



**NADIMPALLI SATYANARAYANA RAJU  
INSTITUTE OF TECHNOLOGY  
(AUTONOMOUS)**



Approved by AICTE, New Delhi & Affiliated to JNTU, Kakinada & An ISO 9001:2015 & ISO 45001 Certified Institution  
Recognized under 2(f) of the UGC Act 1956 & Accredited by NAAC with 'A' Grade (3,18/4-00)  
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**Computer Science and Engineering (Data Science)**

Few specific feedbacks received reflecting the needs of stakeholders at Local-, Regional-, National, International level  
(The feedbacks are received through centralised online system using google form with timestamp and reflected in the Feedback Form by the Program Coordinator of Computer Science Engineering (Data Science) for documentation attested by the HoD). The received feedback (s) are further discussed in the internal pre-BoS meeting and escalated to the BoS for necessary approval.


S. No	Few Feedback at	Few specific feedback received from stakeholders	Integration into the curriculum		Semester	POs/PSOs
			Course-Code	Course-Name		
1	Local Level	Foundations of Data Science	20DS302	Foundations of Data Science	III	01, 02, 03
		<b>Statistical and Probabilistic Approaches to Understand Data</b>	20BSX17	Probability and Statistics with Python	IV	02, 05
		Awareness of Ethical Principles	20HSX04	Professional Ethics	VII	08
2	National Level	Internet of Things	20CS004	Internet of things	VI	01, 04, 05
		Master Competitive Coding Techniques	20AIS02	Competitive Programming Essentials	IV	03,04,05
		Managing Network Security Module	20CS601	Cryptography and Network Security	VI	01, 02, 04, 05, PSO2
		Data Mining and Social Network Analysis	20DS014	Social Networking and Mining	VII	01, 02, 03, 05

**Commented [ds1]:** Few feedback received and action taken are furnished in this page as samples and rest of the evidences are attached in the trailing part of the document pertaining to CSE (DS)

**Commented [ds2]:** Suggested to include Statistical and Probability approach in the Curriculum of Data Science as it plays a vital role in the Data Science Curriculum.

*[Signature]*  
25/11/23  
Head of the Department  
Computer Science and Engineering  
N.S. Raju Institute of Technology  
Sontyam, Visakhapatnam - 531173

		Architectures and Algorithms of IoT	20ECO01	Architectures and Algorithms of IoT	V	01, 04, 05
		Engineering Technical Report in Academics		Technical Paper Writing	V	PO1 – PO12
		Summer Internship		Summer Internship 1	IV	5, 8, 9, 10, PSO 1
		Industry 4.0		Summer Internship 2	VI	5, 8, 9, 10, PSO 1
3	International Level	Cyber Physical Systems	20DSO19	Cloud Security	VII	01, 02, 04, 05, PSO 1, 2
		Project Based Learning	20SHO02	Design the Thinking	VI	01, 04, 05, PSO 1

  
**Head of the Department**  
 Head of the Department  
 Computer Science and Engineering  
 N.S .Raju Institute of Technology  
 Sontyam, Visakhapatnam - 531173

**C 20DS408 Probability and Statistics lab with R Programming Language**

**0 0 3 1.5**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		DoK
		PO1	PO4	
20DS408.1	Understand "R" Basics	3	1	L1, L2
20DS408.2	Understand "R" Data Structures	3	1	L1, L2
20DS408.3	Demonstrate Data Visualization With "R"	3	1	L1, L2
20DS408.4	Demonstrate Regression With "R"	3	1	L1, L2
20DS408.5	Implement the Concepts of Statistics With "R"	3	1	L1, L2

