** - Make use of NLP concepts to create chatbot. **(K3)**

**UNIT I INTRODUCTION****(9 Hrs)**

Introduction – Alan Turing and Turing test - The rise and fall of expert system - technological drivers of modern AI - Structure of AI - Data: types of Data - Big Data - Database and other tools - Data Process - Ethics and Governance - Data terms.

**UNIT II MACHINE LEARNING****(9 Hrs)**

Machine learning - Standard deviation - the normal distribution - Naive Bayes Classifier - K-Nearest Neighbor - Linear regression - K-Means Clustering.

**UNIT III DEEP LEARNING****(9 Hrs)**

Deep Learning - Difference between Deep Learning and Machine learning – ANN – Backpropagation – RNN – CNN – GAN - Deep Learning Applications - Use Case: detecting Alzheimer's Disease - Deep Learning Hardware - When to use Deep Learning? - Drawbacks of deep learning.

**UNIT IV ROBOTIC PROCESS AUTOMATION****(9 Hrs)**

RPA - pros and cons of RPA - Determine the right function to automate - assess the processes - RAP and AI - RPA in the real world.

**UNIT V NATURAL LANGUAGE PROCESSING****(9 Hrs)**

Challenges of NLP - Understanding How AI translated Language - NLP in real World - Voice Commerce - Virtual assistants – Chatbot - Future of NLP - The Future of AI.

**Text Books**

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing" Third Edition. 2000.
2. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva, "Artificial Intelligence (AI) Recent Trends and Applications" CRC Press, 2021.
3. Navin Sabharwal; Amit Agrawal, "Cognitive Virtual Assistants Using Google Dialogflow" Apress, 2020.

### Reference Books

1. Durkin, J., "Expert systems Design and Development", Macmillan, 1994.
2. Peter Jackson, "Introduction to Expert Systems", Addison Wesley Longman, 1999.
3. Amir Shevat, "Designing Bots: Creating Conversational Experiences" O'Reilly, 2017.
4. Anik Das and Rashid Khan, "Build Better Chatbots: A Complete Guide to Getting Started with Chatbots" Apress, 2017.
5. Akhil Mittal "Getting Started with Chatbots: Learn and create your own chatbot with deep understanding of Artificial Intelligence and Machine Learning" BPB Publications, 2019

### Web Resources

1. <https://www.javatpoint.com/application-of-ai>
2. [https://pytorch.org/tutorials/beginner/chatbot\\_tutorial.html](https://pytorch.org/tutorials/beginner/chatbot_tutorial.html)
3. <https://www.mygreatlearning.com/blog/basics-of-building-an-artificial-intelligence-chatbot/>
4. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/lecture-videos/lecture-3-reasoning-goal-trees-and-rule-based-expert-systems/>
5. <http://www.umsl.edu/~joshik/msis480/chapt11.htm>

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2	2	1	1	1	2	-	-	-	-	-	-	-	1	1	1
3	2	2	1	2	2	-	-	-	-	-	-	-	-	1	1
4	1	2	2	2	1	-	-	-	-	-	-	-	2	-	1
5	2	2	2	2	1	-	-	-	-	-	-	-	1	1	-

Correlation Level: 1-Low, 2-Medium, 3- High



**ANNEXURE - II**



**Department of Computer Science and Engineering**

**Details of Examiners for Question Paper Setter and Evaluators**

Sl.No	Name of the Examiner	Specialization	Designation, Department and Institution in which currently working	Contact number and mail id
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