SIES

College of Arts, Science & Commerce

RISE WITH EDUCATION

Sion (West), Mumbai – 400022.

(Autonomous)

Faculty: Science

Program: M.Sc.

Subject: INFORMATION TECHNOLOGY

Academic Year: 2019 – 2020

PART 1

Credit Based Semester and Grading Syllabi approved by Board of Studies in Information Technology to be brought into effect from July 2019.

Semester I

Course Code	Course Title	Credits
SIPSIT11	Advanced Security in Computing	**4**
SIPSIT12	Cloud Computing	**4**
SIPSIT13	Research Methodology	**4**
SIPSIT14	Big Data Analytics	**4**
SIPSITP11	Advanced Security in Computing Practical	**2**
SIPSITP12	Cloud Computing Practical	**2**
SIPSITP13	Research Methodology Practical	**2**
SIPSITP14	Big Data Analytics Practical	**2**
	TOTAL CREDITS	**24**

Semester I

Advanced Security in Computing

Learning Objective:

- To offer complete coverage of all aspects of computer security
- To identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks and ensure privacy.

Learning Outcome:

The learner will be able to detect potential security vulnerabilities, and demonstrate ways of recovering from the effects of attacks.

Theory Component:

M. Sc (Information Technology)	**Semester – I - SIPSIT11**
Course Name	**Advanced Security in Computing**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Introduction:** The Need for Security, Challenges and Basic Approaches, Threats, vulnerabilities, and controls, Confidentiality, integrity and availability, Attackers and attack types; method, opportunity, and motive , Valuing assets	**12**
II	**Toolbox:** Authentication, Access Control, and Cryptography. **Programs and Programming**:- Unintentional (Non-malicious) Programming Oversights, Malicious Code - Malware, Countermeasures.	**12**
III	**The Web—User Side:-** Browser Attacks, Web Attacks Targeting Users, Email Attacks, Ransomeware. **Rootkit :-** Phone Rootkit , Rootkit Evades Detection , Rootkit Operates Unchecked , Sony XCP Rootkit, TDSS Rootkits	**12**
IV	**Networks:** Network Concepts ,War on Networks: Network Security Attacks, Wireless Network Security, Denial of Service, Distributed Denial-of-Service. Strategic Defenses: **Security Countermeasures** :- Cryptography in Network Security, Firewalls ,Intrusion Detection and Prevention Systems.	**12**
V	**Privacy:-** Privacy Concepts, Authentication and Privacy ,Email Security. Computer Crime ,Ethical Issues in Computer Security. **Cryptography :-**Message Digests, Digital Signatures, Cyber Warfare.	**12**

	Cyber Forensics:-Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.	

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Security in Computing	Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies	Pearson Education	Fifth edition	2015
2	Security in Computing Systems :Challenges, Approaches and Solutions	Prof. Dr. Joachim Biskup	Springer		2009
3	Principles of Computer Security	Vincent Nestler and Keith Harrison and Matthew Hirsch and Wm. Arthur Conklin	Mc Graw Hill	Fourth Edition	2015

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Any relevant course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	**Semester – I -SIPSIT11**
Course Name	**Advanced Security in Computing Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

1	Learn Network Attacks Using Wireshark.
2	Implementing Diffie Helman Key Exchange Algorithm.
3	Implement web based exploitations.
4	Implement Software based attacks.
5	Implement AES.
6	Implement RSA Algorithm.
7	Implement Blowfish.
8	Perform a simple MITM attack on local network using ARP Spoofing.
9	Detect and Prevent Malware Free Attacks with CrowdStrike Falcon.
10	**Tools to perform Behavioural Analysis of Malware:-** 1.Process Hacker 2. Process Monitor (ProcMon) 3. CaptureBat 4. Microsoft Network Monitor 5. Autoruns

Cloud Computing

Learning Objective:

The student will learn about the cloud environment, building software systems and components that scale to millions of users in modern internet, cloud concepts capabilities across the various cloud service models including Iaas,Paas,Saas, and developing cloud based software applications on top of cloud platforms.

Learning Outcome:

- Understanding the key dimensions of the challenge of Cloud Computing.
- Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization.
- Assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas.