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos

L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge

**List of Experiments**

1. Write a R program to demonstrate Loops
2. Write a R program for Lists, Vectors, Arrays
3. Write a R program to demonstrate Matrix, Data Frame, Factors
4. Write a R program to demonstrate Histogram, Line Graph, Scatter Plots.
5. Write a R program to demonstrate Linear, Multiple Regression to a real world problem.
6. Write a R program to demonstrate Logistic, Poisson Regression to a real world problem.
7. Write a R program to demonstrate Normal, Binomial Distribution.
8. Demonstrate Time Series Analysis with "R"

**References**

1. Lab Manual for Probability and Statistics lab with R Programming Lab, Department of CSE (Data Science), NSRIT

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*K. Madhan*

Chairman  
Board of Studies (CSE-DS)



### Computer Science and Engineering (Data Science)

Credit requirement for the award of the degree under academic Regulation 2020-2021 for the candidates admitted from the academic year 2021 onwards

	Four Years	Three Years
B.Tech.(Regular Degree)	160	121
B.Tech.(Honors Degree)	180	141
B.Tech.(With Minor specialization other than Chosen Branch of Engg. & Tech.)	180	141

#### Semester I

No.	Code	Course	POs	Contact Hours				
				L	T <sup>1</sup>	P	C	
01	20HSX01	Communicative English	10	3	0	0	3.0	HS
02	20BSX11	Linear Algebra and Differential Equations	1,12 <sup>2</sup>	3	1	0	3.0	BS
03	20BSX33	Applied Physics	1	3	1	0	3.0	BS
04	20ESX02	Programming for Problem Solving using 'C'	1	3	0	0	3.0	ES
05	20CS101	Fundamentals of Computer Science	1	3	0	0	3.0	ES
06	20BSX34	Applied Physics Lab	1, 4	0	0	3	1.5	BS
07	20HSX02	Communicative English Lab	10	0	0	3	1.5	HS
08	20ESX07	Programming for Problem Solving using 'C' Lab	1, 4	0	0	3	1.5	ES
Sub-total				15	02	09	19.5	

#### Semester II

01	20BSX12	Partial Differential Equations and Vector Calculus	1	3	1	0	3.0	BS
02	20BSX23	Applied Chemistry	1	3	1	0	3.0	BS
03	20ESX05	Basic Electrical and Electronics Engineering	1, 2	3	1	0	3.0	ES
04	20CS201	Data Structures using 'C'	1	3	1	0	3.0	ES
05	20EC203	Digital Logic Design	1	3	1	0	3.0	ES
06	20BSX24	Applied Chemistry Lab	1, 4	0	0	3	1.5	BS
07	20ESX08	Basic Electrical & Electronics Engineering Lab	1, 4	0	0	3	1.5	ES
08	20CS202	Data Structures using 'C' Lab	1, 4	0	0	3	1.5	ES
09	20NCX01	Environmental Science	1	2	0	0	-	NC
Sub-total				17	05	09	19.5	

#### Semester III

01	20BSX16	Mathematical Foundations of Computer Science	1	3	1	0	3.0	BS
02	20CS302	Design and Analysis of Algorithms	1,2,3	3	1	0	3.0	PC
03	20CS303	Database Management Systems	1	3	1	0	3.0	PC
04	20CS304	Programming with Python	2	3	1	0	3.0	PC
05	20CS305	Computer Organization	1	3	1	0	3.0	PC
06	20CS307	Database Management Systems Lab	1, 4	0	0	3	1.5	PC
07	20CS307	Programming with Python Lab	1, 4	0	0	3	1.5	PC
08	20CS306	Design and Analysis of Algorithms Lab	4	0	0	3	1.5	PC
09	20OSS01	Short-term Skill Oriented Elective	1, 5, 10	0	0	4	2.0	SC
10	20NCX02	Constitution of India <sup>3</sup>	-	2	0	0	-	NC
Sub-total				17	05	09	21.5	

<sup>1</sup>Suggested tutorial hours will not carry any credits

<sup>2</sup>By default, all courses are mapped to PO 12 as they are weakly contributing

<sup>3</sup>It is mandate for all students to pursue an online certification course for minimum duration of 30 hours

