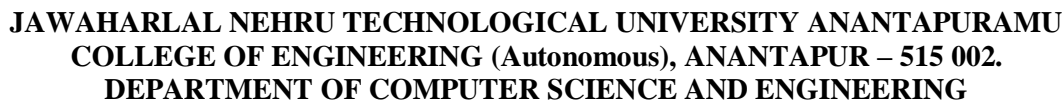




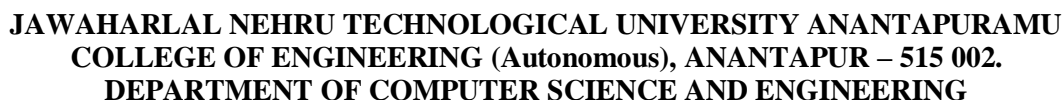
COURSE STRUCTURE

Semester-I							
S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.		Advanced Computer Networks	PC	3	0	0	3
2.		Fundamentals of Data Science	PC	3	0	0	3
3.		ProgramElective Course - I a. Computer Vision b. Machine Learning c. Agile Secure SoftwareEngineering	PE	3	0	0	3
4.		ProgramElective Course – II a. Distributed Systems b. Information Security c. Data Visualization	PE	3	0	0	3
5.		Advanced Computer Networks Lab	PC	0	0	4	2
6.		Data Science Lab	PC	0	0	4	2
7.		Research Methodology and IPR	MC	2	0	0	2
8.		Audit Course - I	AC	2	0	0	0
Total							18



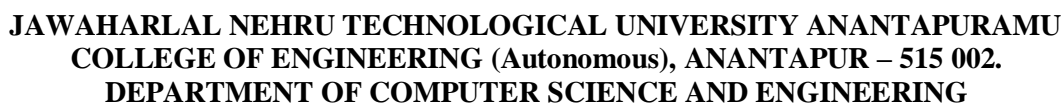
Course Code		Advanced Computer Networks	L	T	P	C
Semester	I		3	0	0	3
Course Objectives:						
<ul style="list-style-type: none"> To introduce the wireless and mobile network environment. To discuss the working of GSM To teach the emerging technologies in the mobile environment. To transmit knowledge regarding wireless LANs. To elucidate the data dissemination techniques To educate the importance of adaptability of the transport layer for the wireless environment. 						
Course Outcomes (CO): Student will be able to						
<ul style="list-style-type: none"> Describe the mobile network environment Justify the need for continuous emergence of technologies Experiment with the protocols of GSM environment Develop new routing protocols for mobile environment Propose new data dissemination techniques Recommend modifications to network and transport protocols 						
UNIT – I		Lecture Hrs:				
Introduction: Mobility of Bits and Bytes, Wireless- The Beginning, Mobile Computing, Dialogue Control, Networks, Middleware and Gateways, Application and Services, Developing Mobile Computing Applications, Security in Mobile Computing, Standards-Why are they Necessary?, Standards Bodies, Players in the wireless Space.						
Mobile Computing Architecture: History of Computers, History of Internet, Internet-The Ubiquitous Network, Architecture for mobile computing, 3-tier architecture, Design considerations for Mobile Computing, Mobile Computing through Internet, Making existing applications mobile-enabled.						
Mobile Devices and Systems: Mobile Smartphones, Smart mobiles, and Systems, Handheld Packet Computers, Handheld devices, Smart systems, Limitations of Mobile Devices, Automotive Systems						
UNIT – II		Lecture Hrs:				
Emerging Technologies: Introduction, Bluetooth, Radio frequency identification (RFID), Mobile IP, Internet Protocol Version 6(IPV6).						
Wireless Medium Access Control, CDMA, 3G, Wireless Broadband (WIMAX), 4G and 5G Networks						

UNIT – III		Lecture Hrs:
Short Message Service(SMS): Mobile Computing over SMS, SMS, Value added Services through SMS. General Packet Radio Service(GPRS): Introduction,GPRS and Packet data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications and limitations for GPRS, Billing and charging in GPRS, Enhanced Data rates for GSM Evolution(EDGE). Wireless Application Protocol: Introduction, WAP, MMS.		
UNIT – IV		Lecture Hrs:
Wireless LAN: Introduction, Advantages, IEEE 802.11 Standards, Architecture, Mobility in Wireless LAN, Deploying wireless LAN, Mobile adhoc Networks and Sensor Networks, Wireless LAN Security, Wireless Access in Vehicular environment, Wireless Local loop, Hiper LAN. Mobile Network Layer: Mobile Internet Protocol, Packet delivery and Handover management, Location management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP, VOIP, IPSec.		
UNIT – V		Lecture Hrs:
Mobile Transport Layer: Conventional TCP/IP transport layer protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other methods for Mobile TCP layer Transmission. Data Dissemination and Systems for Broadcasting: Communication Asymmetry, Classification of data delivery mechanism, Data dissemination Broadcast Models, Selective tuning and Indexing Techniques, Digital Audio Broadcasting(DAB), Digital Video Broadcasting		
Textbooks:		
1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing: Technology, Applications and Service Creation”, 2 nd edition, McGraw Hill, 2010. 2. RaJ Kamal, “Mobile Computing”, 3 rd edition, Oxford University Press. 3.		
Reference Books:		
1. Jochen Schiller, “Mobile Communications”, Addison-Wesley, Second Edition, 2009. 2. UWE Hansmann, Lothar Merk, Martin S. Nocklous, Thomas Stober, “Principles of Mobile Computing,” Second Edition, Springer.		
Online Learning Resources:		



