PROPOSAL FOR BE(CSE) SEMESTER-VII SCHEME:-

Sl.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 701 CS Core-13	Information Security	3	-	-	3	30	70	3	3
2	PC 702 CS Core-14	Data Science Using R Programming	3	1	-	4	30	70	3	4
3	PC 703 CS Core-15	Distributed Systems	3	1	-	4	30	70	3	4
4	OE-II	Open Elective – II	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	PC 751 CS	Data Science Lab	-	-	3	3	25	50	3	1.5
6	PC 752 CS	Distributed Systems Lab	-	-	3	3	25	50	3	1.5
7	PW 761 CS	Project Work – I	-	-	4	4	50	-	-	2
8	SI 762 CS	Summer Internship	-	-	-	-	25	**50**	-	2
			12	**02**	**10**	**24**	**245**	**430**	**18**	**21**

Open Elective – II		
Sl.	**Course Code**	**Course Title**
1	OE 771 CE	Green Building Technologies
2	OE 772 CS**	Data Science and Data Analytics
3	OE 773 EC**	Fundamentals of IoT
4	OE 774 EE	Non-Conventional Energy Sources
5	OE 775 ME	Entrepreneurship
6	OE 776 IT**	Cyber Security

Course Code	Course Title						Core / Elective
PC 701 CS	**Information Security**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn legal and technical issues in building secure informationsystems
- To provide an understanding of networksecurity
- To expose the students to security standards andpractices

Course Outcomes

After completing this course, the student will be able to

1. Describe the steps in Security Systems development life cycle(SecSDLC)
2. Understand the common threats and attack to informationsystems
3. Understand the legal and ethical issues of informationtechnology
4. Identify security needs using risk management and choose the appropriate risk control strategy based on businessneeds
5. Use the basic knowledge of security frameworks in preparing security blue print for theorganization
6. Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hackingtools
7. Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols
8. Understandthetechnicalandnon-technicalaspectsofsecurityprojectimplementationand accreditation

UNIT-I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access,
The SDLC, The Security SDLC.

Need for Security: Business Needs, Threats, Attacks, and Secure Software Development

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management Discussion Points, Recommended Risk Control Practices.

UNIT-III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.

Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

UNIT-IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.

Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non-Technical Aspects of implementation, Security Certification and Accreditation.

Information Security Maintenance: Security management models, Maintenance model

Short case studies in Cryptography and Security: Secure Multi party calculation, Virtual Elections, Single Sign On, Secure Inter Branch Payment transactions, Cross site scripting vulnerability (**Book 2)**

Suggested Readings:

Prescribed Books

1. Michael E Whitman and Herbert J Mattord, *Principles of Information Security*, Cengage Learning, 6 th Edition 2018
2. Atulkhate, Cruptographu and Network Security" 4 th edition , Tata McGraw Hill , 2019

Reference Books:

3. Nina Godbole, "Information Systems Security: Security Management, Metrics, Frameworks and Best Practices" Second Edition, WILEY 2017
4. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi
5. V.K. Pachghare, "Cryptography and Information Security", PHI Learning

Course Code	Course Title						Core / Elective
PC 702 CS	**Data Science Using R Programming**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- To learn basics of R Programming environment: R language, R- studio and Rpackages
- To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
- To learn Decision tree induction, association rule mining and textmining

Course Outcomes:

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

1. UsevariousdatastructuresandpackagesinRfordatavisualizationandsummarization
2. Uselinear,non-linearregressionmodels,andclassificationtechniquesfordataanalysis
3. Use clustering methods including K-means and CUREalgorithm

UNIT – I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT III

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression

UNIT IV

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

UNIT V

Classification: performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbours implementation in R, Clustering: K-Means Algorithm, K-Means implementation inR. Time Series Analysis using R, Social Network Analysis, Reading data from relational databases- MySQL, Reading data from NoSQL databases- MongoDB.

SuggestedReadings:

1. Nina Zumel, Practical Data Science with R, Manning Publications,2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly,2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly,2017.
4. Roger D Peng, R Programming for Data science, Lean Publishing,2016.
5. Rafael A Irizarry, Introduction to Data Science, LeanPublishing,2016.
6. VishwaVishwanathan and ShanthiVishwanathan, R Data Analysis cookbook 2015

Course Code	Course Title						Core / Elective
PC 703 CS	**Distributed Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- To acquire an understanding of the issues in distributedsystems.
- To learn about Naming and synchronization with different algorithms.
- To study architectures and working of Distributed filesystems, Distributed web-based system
- To expose the students to distributed transaction management, security issues andreplication.
- To introduce Emerging trends in distributed computing

Course Outcomes

By the end of this course, the students will be able to

1. List the principles of distributed systems and describe the problems and challenges associated with these principles
2. To know about interposes communication and remote communication.
3. Understand Distributed Computing techniques, Synchronous and Processes.
4. Understand Distributed File Systems Apply Distributed web-based system. Understand the importance of security in distributed systems
5. Student will be able to know distributed service oriented architecture.
6. To know about emerging trends in distributed computing.