Semester IV								
No.	Code	Course	POs	Contact Hours				
				L	T	P	C	
01	20HSX03	Managerial Economics and Financial Analysis	11	3	0	0	3.0	HS
02	20BSX15	Probability and Statistics	2,5	3	1	0	3.0	BS
03	20CS404	Operating Systems	1	3	1	0	3.0	PC
04	20CS502	Computer Networks	1,2	3	0	0	3.0	PC
05	20DS405	Foundations of Data Science	1,3	3	1	0	3.0	PC
06	20CS408	Operating Systems Lab	1,4	0	0	3	1.5	PC
07	20DS407	Foundations of Data Science Lab	1,4	0	0	3	1.5	PC
08	20DS408	Probability and Statistics Lab with R programming Language	1,4	0	0	3	1.5	PC
09	20DGS02	Short-term Skill Oriented Elective	1, 5, 10	0	0	4	2.0	SC
Sub-total				16	03	11	21.5	
Semester V								
01	20CS405	Theory of Computation	1, 2	3	1	0	3.0	PC
02	20DS502	Big Data	1, 2	3	1	0	3.0	PC
03	20AIS02	Machine Learning	1, 2, 3	3	1	0	3.0	PC
04	-	Professional Elective I	-	3	0	0	3.0	PE
05	-	Open Elective I	-	3	0	0	3.0	OE
06	20AIS07	Machine Learning Lab	4	0	0	3	1.5	PC
07	20DS507	Big Data Lab	4, 5	0	0	3	1.5	PC
08	20DSS03	Technical Paper Writing <sup>a</sup>	1,4, 5, 10	0	0	4	2.0	SC
09	20MCX03	Intellectual Property Rights and Patents <sup>b</sup>	-	2	0	0	-	MC
10	-	Summer Internship#1 <sup>c</sup> / CSP	5,8,9,10,PSO1	0	0	0	1.5	IN
Sub-total				17	03	08	21.5	

<sup>a</sup>The students are expected to identify one research area in the recent trends, collect recent research articles, prepare a technical research review paper and publish in renowned annual conferences/ journals, preferably indexed in Scopus or UGC care

<sup>b</sup>It is mandate for all students to pursue an online certification course for minimum duration of 30 hours

<sup>c</sup>The work pertaining to summer Internship #1 and #2 shall be completed at the end of the semesters IV & VI respectively. The assessment shall be carried out during the semesters V and VII

It is mandate for all the students to undergo 4-6 weeks of industrial training and appear for assessment during Semester V with report. With regard to Community Service Project (CSP), based on the availability the students can opt CSP as an alternate option for summer internship #1 for a duration of 08 weeks

Semester VI									
01	20CS501	Java Programming	1	3	1	0	3.0	PC	
02	20CS402	Data Ware Housing and Mining	3, 5	3	1	0	3.0	PC	
03	20DS603	Data Visualization	2, 3, 5	3	0	0	3.0	PC	
04	-	Professional Elective II	-	3	1	0	3.0	PE	
05	-	Open Elective II	-	3	0	0	3.0	OE	
06	20DS606	Data Visualization Lab	4, 5	0	0	3	1.5	PC	
07	20CS506	Java Programming Lab	4	0	0	3	1.5	PC	
08	20CS406	Data Mining Lab	4, 5	0	0	3	1.5	PC	
09	20DS604	Short-term Skill Oriented Elective	1, 5, 10	0	0	4	2.0	SC	
10	20MCX04	Indian Traditional Knowledge <sup>7</sup>	-	2	0	0	-	MC	
				<b>Sub-total</b>	<b>17</b>	<b>03</b>	<b>13</b>	<b>21.5</b>	
Semester VII									
01	-	Professional Elective III	-	3	0	0	3.0	PE	
02	-	Professional Elective IV	-	3	0	0	3.0	PE	
03	-	Professional Elective V	-	3	0	0	3.0	PE	
04	-	Open Elective III	-	2	0	0	3.0	OE	
05	-	Open Elective IV	-	2	0	0	3.0	OE	
06	20HSX04	Professional Ethics	8	3	0	0	3.0	HS	
07	20DS605	Finishing School for Data Science	9,PS01	0	0	4	2.0	SC	
08	-	Summer Internship <sup>8</sup>	5,8,9,10,PS01	0	0	0	3.0	IN	
				<b>Sub-total</b>	<b>16</b>	<b>0</b>	<b>04</b>	<b>23.0</b>	
Semester VIII									
01	-	Full Semester Internship <sup>9</sup>	5-10,PS01,PS02	0	0	0	06	IN	
02	-	Capstone Project	5-10,PS01,PS02	0	0	0	06	IN	
				<b>Sub-total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12.0</b>	
				<b>Total Credits</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>160</b>	

<sup>7</sup>It is mandate for all the students to pursue an online certification course for minimum duration of 30 hours

<sup>8</sup>It is mandate for all the students to undergo 6-8 weeks of industrial training and appear for assessment during Semester VII with report and those opted FSI during Semester VII shall appear through online for reviews

<sup>9</sup>Students opting for FSI in VII semester have to take up courses of VII semester in VIII semester. The students are expected to do a capstone project parallelly demonstrating their POs & PSOs and submit a separate report

## List of Electives

Professional Elective#1								
1	20CS003	Modern Software Engineering	-	3	0	0	3.0	PE
2	20DS002	Computer Vision	-	3	0	0	3.0	PE
3	20AI405	Artificial Intelligence	-	3	0	0	3.0	PE
4	20DS004	Fundamentals of Natural Language Processing	-	3	0	0	3.0	PE
5	20CS005	Mobile Computing	-	3	0	0	3.0	PE
Professional Elective#2								
6	20CS001	Object Oriented Analysis and Design	-	3	0	0	3.0	PE
7	20DS007	Digital Image Processing and Applications	-	3	0	0	3.0	PE
8	20AI603	Artificial Neural Networks	-	3	0	0	3.0	PE
9	20DS009	Data Acquisition and Production	-	3	0	0	3.0	PE
10	20CS601	Cryptography and Network Security	-	3	0	0	3.0	PE
Professional Elective#3								
11	20CS011	Software Testing Methodologies	-	3	0	0	3.0	PE
12	20DS012	Pattern Recognition	-	3	0	0	3.0	PE
13	20DS013	Deep Learning	-	3	0	0	3.0	PE
14	20DS014	Social Networking and Mining	-	3	0	0	3.0	PE
15	20CS010	Cloud Computing	-	3	0	0	3.0	PE
Professional Elective#4								
16	20CS016	Software Project Management	-	3	0	0	3.0	PE
17	20DS017	Image and Video Analytics	-	3	0	0	3.0	PE
18	20DS018	Web Intelligence	-	3	0	0	3.0	PE
19	20DS019	Cloud Security	-	3	0	0	3.0	PE
20	20DS020	Embedded Systems	-	3	0	0	3.0	PE
Professional Elective#5								
The curriculum provides academic flexibility to choose any of the domain specific courses from MCOCs as approved by the respective Board of Studies and Academic Council. The students can take up this course on self study mode. The course shall be of 45-60 hours duration (4 credits) and the assessment shall be as per the academic regulation 2020.								
								PE
Open Elective #1								
21	20CE001	Urban Environmental Services	-	3	0	0	3.0	OE
22	20CS001	Data Structures and Algorithms	-	3	0	0	3.0	OE
23	20AI001	Machine Learning for Engineers	-	3	0	0	3.0	OE
24	20DS001	Introduction to Database Management Systems	-	3	0	0	3.0	OE
25	20EC001	Architecture and Algorithms of IoT	-	3	0	0	3.0	OE
26	20EE001	Introduction to Renewable Energy Sources	-	3	0	0	3.0	OE
27	20ME001	Nano Technology	-	3	0	0	3.0	OE
28	20SH001	Women and Society	-	3	0	0	3.0	OE
Open Elective #2								
29	20CE002	Ecology, Environment and Resource Management	-	3	0	0	3.0	OE
30	20CS002	Designing the Internet of Things	-	3	0	0	3.0	OE
31	20AI002	Fundamentals of Deep Learning	-	3	0	0	3.0	OE
32	20DS002	Introduction to Data Science	-	3	0	0	3.0	OE
33	20EC002	IoT for Smart Grids	-	3	0	0	3.0	OE
34	20EE002	Electrical Safety and Management	-	3	0	0	3.0	OE
35	20ME002	Fundamentals of Automobile Engineering	-	3	0	0	3.0	OE
Open Elective #3								
36	20CE003	Disaster, Risk mitigation and Management	-	3	0	0	3.0	OE
37	20CS404	Operating Systems	-	3	0	0	3.0	OE
38	20AI003	Fundamentals of AI	-	3	0	0	3.0	OE
39	20DS003	Introduction to Big Data	-	3	0	0	3.0	OE
40	20EC003	Privacy and Security in IoT	-	3	0	0	3.0	OE
41	20EE003	Low-cost Automation	-	3	0	0	3.0	OE
42	20ME003	Industrial Automation	-	3	0	0	3.0	OE
43	20SH002	Design Thinking	-	3	0	0	3.0	OE

**Open Elective #4**

The curriculum provides academic flexibility to choose any of the inter-disciplinary courses from MOOCs as approved by the respective Board of Studies and Academic Council. The students can take up this course on self-study mode. The course shall be of 45 – 60 hours duration and the assessment shall be as per the academic regulation 2020.

OE

**B. Tech. (Honors)**

**Category I**

1	20DSH01	Text Analytics	-	4	0	0	4.0	HO
2	20DSH02	Computational Statistics for Data Science	-	4	0	0	4.0	HO
3	20DSH03	Introduction to Tableau	-	4	0	0	4.0	HO

**Category II**

4	20DSH04	Recommender Systems	-	4	0	0	4.0	HO
5	20DSH05	Programming for Analytics and Data Processing	-	4	0	0	4.0	HO
6	20DSH06	Descriptive and inferential statistics	-	4	0	0	4.0	HO

**Category III**

7	20DSH07	Data Analysis With Matlab	-	4	0	0	4.0	HO
8	20DSH08	The Essential Elements of Predictive Analytics and Data Mining	-	4	0	0	4.0	HO
9	20DSH09	Introduction to Computational Thinking and Data Science	-	4	0	0	4.0	HO

**Category IV**

10	20DSH10	Data Preparation and Cleaning	-	4	0	0	4.0	HO
11	20DSH11	Health care Analytics	-	4	0	0	4.0	HO
12	20DSH12	Data Scientist Toolbox	-	4	0	0	4.0	HO

**B. Tech. (Minor with Specialization)**

**Category I**

1	20CEM01	Air Pollution	-	3	0	0	3.0	MI
2	20CSM01	E-Commerce	-	3	0	0	3.0	MI
3	20MEM01	Biomaterials	-	3	0	0	3.0	MI
4	20EEM01	Basic Control Systems	-	3	0	0	3.0	MI
5	20ECM01	Semiconductor Devices & Circuits	-	3	0	0	3.0	MI
6	20AIM01	Fundamentals of Neural Networks	-	3	0	0	3.0	MI
7	20DSM03	Introduction to R Programming	-	3	0	0	3.0	MI
8	20SHM01	Psychology	-	3	0	0	3.0	MI
9	20SHM02	Statistical Methods	-	3	0	0	3.0	MI
10	20MBM01	General Management	-	3	0	0	3.0	MI
11	20MBM02	Human Resource Planning	-	3	0	0	3.0	MI

**Category II**

12	20CEM02	Climate Change Mitigation and Adaptation	-	3	0	0	3.0	MI
13	20CSM02	Knowledge Discovery and Databases	-	3	0	0	3.0	MI
14	20MEM02	Micro Electromechanical Systems	-	3	0	0	3.0	MI
15	20EEM02	Basics of Electrical Machines and Drives	-	3	0	0	3.0	MI
16	20ECM02	Digital Electronics	-	3	0	0	3.0	MI
17	20AIM02	Machine Learning with Python	-	3	0	0	3.0	MI
18	20DSM02	Data Management and Analysis	-	3	0	0	3.0	MI
19	20SHM03	English for Media	-	3	0	0	3.0	MI
20	20SHM04	Statistical Inference	-	3	0	0	3.0	MI
21	20MBM03	Organization Behavior	-	3	0	0	3.0	MI
22	20MBM04	Compensation Management & Employee Welfare Laws	-	3	0	0	3.0	MI

**Category III**

23	20CEM03	Sustainability and Pollution Prevention Practices	-	3	0	0	3.0	MI
24	20CSM03	Database Security	-	3	0	0	3.0	MI
25	20MEM03	Surface Engineering	-	3	0	0	3.0	MI
26	20EEM03	Electrical Engineering Material Science	-	3	0	0	3.0	MI
27	20ECM03	Analog Electronic Circuits	-	3	0	0	3.0	MI
28	20AIM03	Interpretable Deep Learning	-	3	0	0	3.0	MI
29	20DSM03	Data Governance	-	3	0	0	3.0	MI



30	20SHM05	Journalism	-	3	0	0	3.0	MI
31	20SHM06	Statistical Quality Control	-	3	0	0	3.0	MI
32	20VBM05	Entrepreneurship & Business Venture Planning	-	3	0	0	3.0	MI
33	20VBM06	Performance Management & Talent Management	-	3	0	0	3.0	MI

#### Short Term Skill Oriented Electives

34	20DSS01	Basics of R Programming	-	0	0	4	2.0	SC
35	20DSS02	Competitive Programming Essentials	-	0	0	4	2.0	SC
36	20DSS03	Technical Paper Writing	-	0	0	4	2.0	SC
37	20DSS04	Introduction to Power BI	-	0	0	4	2.0	SC
38	20DSS05	Finishing School for Data Science	-	0	0	4	2.0	SC

#### Industry Connect Courses (Skill Oriented Courses)<sup>10</sup>

39	20ICC01	Competitive Programming	-	2	0	8	6.0	ICC
40	20ICC02	Web Technologies – Transferring to Practice	-	2	0	8	6.0	ICC
41	20ICC03	Java and Spring boot	-	2	0	8	6.0	ICC
42	20ICC04	Robotics Process Automation	-	2	0	8	6.0	ICC
43	20ICC05	Information Security and Forensics	-	2	0	8	6.0	ICC
44	20ICC06	Battery System –Design Engineering	-	2	0	8	6.0	ICC
45	20ICC07	Blockchain Technology	-	2	0	8	6.0	ICC
46	20ICC08	Network Administration	-	2	0	8	6.0	ICC
47	20ICC09	Product Engineering	-	2	0	14	9.0	ICC
48	20ICC10	Machine Learning Engineer	-	2	0	8	6.0	ICC
49	20ICC11	Data Scientist	-	2	0	8	6.0	ICC
50	20ICC12	Industrial IoT	-	2	0	8	6.0	ICC

#### List of Honors offered by Computer Science & Engineering (DS) Program

1. Data Analytics
2. Data Processing
3. Advanced Data Science

#### List of Minor with Specialization offered by Computer Science & Engineering (DS) Program

1. Data Governance

<sup>10</sup>The credits earned through Industry Connect Courses (Skill Oriented Course) can be tradeoff with any other 3-Credit course other than Professional Core