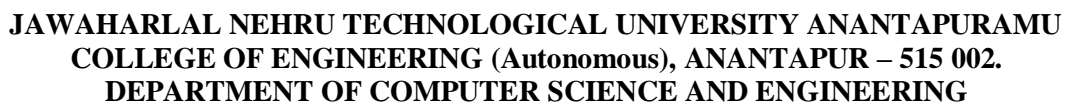
Course Code	I	Fundamentals of Data Science	L	T	P	C
Semester			3	0	0	3
Course Objectives:						
<ul style="list-style-type: none"> • Provide you with the knowledge and expertise to become a proficient data scientist. • Demonstrate an understanding of statistics and machine learning concepts that are vital for data science • Produce Python code to statistically analyse a dataset • Critically evaluate data visualizations based on their design and use for communicating stories from data 						
Course Outcomes (CO): Student will be able to						
<ul style="list-style-type: none"> • Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists • Explain how data is collected, managed and stored for data science • Demonstrate an understanding of statistics and machine learning concepts that are vital for data science • Critically evaluate data visualisations based on their design and use for communicating stories from data 						
UNIT – I		Lecture Hrs:				
Introduction, What Is Statistical Learning?, Why Estimate f?, How Do We Estimate f?, The Trade-Off Between Prediction Accuracy and Model Interpretability, Supervised Versus Unsupervised Learning, Regression Versus Classification Problems, Assessing Model Accuracy, Measuring the Quality of Fit, The Bias-Variance Trade-of, The Classification Setting, Introduction to R, Basic Commands, Graphics, Indexing Data, Loading Data, Additional Graphical and Numerical Summaries.						
UNIT – II		Lecture Hrs:				
Linear Regression, Simple Linear Regression, Multiple Linear Regression, Other Considerations in the Regression Model, Comparison of Linear Regression with K-Nearest Neighbours, Linear Regression.						
UNIT – III		Lecture Hrs:				
Classification, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods, Logistic Regression, LDA, QDA, and KNN.						
UNIT – IV		Lecture Hrs:				
Programming for basic computational methods such as Eigen values and Eigen vectors, sparse matrices, QR and SVD, Interpolation by divided differences. Data Wrangling: Data Acquisition, Data Formats, Imputation, The split-apply-combine paradigm.						

UNIT – V		Lecture Hrs:
Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.		
Textbooks:		
1. Gareth James Daniela Witten Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, February 11, 2013, web link: www.statlearning.com . 2. Mark Gardener, Beginning R The statistical Programming Language, Wiley, 2015. 3. Han , Kamber, and J Pei, Data Mining Concepts and Techniques, 3rd edition, Morgan Kaufman, 2012.		
Reference Books:		
1. Sinan Ozdemir, Principles of Data Science, Packt Publishing Ltd Dec 2016. 2. Joel Grus, Data Science from Scratch, Oreilly media, 2015.		
Online Learning Resources:		