Theory Component:

M. Sc (Information Technology)	**Semester – I - SIPSIT12**
Course Name	**Cloud Computing**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Defining Cloud Computing**: Define Cloud Computing, Cloud Types, The NIST model, The Cloud Cube Model, Deployment models, Service models, Examining the Characteristics of Cloud Computing, Paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing, **Understanding Services and Applications by Type:** Defining Infrastructure as a Service (IaaS), Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS)	**12**
II	**Understanding Virtualization:** Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications **Virtual Machines Provisioning and Migration Services:** Virtual Machines Provisioning and Manageability**,** Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context **Secure Distributed Data Storage in Cloud Computing:** Cloud Storage: from LANs TO WANs, Technologies for Data Security in Cloud Computing.	**12**

III	**Cloud Management**: System Center and the Cloud OS, Provisioning infrastructure with Virtual Machine Manager	**12**
IV	**Configuration Manager & DPM:** Managing and maintaining with Configuration Manager, Backup and recovery with Data Protection Manager	**12**
V	**Operations Manager, Service Manager, Orchestrator** : Real-time monitoring with Operations Manager, Standardization with Service Manager, Automation with Orchestrator	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Cloud Computing Bible	Barrie Sosinsky	Wiley-India	--	2010
2	Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James Broberg ,Andrzej M. ,Goscinski,	Wiley	--	2011
3	Introducing Microsoft System Center 2012, Technical Overview	Mitch Tulloch, Symon Perriman	Microsoft	--	--

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Any relevant course with' SWAYAM-NPTEL'

Practical Component:

M. Sc (Information Technology)	**Semester – I - SIPSITP12**
Course Name	**Cloud Computing Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practicals:

1	Creating Failover Clustering using Windows server.
2	Migration of VM's (using any VM)
3	Implement PaaS
4	Implement IaaS
5	Implementing ESXi Sever with Vsphere Client
6	Managing with SCVMM
7	Using Service Manager to Standardize.
8	Using Orchestrator for Automation.
9	Using Operations Manager for real-time monitoring.
10	Using Data Protection Manager for Backup and Recovery.

Research Methodology

Learning Objective:

To develop the aptitude for research and the ability to explore research techniques to solve real world problems

Learning Outcome:

- The learner will be able to critically analyze, synthesize and solve complex unstructured business and real world problems with scientific approach.
- The learner will develop analytical skills by applying scientific methods.

Theory Component:

M. Sc (Information Technology)	**Semester – I - SIPSIT13**
Course Name	**Research Methodology**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	Introduction to Research: Objectives of research, Types of Research, Research approaches, Research methods versus methodology, Research Process. Formulation of the research problem: Selecting the problem, Technique involved in defining a problem.	**12**
II	Research Design: Meaning, Need and Features of a research design, Different research designs, Basic principles of Experimental Designs, Sampling Design: Implications and Steps in Sampling Design, Types of Sampling Designs.	**12**
III	Data Collection Methods: Primary data and Secondary data, Processing and Analysis of Data, Statistics in research, Sampling theory, Concept of Standard Error, Estimation, Sample size and its determination	**12**
IV	Testing of hypotheses: Procedure and flow diagram for hypothesis testing, Parametric Tests, Chi-Square Test, Analysis of Variance and Covariance, Non-parametric tests	**12**
V	Multivariate analysis techniques: Classification, Variables, Factor Analysis, Path Analysis, Interpretation and Report Writing :Technique and Precaution in interpretation, Report Writing, Layout of the Research report, Types of Report, Writing a Research report, Use of tools/techniques for research	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Research Methodology – Methods and Techniques	C.R.Kothari, Gaurav Garg	New Age	4e	
2	Research Methodology – a step by step guide for beginners	Ranjit Kumar	Sage Publications	3e	2011
3	Research Methodology	Panneerselvam	PHI Learning	2e	2014
4	Business Research Methods	William G.Zikmund, B.J Babin, J.C. Carr, Atanu Adhikari, M.Griffin	Cengage	8e	2016
5	Business Research Methods	Alan Bryman and Emma Bell	Oxford University Press	3e	2011