UNIT-I

Introduction: Characteristics & Properties of Distributes Systems – Taxonomy - Types of Distributed Systems Design goals – Transparency Issues.

Architectures: Architectural Styles, System Architectures, Architectures versus Middleware, and Self-Management in Distributed Systems.

Processes: Threads, Virtualization, Software Agents, Clients, Servers, and Code Migration.

Communication: Inter process communication Mechanisms,Remote Procedure Call, Remote Method Invocation, Message-Oriented Communication, Stream- Oriented Communication, and Multicast Communication.

UNIT-II

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming and Attribute-Based Naming. **Synchronization:** Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, and Election Algorithms.

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

UNIT-III

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, andRecovery.

Distributed Object-Based Systems: CORBA, DCOM, GLOBE -Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT-IV

Distributed File Systems: File system, DFS- definition, Characteristics, Goals, SUN NFS-NFS Architecture, NFS Implementation, Protocols, The CODA file system-Design Overview, An Example,

Design Rational, Implementation, The GOOGLE file system-Definition, Architectures, GFS Architecture

Distributed Web-Based Systems: Traditional Web-Based Systems, Web Services Fundamentals, The Apache Web Server, Web Server Clusters, Communication, HTTP Fundamentals, Simple Object Access Protocol SOAP, Web Proxy Caching, Replication for Web Hosting Systems-CDN'S**,** Service-Oriented Architectures, REST and Web Services

UNIT-V

Distributed Coordination-Based Systems -- Architecture, Naming and Security

Emerging Trends in Distributed Systems - Emerging Trends Introduction, Grid Computing, Cloud Computing and its roots in distributed systems mechanisms and self-management of distributed systems, Virtualization, Service Oriented Architecture, The Future of Emerging Trends.

Map-Reduce: Example, Scaling, Programming Model, Apache Hadoop, Amazon Elastic Map Reduce, Mapreduce.net, Pig andHive.

Suggested Readings:

1. Andrew S. Tanenbaum and Maarten Van Steen, *Distributed Systems*, PHI 2nd Edition,2009.
2. Distributed Computing, Sunita Mahajan and Seema Shah, Oxford University
3. R. Hill,L. Hirsch,P.Lake,S.Moshiri, *Guide to Cloud Computing*,Principles andPractical, Springer, 2013.
4. R. Buyya, J. Borberg, A. Goscinski, *Cloud Computing-Principles and Paradigms*, Wiley,2013.
5. Distributed Operating Systems by P. K. Sinha, PHI

Reference Books:

1. Distributed Systems: Principles and Paradigms, Taunenbaum
2. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India
3. Distributed Systems: Concepts and Design, G. Coulouris, J. Dollimore, and T. Kindberg,
4. Java Network Programming & Distributed Computing by David Reilly, Michael Reill

Course Code	Course Title						Core / Elective
OE 772 CS	**Data Science and Data Analytics**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn basicsof Data Science: Linear Algobra, Linear Equations, Matrices, Eigen Values and Eigen Vectors.
- To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
- To learn Decision tree induction, association rule mining and textmining

Course Outcomes:

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

4. Usevarious Mathematical models, and Probability and Statics
5. Uselinear,non-linearregressionmodels,andclassificationtechniquesfordataanalysis
6. Use clustering methods including K-means and CUREalgorithm

UNIT – I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT III

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression

UNIT IV

Decision Tree: Introduction, What Is A Decision Tree?Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm,Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias InDecision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Classification:K-Nearest neighbours (KNN),Performance Measures,

UNIT V

Clustering: K-Means Algorithm,

Association Rules: Introduction, Frequent Itemset, DataStructure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

SuggestedReadings:

7. Nina Zumel, Practical Data Science with R, Manning Publications,2014.
8. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly,2017.
9. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly,2017.
10. Roger D Peng, R Programming for Data science, Lean Publishing,2016.
11. Rafael A Irizarry, Introduction to Data Science, LeanPublishing,2016.
12. VishwaVishwanathan and ShanthiVishwanathan, R Data Analysis cookbook 2015

Course Code	Course Title						Core / Elective
PC 751 CS	**Data Science Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**3**	**25**	**50**	**1.5**

Course Objectives

- To understand the R Programming Language.
- Exposure on solving of data science problems.
- Understand Classification and Regression Modelling.

Course Outcomes

After completing this course, the student will be able to

- Work with data science using R Programming environment.
- Implement various statistical concepts like linear and logistic regression.
- Perform Classification and Clustering over a given data set.

1	**R AS CALCULATOR APPLICATION** a. Using with and without R objects onconsole b. Using mathematical functions onconsole c. Write an R script, to create R objectsforcalculator application and save in a specified location in disk.
2	**DESCRIPTIVE STATISTICS IN R** a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& carsdatasets. b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.
3	**READING AND WRITING DIFFERENT TYPES OF DATASETS** a. Reading different types of data sets (.txt, .csv)from web and disk and writing in file in specific disk location. b. Reading Excel data sheet inR.
4	**VISUALIZATIONS** **a.** Find the data distributions using box and scatterplot. **b.** Find the outliers usingplot. **c.** Plot the histogram, bar chart and pie chart onsample data.
5	**CORRELATION AND COVARIANCE** a. Find the correlationmatrix. b. Plot the correlation plot on dataset and visualize giving an overview of relationshipsamong data on iris data. c. Analysis of covariance: variance (ANOVA), if data have categorical variables on irisdata.
6	**REGRESSION MODEL** Import a data from web storage. Name the dataset and perform Logistic Regression to find out relation between variables the model. Also check the model is fit or not [require (foreign), require(MASS)]
7	**CLASSIFICATION MODEL** a. Install relevant package forclassification. b. Choose classifier for classificationproblem. c. Evaluate the performance ofclassifier.
8	**CLUSTERING MODEL** a. Clustering algorithms for unsupervisedclassification. b. Plot the cluster data using Rvisualizations.

Suggested Reference Books:

1. *Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st Edition, 2012*

Web References:

1. http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in-r/
2. http://www.ats.ucla.edu/stat/r/dae/rreg.htm
3. http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html
4. http://www.ats.ucla.edu/stat/r/data/binary.csv

Tools: *R-Studio*

Course Code	Course Title						Core / Elective
PC 752 CS	**Distributed Systems Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**3**	**25**	**50**	**1.5**

Course Objectives

- To implement client and server programs using sockets
- To learn about working of NFS
- Understanding Remote Communication and Interprocess Communication
- To use Map, reduce model for distributed processing
- To develop mobile applications

Course Outcomes

After completing this course, the student will be able to

- Write programs that communicate data between two hosts
- Configure NFS
- To implement inter process communication and remote communication
- Use distributed data processing frameworks and mobile application tool kits

List of Experiments to be performed:

1. Implementation FTPClient
2. Implementation of NameServer
3. Implementation of ChatServer
4. Understanding of working of NFS (Includes exercises on Configuration ofNFS)
5. Write a program to implement hello world service using RPC or Write a program to implement date service using RPC.
6. Implement a word count application which counts the number of occurrences of each word a large collection of documents Using Map Reducemodel.
7. Develop an application using 3 -tier architectures.

Course Code	Course Title						Core / Elective
PW 761 CS	**Project Work – I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**4**	**50**	-	**2**

Course Objectives

- To enhance practical and professionalskills.
- To familiarize tools and techniques of systematic literature survey anddocumentation
- To expose the students to industry practices and teamwork.
- To encourage students to work with innovative and entrepreneurialideas

Course Outcomes

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-worldproblems.
2. Evaluate different solutions based on economic and technicalfeasibility
3. Effectively plan a project and confidently perform all aspects of projectmanagement
4. Demonstrate effective written and oral communicationskills

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

- Collection of project topics/ descriptions from faculty members (Problems can also be invited from theindustries)
- Grouping of students (max 3 in agroup)
- Allotment of projectguides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the projectguide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on noticeboard.
2. Give a 30 minutes' presentation followed by 10 minutes'discussion.
3. Submit a technical write-up on thetopic.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition andspecification
- Literaturesurvey
- Broad knowledge of available techniques to solve a particularproblem.
- Planning of the work, preparation of bar (activity)charts
- Presentation- oral andwritten.

Course Code	Course Title						Core / Elective
SI 762 CS	**Summer Internship**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	-	**50**	-	**2**

Course Objectives

- To train and provide hands-on experience in analysis, design, and programming of information systems by means of case studies andprojects.
- To expose the students to industry practices and teamwork.
- To provide training in soft skills and also train them in presenting seminars and technical report writing.

Course Outcomes

After completing this course, the student will be able to

1. Get Practical experience of software design and development, and coding practices within Industrial/R&DEnvironments.
2. Gain working practices within Industrial/R&DEnvironments.
3. Prepare reports and other relevantdocumentation.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co- ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on theinternship

- Overview ofcompany/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientificpapers
- Planning, designing, and reviewing the plannedwork
- Executing theplans
- Documenting progress, experiments, and other technicaldocumentation
- Further team discussions to discussresults
- Final report writing andpresentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executedand
2. Present the work through a seminar talk (to be organized by theDepartment)

Award of sessionals are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (25 Marks) **followed by presentation before the external examiner appointed by the university (25 Marks)**. One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.