Course Code		Agile Secure Software Engineering	L	T	P	C
Semester	I		3	0	0	3
Course Objectives:						
<ul style="list-style-type: none"> To understand security in delivery of more useful software To understand the essence of agile development methods To understand the risks and attacks of agile programming To understand the principles and practices of extreme programming 						
Courses Outcomes:						
<ul style="list-style-type: none"> Introduce the concept of development agility and the Agile enablers Review each of the major agile development methods underscoring their strengths and weaknesses of security threats Understand how to manage an agile environment even within a structured organizational approach Learn how to introduce agility into a development organization 						
UNIT - I						Lecture Hrs:
Getting started with Security: Security is about Risk, Threat actors and Knowing Your Enemy, Security Values: Protecting our data, systems and people, Common security misconceptions or mistakes. Agile Enablers: Build Pipeline, Automated Testing, Continuous Integration, Infrastructure as Code, Release Management, Visible Tracking, Centralised Feedback, The Only Good code is deployed code, Operating Safely and at Speed. Welcome to the Agile Revolution: Agile: A Potted Landscape, Scrum, the Most Popular of Agile Methodologies ,Extreme Programming, Kanban, Lean ,Agile Methods in General ,What About DevOps? , Agile and Security. Working with Your Existing Agile Life Cycle: Traditional Application Security Models, Per-Iteration Rituals, Pre-Iteration Involvement , Post-Iteration Involvement ,Setting Secure Baselines , What About When You Scale? , Building Security Teams That Enable.						
UNIT - II						Lecture Hrs:
Security and Requirements: Dealing with Security in Requirements, Agile Requirements: Telling Stories, Tracking and Managing Stories: The Backlog, Dealing with Bugs , Getting Security into Requirements, Security Personas and Anti-Personas , Attacker Stories: Put Your Black Hat On, Attack Trees, Infrastructure and Operations Requirements. Agile Vulnerability Management: Vulnerability Scanning and Patching ,Dealing with Critical Vulnerabilities, Securing Your Software Supply Chain, How to Fix Vulnerabilities in an Agile Way ,Security Sprints, Hardening Sprints, and Hack Days, Taking On and Paying Down Security Debt. Risk for Agile Teams: Security Says, No, Understanding Risks and Risk Management ,Risks and Threats, Dealing with Risk, Risk Management in Agile and DevOps, Handling						

Security Risks in Agile and DevOps.		
Threat Assessments and Understanding Attacks: Understanding Threats: Paranoia and Reality, Your System's Attack Surface , Agile Threat Modeling, Common Attack Vectors.		
UNIT - III		Lecture Hrs:
Building Secure and Usable Systems: Design to Resist Compromise ,Security Versus Usability , Technical Controls, Security Architecture, Complexity and Security Code Review for Security: Why Do We Need to Review Code?, Types of Code Reviews, Peer Code Reviews, When Should You Review Code?, How to Review Code, Who Needs to Review Code?, Automated Code Reviews, Code Review Challenges and Limitations, Adopting Secure Code Reviews, Reviewing Security Features and Controls, Reviewing Code for Insider Threats. Agile Security Testing: How Is Testing Done in Agile? , If You Got Bugs, You'll Get Pwned, The Agile Test Pyramid , Unit Testing and TDD, Service-Level Testing and BDD Tool, Acceptance Testing, Functional Security Testing and Scanning, Testing Your Infrastructure, Creating an Automated Build and Test Pipeline, A Place for Manual Testing in Agile, How Do You Make Security Testing Work in Agile and DevOps?		
UNIT - IV		Lecture Hrs:
External Reviews, Testing, and Advice: Why Do We Need External Reviews?, Vulnerability Assessment, Penetration Testing, Red Teaming, Bug Bounties, How Bug Bounties ,Configuration Review, Secure Code Audit, Crypto Audit, Choosing an External Firm, Getting Your Money's Worth. Operations and OpSec: System Hardening: Setting Up Secure Systems, Network as Code, Monitoring and Intrusion Detection, Catching Mistakes at Runtime , Runtime Defense, Incident Response: Preparing for Breaches, Securing Your Build Pipeline, Shh...Keeping Secrets Secret. Compliance: Compliance and Security, Different Regulatory Approaches, Which Approach Is Better? ,Risk Management and Compliance, Traceability of Changes, Data Privacy, How to Meet Compliance and Stay Agile, Building Compliance into Your Culture, Certification and Attestation.		
UNIT – V		Lecture Hrs:
Security Culture: The Importance of Security Culture, Building a Security Culture , Principles of Effective Security, Security Outreach. What Does Agile Security Mean?: Laura's Story, Jim's Story, Michael's Story, Rich's Story.		
Textbooks:		
1. "Agile Application Security: Enabling Security in a Continuous Delivery Pipeline", By Laura Bell, Michael Brunton-Spall, Rich Smith, Jim Bird, O'Reilly Media, Inc.,2017		
Reference Books:		
Online Learning Resources:		