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Research paper publication

Practical Component:

M. Sc (Information Technology)	**Semester I - SIPSIT13**
Course Name	**Research Methodology Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:
(Using Google scholar/SPSS/Mendeley/End note etc)

1	Defining a research problem
2	Literature Review using search tools like google scholar
3	Research design
4	Sampling Design
5	Usage of measurement and scaling techniques
6	Testing of Hypothesis
7	Implement data analysis techniques
8	Writing a research report

Big Data Analytics

Learning Objective: The main goal of this course is to help students learn, understand, and practice big data analytics approaches, which include the conceptualization and summarization of big data and machine learning, and big data computing technologies.

Learning Outcome:

- Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.
- Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

Theory Component:

M. Sc (Information Technology)	**Semester – I -SIPSIT14**
Course Name	**Big Data Analytics**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	Introduction: Introduction to Big Data, Big Data Characteristics, Types of Big Data, Traditional Versus Big Data Approach, Technologies Available for Big Data, Infrastructure for Big Data, Use of Data Analytics, Big Data Challenges, Desired Properties of a Big Data System, Case Study of Big Data Solutions	**12**
II	Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models.	**12**
III	Analytical Theory and Methods: Classification, Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods, Time Series Analysis, Box Jenkins methodology, ARIMA Model, Additional methods. Text Analysis, Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments	**12**
IV	Hadoop: Introduction, What is Hadoop?, Core Hadoop Components, Operating System for Big Data, Concepts, Hadoop Architecture, Hadoop Ecosystem, Hive, , Hadoop Limitations	**12**

V	NoSQL: What is NoSQL?, NoSQL Business Drivers, NoSQL Case Studies, NoSQL Data Architectural Patterns, Variations of NoSQL Architectural Patterns, Using NoSQL to Manage Big Data Map Reduce: MapReduce and The New Software Stack, MapReduce, Algorithms Using MapReduce	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Big Data Analytics	Radha Shankarmani	Wiley		
2	Big Data and Analytics	Subhashini Chellappan Seema Acharya	Wiley	First	
3	Big Data Analytics with R and Hadoop	Vignesh Prajapati	Packt	First	
4	Practical Big data Analytics	Nataraj Dasgupta	Pack	First	
5	Big Data Analytics	Anuradha Bhatia			

Internal Evaluation: 40 Marks

20 Marks	20 marks
Class Test	Project / Analysis of research papers

Practical Component:

M. Sc (Information Technology)	**Semester – I -SIPSITP14**
Course Name	**Big Data Analytics Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

1	To understand the overall programming architecture using Map Reduce API
2	Store the basic information about students such as roll no, name, date of birth , and address of student using various collection types such as List, Set and Map
3	Basic CRUD operations in MongoDB
4	Retrieve various types of documents from collection
6	Develop Map Reduce Work Application
7	Creating the HDFS tables and loading them in Hive and learn joining of tables in Hive

Suggested Practical

1	To draw and explain Hadoop Architecture and Ecosystem with the help of a case study using WorkCount example. To define and install Hadoop.
2	To implement the following file management tasks in Hadoop System (HDFS): Adding files and directories, Retrieving files, Deleting files
3	To run a basic Word Count MapReduce program to understand MapReduce Paradigm: To count words in a given file, To view the output file, and To calculate execution time.
4	To perform NoSQL database using mongodb to create, update and insert.
5	To study and implement basic functions and commands in R Programming.
6	To build WordCloud, a text mining method using R for easy to understand and visualization than a table data.
7	To implement Bloom Filters for filter on Stream Data in C++/java
8	To implement clustering program using R programming.
9	To find Term Frequency and Inverse Document Frequency (tf-idf) Matrix for Recommendation Systems and Plot TF Using R used.
10	To install and run HIVE in Ubuntu so as to work with Hadoop.
	Installation of Hadoop
	Implement Hadoop file system
	Implement Mapreduce

Semester II

Course Code	Course Title	Credits
SIPSIT21	Soft Computing Fundamentals	**4**
SIPSIT22	Digital Image Processing	**4**
SIPSIT23	Introduction to Data Science	**4**
SIPSIT24	.NET Core	**4**
SIPSITP21	Soft Computing Fundamentals Practical	**2**
SIPSITP22	Digital Image Processing Practical	**2**
SIPSITP23	Introduction to Data Science Practical	**2**
SIPSITP24	.NET Core Practical	**2**
	TOTAL CREDITS	**24**

Semester II

Soft Computing Fundamentals:

Learning Objective:

- Soft Computing is a consortium of methodologies which collectively provide the concepts and techniques for designing intelligent systems.
- To introduce the techniques of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

Learning Outcome: After completing this course, learner will be able to learn:

- Fuzzy logic and its applications.
- Artificial neural networks and its applications.
- Solving single-objective optimization problems using GAs.
- Applications of soft computing to solve problems in several of application domains.

Theory Component:

M.Sc (Information Technology)	**Semester – II - SIPSIT21**
Course Name	**Soft Computing Fundamentals**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Introduction to Soft Computing**: Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques. **Fuzzy logic:** Introduction to Fuzzy logic, Fuzzy sets and membership function, Operations on Fuzzy sets.	**12**
II	**Fuzzy logic:** Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques. Fuzzy logic controller design, Some applications of Fuzzy logic. **Genetic Algorithms:**Biological Background, Traditional optimization and search techniques, genetic algorithm and search space, genetic algorithm vs. traditional algorithms, basic terminologies, simple genetic algorithm, general genetic algorithm, operators in genetic algorithm, stopping condition for genetic algorithm flow, constraints in genetic algorithm,	**12**
III	Problem solving using genetic algorithm, the schema theorem, classification of genetic algorithm, Holland classifier systems, genetic programming, advantages and limitations and applications of genetic algorithm. Concept of multi-objective optimization problems (MOOPs) and issues of solving them.	**12**
IV	**Artificial Neural Networks :** What is Neural Network, Learning rules and various activation functions, Single layer Perceptron, Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.	**12**
V	**Special Networks:** Simulated annealing, Boltzmann machine, Gaussian Machine, Cauchy Machine, Probabilistic neural net, cascade correlation network, cognition network, neo-cognition network, cellular neural network, optical neural network **Third Generation Neural Networks:** Spiking Neural networks, convolutional neural networks, deep learning neural networks, extreme learning machine model.	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Fuzzy Logic with Engineering Applications	Timothy J. Ross	Wiley	3rd	
2	Introduction to Genetic Algorithms	S.N Sivanandam and S.N. Deepa	Springer		

3	Principles of Soft Computing	S.N.Sivanandam, S.N.Deepa	Wiley	2nd	
4	Genetic Algorithms: Search, Optimization and Machine Learning	Davis E.Goldberg	Addison Wesley		
5	An Introduction to Genetic Algorithm	Melanic Mitchell	MIT Press		
6	Evolutionary Algorithm for Solving Multi-objective, Optimization Problems	Collelo, Lament, Veldhnizer	Springer	2nd	
7	Neural Networks and Learning Machines	Simon Haykin	PHI		

Internal Evaluation: 40 Marks

20 Marks	**20 Marks**
Class Test	Any relevant course with SWAYAM-NPTEL

Practical Component:

M. Sc (Information Technology)	**Semester – II - SIPSITP21**
Course Name	**Soft Computing Fundamentals Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

1	Implementation of Fuzzy operations using JAVA/C/C++/MATLAB
2	Implementation of Fuzzy Relations(Max-Min composition) using JAVA/C/C++/MATLAB
3	Implementation of Fuzzy controller(Washing machine) using JAVA/C/C++/MATLAB
4	To implement Mc-Culloch pits Model using XOR using JAVA/C/C++/MATLAB
5	Implementation of Single layer Perceptron Learning Algorithm using JAVA/MATLAB
6	Implementation of unsupervised learning algorithm – Hebbian Learning using JAVA/MATLAB
7	Implementation of simple Genetic Application – Match Word Finding using JAVA/MATLAB
8	Implement TSP using GA

Digital Image Processing

Learning Objective:

- To cover the basic theory and algorithms that are widely used in digital image processing,
- To expose students to current technologies and issues that are specific to image processing systems
- To develop skills in using computers to process images.

Learning Outcome:

Students should demonstrate the ability:

- To understand the fundamental concepts of a digital image processing system,
- To make extensive use of these concepts in implementing processing techniques such as noise removal, enhancement, compression for efficient storage and transmission, object extraction, representation and description for recognition or building computer vision, etc.

Theory Component:

M. Sc(Information Technology)	**Semester – II - SIPSIT22**
Course Name	**Digital Image Processing**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures

I	**Introduction:** Digital Image Processing, Origins of Digital Image Processing, Applications and Examples of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System **Digital Image Fundamentals:** Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships Between Pixels, Basic Mathematical Tools Used in Digital Image Processing	**12**
II	**Image Enhancement in spatial domain:** Basics, Basic Intensity Transformation Functions, Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters, Highpass, Bandreject, and Bandpass Filters from Lowpass Filters, Combining Spatial Enhancement Methods, Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering **Filtering in the Frequency Domain:** Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform of One Variable, Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters, Selective Filtering, Fast Fourier Transform	**12**
III	**Image Restoration and Reconstruction:** A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-----Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Image Reconstruction from Projections	**12**
IV	**Color Image Processing:** Color Fundamentals, Color Models, Pseudocolor Image Processing, Full-Color Image Processing, Color Transformations, Color Image Smoothing and Sharpening, Using Color in Image Segmentation, Noise in Color Images, Color Image Compression. **Image Compression:**Fundamentals, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-length Coding, Symbol-based Coding, 8 Bit-plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding	**12**
V	**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transform, Morphological Algorithms, Morphological Reconstruction, Morphological Operations on Binary Images, Grayscale Morphology **Image Segmentation I: Edge Detection, Thresholding, and Region Detection:** Fundamentals, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Clustering and Superpixels, Region Segmentation Using Graph	**12**

	Cuts, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation	

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Digital Image Processing	Gonzalez and Woods	Pearson/Prentice Hall	Fourth	2018
2	Fundamentals of Digital Image Processing	A K. Jain	PHI		
3	The Image Processing Handbook	J. C. Russ	CRC	Fifth	2010

Internal Evaluation: 40 Marks

20 Marks	20 marks
Class Test	Project work in image processing

Practical Component:

M. Sc (Information Technology)	**Semester – II - SIPSITP22**
Course Name	**Digital Image Processing Practical**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

1		WAP to study the effects of reducing the quantization values and spatial Resolution
2		Image enhancement
	A	Thresholding
	B	Contrast adjustment
	C	Brightness adjustment
	D	Gray level slicing
3		Basic Transformations
	A	Log transformation

	B	Power law transformation
	C	Negation
4	A	Different Filters (LPF, HPF, Lapalcian, LOG etc.) $h_g(n_1, n_2) = e^{-(n_1^2+n_2^2)/(2\sigma^2)}$ ıg formula. $h(n_1, n_2) = \frac{(n_1{}^2 + n_2{}^2 - 2\sigma^2)h_g(n_1, n_2)}{2\pi\sigma^6 \sum_{n_1}\sum_{n_2} h_g}$
	B	Write a program to apply a mask on the image.
		a. Accept the size of mask from the user. b. Check whether the mask is of odd size. c. The program should work for any high pass and low pass mask. d. Check the sum of all the elements of the mask. For low pass filter the sum should be one and zero for high pass filter. e. Compare the output for different size of masks.
5		a. Write a program to plot a Histogram and apply histogram equalization
		b. Write a program to apply bit plane slicing
6		Write a program to apply Gaussian filter on an image. a. Write a code to generate a Gaussian mask and then apply the mask on the image. b. Accept the size of mask and the sigma value from the user to generate a mask. c. Use the following formula to generate Gaussian mask. $h_g(n_1, n_2) = e^{-(n_1^2+n_2^2)/(2\sigma^2)}$ $h(n_1, n_2) = \frac{h_g(n_1, n_2)}{\sum_{n_1}\sum_{n_2} h_g}$
7		1.Apply following morphological operations on the image: a. Opening b. Closing c. Morphological gradient d. Top-hat transformation 2. Write a program for boundary detection.
8		1.WAP to show RGB planes 2. WAP to convert a. RGB to NTSC

		b. RGB to YCbCr c. RGB to CMY d. RGB to HIS
9		WAP to achieve Pseudo coloring

Introduction to Data Science

Learning Objective:

- To develop the skill sets needed to be a data scientist.
- To understand Statistical Inference and identify probability distributions commonly used as foundations for statistical modeling.
- To use R to carry out basic statistical modeling and analysis.
- Apply basic machine learning algorithms (Linear Regression, k-Nearest Neighbors (k-NN), k-means, Naive Bayes) for predictive modeling.

Learning Outcome:

- Students can design their own statistical analysis and implement them with advanced statistical programming tools.

Theory Component:

M. Sc (Information Technology)	**Semester – II - SIPSIT23**
Course Name	**Introduction to Data Science**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	**Contents**	**No. of Lectures**
I	**Data Science Technology Stack :** Rapid Information Factory Ecosystem, Data Science Storage Tools, Data Lake, Data Vault, Data Warehouse Bus Matrix, Data Science Processing Tools	**12**

	Layered Framework : Definition of Data Science Framework, Cross-Industry Standard Process for Data Mining (CRISP-DM), Homogeneous Ontology for Recursive Uniform Schema, The Top Layers of a Layered Framework, Layered Framework for High-Level Data Science and Engineering **Business Layer:** Business Layer, Engineering a Practical Business Layer **Utility Layer:** Basic Utility Design, Engineering a Practical Utility Layer	
II	**Three Management Layers:** Operational Management Layer, Audit, Balance, and Control Layer, Functional Layer	**12**
III	**Retrieve Superstep :** Data Lakes, Data Swamps, Training the Trainer Model, Understanding the Business Dynamics of the Data Lake, Actionable Business Knowledge from Data Lakes, Engineering a Practical Retrieve Superstep, Connecting to Other Data Sources	**12**
IV	**Assess Superstep:** Assess Superstep, Errors, Analysis of Data, Practical Actions, Engineering a Practical Assess Superstep, **Process Superstep :** Data Vault, Time-Person-Object-Location-Event Data Vault, Data Science Process	**12**
V	**Transform Superstep :** Transform Superstep, Building a Data Warehouse, Transforming with Data Science, Hypothesis Testing, Overfitting and Underfitting, Precision-Recall, Cross-Validation Test. Univariate Analysis, Bivariate Analysis, Multivariate Analysis, Linear Regression, Logistic Regression, Clustering Techniques, ANOVA, Principal Component Analysis (PCA), Decision Trees, Support Vector Machines, Networks, Clusters, and Grids, Data Mining, Pattern Recognition, Machine Learning, Bagging Data,Random Forests, Computer Vision (CV) , Natural Language Processing (NLP), Neural Networks, TensorFlow. **Organize and Report Supersteps :** Organize Superstep, Report Superstep, Graphics, Pictures, Showing the Difference	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Practical Data Science	Andreas François Vermeulen	APress	1st	2018
2	Doing Data Science	Cathy O'Neil and Rachel Schutt.	O'Reilly	1st	2014
3	Practical Data Science with R	Nina Zumel John Mount	Manning Publication	1st	2014

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Any relevant course with SWAYAM - NPTEL

Practical Component:

M. Sc (Information Technology)	Semester – II - SIPSITP23
Course Name	**Introduction to Data Science Practicals**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

1	Perform Linear Regression on any given data – Simple and Multiple Linear Regression
2	Perform classification on any given data – Logistic Regression and Discriminant Analysis.
3	Generate unique sampling distribution – Bootstrapping and Cross validation.
4	Implement methods that can provide better prediction accuracy and model interpretability for fitting linear models- Subset Selection, Best-Subset Selection, Forward Stepwise Selection, Backward Stepwise Selection, and Hybrid Methods.
5	Perform Shrinkage approach to fit a model involving all predictors – Ridge Regression and Lasso.
6	Implement dimension reduction by 2 approaches – Principal Component Regression and Partial Least Squares.
7	Implement a nonlinear regression using the following techniques – Step function, Piecewise function, Spline function and Generalized Additive Model.
8	Perform regression and classification using Tree based methods – Bagging, Boosting and Random Forest.
9	Implement Supervised Learning Model using Support Vector Machine.

10	Implement Unsupervised Learning using the following algorithms – Principal Component Analysis, k-Means Clustering, and Hierarchical Clustering.

.NET Core

Learning Objective:

ASP.NET MVC has many features that enable fast and testing-friendly approach used for creating polished online services which use advanced web standards.

Learning Outcome:

- The students can develop rich web applications using Model View Control.
- Students experience the fact that complex applications are easy to manage because of divisions of Model, View, and Controllers.

Theory Component:

M. Sc (Information Technology)	**Semester – II - SIPSIT24**
Course Name	**.NET Core**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**4**

Unit	Contents	No. of Lectures
I	**Microservices:** Understanding Microservices, Adopting Microservices, The Microservices Way	**12**

	Microservices Value Proposition: Deriving Business Value, Defining a Goal-Oriented, Layered Approach, Applying the Goal-Oriented, Layered Approach **Designing Microservice Systems:** The Systems Approach to Microservices, A Microservices Design Process **Establishing a Foundation:** Goals and Principles, Platforms, Culture	
II	**Service Design:** Microservice Boundaries, API design for Microservices, Data and Microservices, Distributed Transactions and Sagas, Asynchronous Message-Passing and Microservices, Dealing with Dependencies **System Design and Operations:** Independent Deployability, More Servers, Docker and Microservices, Role of Service Discovery, Need for an API Gateway, Monitoring and Alerting **Adopting Microservices in Practice:** Solution Architecture Guidance, Organizational Guidance, Culture Guidance, Tools and Process Guidance, Services Guidance	**12**
III	**Building Microservices with ASP.NET Core:** Introduction, Installing .NET Core, Building a Console App, Building ASP.NET Core App **Delivering Continuously:** Introduction to Docker, Continuous integration with Wercker, Continuous Integration with Circle CI, Deploying to Dicker Hub **Building Microservice with ASP.NET Core:** Microservice, Team Service, API First Development, Test First Controller, Creating a CI pipeline, Integration Testing, Running the team service Docker Image. **Backing Services:** Microservices Ecosystems, Building the location Service, Enhancing Team Service	**12**
IV	**Creating Data Service:** Choosing a Data Store**,** Building a Postgres Repository, Databases are Backing Services, Integration Testing Real Repositories, Exercise the Data Service **Event Sourcing and CQRS:** Event Sourcing, CQRS pattern, Event Sourcing and CQRS, Running the samples **Building an ASP.NET Core Web Application:** ASP.NET Core Basics, Building Cloud-Native Web Applications **Service Discovery:** Cloud Native Factors, Netflix Eureka, Discovering and Advertising ASP.NET Core Services. DNS and Platform Supported Discovery	**12**
V	**Configuring Microservice Ecosystems:** Using Environment Variables with Docker, Using Spring Cloud Config Server, Configuring Microservices with etcd, **Securing Applications and Microservices:** Security in the Cloud, Securing ASP.NET Core Web Apps, Securing ASP.NET Core Microservices **Building Real-Time Apps and Services:** Real-Time Applications Defined, Websockets in the Cloud, Using a Cloud Messaging Provider, Building the Proximity Monitor.	**12**

	Putting It All Together: Identifying and Fixing Anti-Patterns, Continuing the Debate over Composite Microservices, The Future	

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	**Microservice Architecture:** ***Aligning Principles, Practices, and Culture***	Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, and Mike Amundsen	O'Reilly	1st	2016
2	**Building Microservices with ASP.NET Core**	Kevin Hoffman	O'Reilly	1st	2017
3	**Building Microservices**	Sam Newman	O'Reilly	1st	2015

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	A project work using .NET Core

Practical Component:

M. Sc (Information Technology)	**Semester – II - SIPSITP24**
Course Name	**.Net Core Practicals**
Periods per week (1 Period is 60 minutes)	**4**
Credits	**2**

List of Practical:

Implement any 10 Practical relevant to .NET Core.