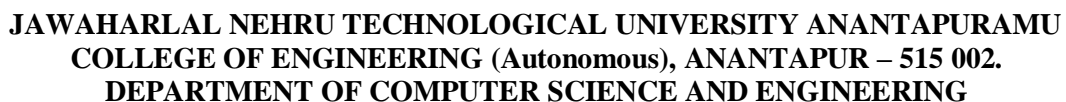


Course Code		Data Visualization	L	T	P	C
Semester	I		3	0	0	3
Course Objectives:						
<ul style="list-style-type: none"> To develop skills to both design and critique visualizations. To introduce visual perception and core skills for visual analysis. To understand visualization for time-series analysis. To understand visualization for ranking analysis. To understand visualization for deviation analysis.. 						
Course Outcomes (CO): Student will be able to						
<ul style="list-style-type: none"> Explain principles of visual perception Apply core skills for visual analysis Apply visualization techniques for various data analysis tasks Design information dashboard 						
UNIT - I			Lecture Hrs:			
Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.						
UNIT - II			Lecture Hrs:			
Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.						
UNIT - III			Lecture Hrs:			
Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.						
UNIT - IV			Lecture Hrs:			
Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together- Unveiling the dashboard.						
UNIT - V			Lecture Hrs:			
Plotting Geospatial Data: Introduction to Geoplotlib, Design Principles of Geoplotlib, Geospatial Visualizations, Plotting Geospatial Data on a Map Web-Based Visualizations: Concepts of Bokeh, Interfaces-Plotting and Model Interfaces, Output, Bokeh Server, Presentation, Integrating – HTML Document and Bokeh Applications						
Textbooks:						
<ol style="list-style-type: none"> Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008. Mario Dobler, Tim Grobmann, “Data Visualization with Python”, O’Reilly, First Edition, 2019 						

3.Scott Murray, “Interactive data visualization for the web”, O’Reilly Media, Inc., 2013

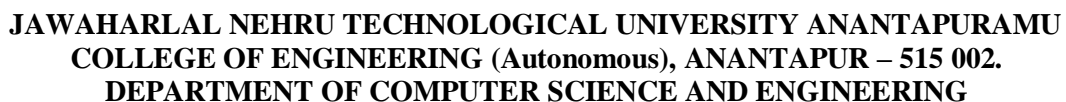
Reference Books:

1. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.
2. Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007.



Course Code		Advanced Computer Networks Lab	L	T	P	C
Semester	I		0	0	4	2

Online learning resources/Virtual labs



Course Code		Data Science Lab	L	T	P	C
Semester	I		0	0	4	2

- To make students understand learn about a Big Data – R Programming, way of solving problems.
- To teach students to write programs in Scala to solve problems.

- Develop new algorithms and software tools for data management and mining, and to use them for social good.
- Applying machine learning, data mining, and network analysis to real-world problems in society and industry.
- Exploring the creation of novel statistical and computational methods for scalable data mining, machine learning, optimization as well as statistical modelling with complex data sets

1. Write an R program to evaluate the following expression $ax+b/ax-b$.
2. Write an R program to read input from keyboard (hint: `readLine()`).
3. Write an R program to find the sum of n natural numbers: $1+2+3+4+\dots+n$
4. Write an R program to read n numbers. (i) Sum of all even numbers (ii) Total number of even numbers.
5. Write an R program to read n numbers. (i) Total number of odd numbers (ii) Sum of all odd numbers.
6. Write an R program to obtain (i)sum of two matrices A and B (ii) subtraction of two matrices A and B (iii) Product of two matrices.
7. Write an R program for “declaring and defining functions “
8. Write an R program that uses functions to add n numbers reading from keyboard .
9. Write an R program uses functions to swap two integers.
10. Write an R program that use both recursive and non-recursive functions for implementing the Factorial of a given number, n.
11. Write an R program to reverse the digits of the given number {example 1234 to be written as 4321 }

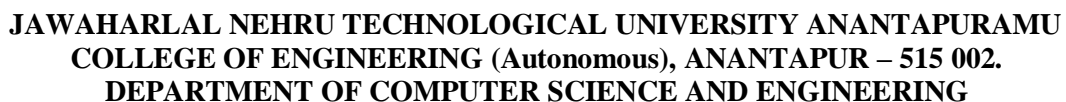
12. Write an R program to implement (i) Linear search (ii) Binary Search.
13. Write an R program to implement (i) Bubble sort (ii) selection sort.
14. Write a R program to implement the data structures (i) Vectors (ii) Array (iii) Matrix (iv) Data Frame (v) Factors
15. Write a R program to implement scan(), merge(), read.csv() and read.table() commands.
16. Write an R program to implement “Executing Scripts” written on the note pad, by calling to the R console.
17. Write a R program, Reading data from files and working with datasets (i) Reading data from csv files, inspection of data. (ii) Reading data from Excel files.
18. Write a R program to implement Graphs (i) Basic high-level plots (ii) Modifications of scatter plots (iii) Modifications of histograms, parallel box plots.

References:

1. Big data – Black Book: 2015 edition: dreamtech press. Pg. (490- 642).
2. Introducing to programming and problem solving by scala, mark c. lewis, lisa l.lacher. CRC press, second edition.
- 3.

Online Learning Resources:

1. <https://www.tutorialspoint.com/scala/>
2. <https://www.tutorialspoint.com/r/>



Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Textbooks:
<ol style="list-style-type: none"> 1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students" 2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
Reference Books:
<ol style="list-style-type: none"> 1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" 2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007. 3. Mayall, "Industrial Design", McGraw Hill, 1992. 4. Niebel, "Product Design", McGraw Hill, 1974. 5. Asimov, "Introduction to Design", Prentice Hall, 1962. 6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016. 7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008
Online Learning Resources:

