Sheth NKTT College of Commerce and Sheth JTT College of Arts, Thane (Autonomous)

Credit Structure: Post Graduate Programme

As per NEP-2020

(w.e.f. 2024-25)

M.Sc. (Information Technology) Sem I

Category	Code	Course	Credit
Mandatory	MSD101	Data Science	**4**
	MSDP102	Data Science Practical	**2**
	MSS103	Soft Computing Techniques	**4**
	MSSP104	Soft Computing Techniques Practical	**2**
	MSC105	Cloud Computing	**2**
OE (Any One)	MSSB106	Security Breaches and Countermeasures	**4**
	MSDC107	Data Center Technologies	
	MSI108	Image Processing	
	MSR109	Research Methodology	**4**
		Total Credit	**22**

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Program Name: **M.Sc. (Information Technology)**	**Semester: I**
Course Category/Vertical: Major Mandatory	
Name of the Dept: **Science and Technology**	
Course Title: **Data Science**	
Course Code: MSD101	Course Level:6.0
Type: **Theory**	
Course Credit: 4 credits	
Hours Allotted: 60 Hours	
Marks Allotted: 100 Marks	

Course Objectives:

To enable the students to:

1: Develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.

2: Practice problem analysis and decision-making.

3 : Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences

Course Outcomes :

CO1: Analyze the Data Science technology stack, layered framework, business and utility layers, and apply modern tools

CO2: Apply statistical frameworks and super steps to manage data layers, analyze business dynamics, and engineer practical solutions for actionable data-driven decision-making.

CO3: Apply Python-based data analysis and visualization techniques to process, transform, and evaluate data using statistical methods and machine learning

CO4: Apply machine learning algorithms and statistical techniques to analyze, organize, and report data, enabling predictive modeling

Syllabus: NEP 2020 w.e.f 2024-25

Unit No.	Content	Hours
I	**Data Science Introduction & Basics** **a. Data Science Technology Stack**: Rapid Information Factory Ecosystem, Data Science Storage Tools, Data Lake, Data Vault, Data Warehouse Bus Matrix, Data Science Processing Tools, Spark, Mesos, Akka , Cassandra, Kafka, Elastic Search, R ,Scala, Python, MQTT, The Future. **b. 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 c**. Business Layer**: Business Layer, Engineering a Practical Business Layer d. **Utility Layer**: Basic Utility Design, Engineering a Practical Utility Layer.	15
II	**Statistics for Data Science** **a. Three Management Layers**: Operational Management Layer, Processing-Stream Definition and Management, Audit, Balance, and Control Layer, Balance, Control, Yoke Solution, Cause-and-Effect, Analysis System, Functional Layer, Data Science Process **b. 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. **c. Assess Supersteps**: Assess Superstep, Errors, Analysis of Data, Practical Actions, Engineering a Practical Assess Superstep.	15
III	**Data Analysis with Python & Data Visualization** a**. Process Superstep:** Data Vault, Time-Person-Object-Location Event Data Vault, Data Science Process, Data Science, **b. Transform Superstep**: Transform Superstep, Building a Data Warehouse, Transforming with Data Science, Hypothesis Testing, Overfitting and Underfitting, Precision-Recall, Cross Validation Test.	15
IV	**Machine Learning for Data Science** **a. Transform Superstep**: 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, Tensor Flow.	15

	b. Organize and Report Supersteps: Organize Superstep, Report Superstep, Graphics, Pictures, Showing the Difference.	
	Total Hours	**60**

References:

1 Practical Data Science - Andreas François Vermeulen (APress 2018)

2 Principles of Data Science - Sinan Ozdemir (PACKT 2016)

3 Data Science from Scratch - Joel Grus (O'Reilly 2015)

4 Data Science from Scratch First Principle in python - Joel Grus (Shroff Publishers 2017)

5 Experimental Design in Data science with Least Resources - N C Das Shroff (Publishers 2018)

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Programme Name: **M.Sc (Information Technology)**	**Semester: I**
Course Category/Vertical: Major Mandatory	
Name of the Dept: **Science and Technology**	
Course Title: **Data Science Practical**	
Course Code: MSDP102	Course Level:6.0
Type: **Practical**	
Course Credit: 2 credits	
Hours Allotted: 60 Hours	
Marks Allotted: 50 Marks	

Course Objectives:

To enable the students to:

1. Develop statistical and analytical modelling using data science concepts
2. Develop data visualization
3. Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences

Course Outcomes:

Upon completing this course, the student will be able to:

CO1. Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.
CO 2. Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy.
CO 3. Apply ethical practices in everyday business activities and make well-reasoned ethical business and data management decisions.
CO 4. Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
CO 5. Apply principles of Data Science to the analysis of business problems.
CO 6. Use data mining software to solve real-world problems.
CO 7. Employ cutting edge tools and technologies to analyze Big Data.
CO 8. Apply algorithms to build machine intelligence.
CO 9. Demonstrate use of team work, leadership skills, decision making and organization theory

Syllabus: NEP 2020 w.e.f 2024-25

Unit No.	Content	Hours
I	1. 1. Creating and using database in Cassandra 2. Write the programs for the following: 2a Text Delimited CSV to HORUS format 2b XML to HORUS format 2c JSON to HORUS format 2d MySql database to HORUS format 2e Picture(JPEG) to HORUS format 2f Video to HORUS format 2g Audio to HORUS format 3. 3a Fixers Utilities 3b Data Binning or Bucketing 3c Averaging of data 3d Outlier Detection 3e Logging	15
II	4. 4a Perform following data processing using R 4b Program retrieve different attributes of data 4c Data pattern 4d Loading IP_DATA_ALL 5. 5a Perform error management on the given data using pandas package 5b Write python/R program to create the network routing diagram from the given data on routers 5c Write a python/R program to build acyclic graph 5d Write python/R program to pick the content for Billboards from the given data 5e Write a python/R program to generate GML file from given csv file 5f Write python/R program to plan location of warehouse from the given data 5g Write python/R program using data science via clustering to determine new warehouse using the given data 5h Using the given data Write python/R program to plan the shipping routers from best-fit international logistics 5i Write python/R program to delete the best packing option to ship in container from the given data 5j Write python program to create delivery route using the given data 5k Write python program to crate simple forex trading planner from the given data 5l Write python program to process the balance sheet to ensure the only good data is processing 5m Write python program to generate payroll from the given data	30

III	6. Build the time hub, links and satellites 7. Transforming data III 8. Organizing data 9. Generating data 10. Data visualization using power Bi	15
	Total Hours	**60**

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Programme Name: **M.Sc (Information Technology)**	**Semester: I**
Course Category/Vertical: Major Mandatory	
Name of the Dept: **Science and Technology**	
Course Title: **Soft Computing Techniques**	
Course Code: MSS103	Course Level:6.0
Type: **Theory**	
Course Credit: 4 credits	
Hours Allotted: 60 Hours	
Marks Allotted: 100 Marks	

Course Objectives:

To enable the students to:

1: Soft computing concepts like fuzzy logic, neural networks and genetic algorithm, where Artificial Intelligence is mother branch of all.

2 : All these techniques will be more effective to solve the problem efficiently.

Course Outcomes:

Upon completing this course, the student will be able to:

CO1: Evaluate the fundamental concepts of soft computing as a core branch of Artificial Intelligence, contrasting its tolerance for imprecision and uncertainty against traditional hard computing methods.

CO2: Synthesize various neural network architectures and training algorithms to solve complex real-world classification, regression, and pattern recognition problems.

CO3: Apply fuzzy logic principles and reasoning mechanisms to design robust decision-making and modeling frameworks capable of handling vague, noisy, or incomplete data.

CO4: Formulate high-dimensional search and optimization problems across engineering, finance, and healthcare domains using genetic algorithms and swarm intelligence techniques (such as PSO and ACO).

Syllabus: NEP 2020 w.e.f 2024-25

Unit No.	Content	Hours
I	a**) Introduction of soft computing** - soft computing vs. hard computing, various types of soft computing techniques, Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Classification, Clustering, Bayesian Networks, Probabilistic reasoning, applications of soft computing. **b) Artificial Neural Network** - Fundamental concept, Evolution of Neural Networks, Basic Models, McCulloh-Pitts Neuron, Linear Separability, Hebb Network. **c) Supervised Learning Network** - Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neurons, Backpropagation Network, Radial Basis Function, Time Delay Network, Functional Link Networks, Tree Neural Network	15
II	**a) Associative Memory Networks -** Training algorithm for pattern Association, Auto associative memory network, hetroassociative memory network, bi-directional associative memory, Hopfield networks, iterative auto associative memory networks, temporal associative memory networks. Kohonen self-organizing feature maps, learning vectors quantization, counter propagation networks, adaptive resonance theory networks. **b) 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 **c) Third Generation Neural** Networks - Spiking Neural networks, convolutional neural networks, deep learning neural networks, extreme learning machine model. **d) UnSupervised Learning Networks** - Fixed weight competitiveness	15
III	**a. Introduction to Fuzzy Logic, Classical Sets and Fuzzy sets** Classical sets, Fuzzy sets. **b. Classical Relations and Fuzzy Relations -** Cartesian Product of relation, classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. **c. Membership Function** - features of the membership functions, fuzzification, methods of membership value assignments. ‘ **d. Defuzzification -** Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. e**. Fuzzy Arithmetic and Fuzzy measures** - fuzzy arithmetic, fuzzy measures, measures of fuzziness, fuzzy integrals.	15
IV	**a) Fuzzy Rule base and Approximate reasoning -** Fuzzy proportion, formation of rules, decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, Fuzzy logic control systems, control system design, architecture and operation of FLC system, FLC	15

	system models and applications of FLC System. **b) Genetic Algorithm** - 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, operator's in genetic algorithm, stopping condition for genetic algorithm flow, constraints in genetic algorithm, 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. Differential Evolution. Algorithm, Hybrid soft computing techniques – neuro – fuzzy hybrid, genetic neuro-hybrid systems, genetic fuzzy hybrid and fuzzy genetic hybrid systems.	
	Total Hours	**60**

References:

1. Artificial Intelligence and Soft Computing by Anandita Das Bhattacharya, SPD publisher, 3rd edition, 2018

2. Principles of Soft computing by S.N.Sivanandam S.N.Deepa, Wiley publisher, 3rd Edition, 2019

3. Neuro-Fuzzy and Soft Computing by J.S.R.Jang, C.T.Sun and E.Mizutani, Prentice Hall of India publisher, 2004

4. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications by S.Rajasekaran, G. A. Vijayalakshami, Prentice Hall of India publisher, 2004

5. Fuzzy Logic with Engineering Applications by Timothy J.Ross, McGraw Hill publisher, 1997

6. Genetic Algorithms: Search, Optimization and Machine Learning by Davis E.Goldberg, Addison Wesley publisher, 1989

7. Introduction to AI and Expert System by Dan W. PaΣerson, Prentice Hall of India publisher, 2009

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Programme Name: **M.Sc (Information Technology)**	**Semester: I**
Course Category/Vertical: Major Mandatory	
Name of the Dept: **Science and Technology**	
Course Title: **Soft Computing Techniques Practical**	
Course Code: MSSP104	Course Level:6.0
Type: **Practical**	
Course Credit: 2 credits	
Hours Allotted: 60 Hours	
Marks Allotted: 50 Marks	
Course Objectives: 1. Hands-On Implementation 2. Algorithm Understanding 3. Real-World Applications 4. Develop students' programming skills by experimenting with soft computing algorithms. 5. Train students to visualize and interpret the results of soft computing techniques effectively	
Course Outcomes: Upon completing this course, the student will be able to: CO 1: Identify and describe soft computing techniques and their roles in building intelligent machines CO 2: Recognize the feasibility of applying a soft computing methodology for a particular problem CO 3: Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems CO 4: Apply genetic algorithms to combinatorial optimization problems CO 5: Apply neural networks for classification and regression problems CO 6: Effectively use existing software tools to solve real problems using a soft computing approach CO 7: Evaluate and compare solutions by various soft computing approaches for a given problem.	

Syllabus: NEP 2020 w.e.f 2024-25

Unit No.	Content	Hours
I	1**.Implement the following**: A. Design a simple linear neural network model. B. Calculate the output of neural net using both binary and bipolar sigmoidal function. **2. Implement the following:** A. Generate AND/NOT function using McCulloch-Pitts neural net. B. Generate XOR function using McCulloch-Pitts neural net. **3.Implement the Following:** A. Write a program to implement Hebb's rule. B. Write a program to implement of delta rule.	20
II	**4. Implement the Following** A. Write a program for Back Propagation Algorithm B. Write a program for error Backpropagation algorithm. **5. Implement the Following** A. Write a program for Hopfield Network. B. Write a program for Radial Basis function **6.Implement the Following** A. Kohonen Self organizing map B. Adaptive resonance theory	20
III	**7.Implement the Following** A. Write a program for Linear separation. B. Write a program for Hopfield network model for associative memory **8.Implement the Following** A. Membership and Identity Operators | in, not in, B. Membership and Identity Operators is, is not **9. Implement the Following** A. Find ratios using fuzzy logic B. Solve Tipping problem using fuzzy logic **10.Implement the Following** A. Implementation of Simple genetic algorithm B. Create two classes: City and Fitness using Genetic algorithm	20
	Total Hours	**60**

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Programme Name: **M.Sc (Information Technology)**	**Semester: I**
Course Category/Vertical: Major Mandatory	
Name of the Dept: **Science and Technology**	
Course Title: **Cloud Computing**	
Course Code: MSC105	Course Level:6.0
Type: **Theory**	
Course Credit: 2 credits	
Hours Allotted: 30 Hours	
Marks Allotted: 50 Marks	
Course Objectives: 1. To learn how to use Cloud Services. 2. To implement Virtualization. 3. To implement Task Scheduling algorithms. 4. Apply Map-Reduce concept to applications. 5. To build Private Cloud. 6. Broadly educate to know the impact of engineering on legal and societal issues Involved	
Course Outcomes: CO1: Understand the basic concepts of cloud computing, distributed systems, and virtualization. CO2: Analyze cloud architectures, service models, and security mechanisms in cloud environments.	

Syllabus: NEP 2020 w.e.f 2024-25

Unit No.	Content	Hours
I	Introduction to Cloud Computing - Introduction, Historical developments, Building Cloud Computing Environments, Principles of Parallel and Distributed Computing - Eras of Computing, Parallel v/s distributed computing, Elements of Parallel Computing, Elements of distributed computing, Technologies for distributed computing. Virtualization -Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples. Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud usage monitor, Resource replication, Ready-made environment.	15
II	Cloud Computing Architecture: Introduction, Fundamental concepts and models, Roles and boundaries, Cloud Characteristics, Cloud Delivery models, Cloud Deployment models, Economics of the cloud, Open challenges. Fundamental Cloud Security: Basics, Threat agents, Cloud security threats, additional considerations. Industrial Platforms and New Developments: Amazon Web Services, Google App Engine, Microsoft Azure.	15
	Total Hours	**30**

References:

Sr.No	Title	Author	Publisher	Edition	Year
1.	Mastering Cloud Computing Foundations and Applications Programming	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi	Elsevier		2013
2.	Cloud Computing Concepts, Technology & Architecture	Thomas Erl, Zaigham Mahmood, and Ricardo Puttini	Prentice Hall		2013
3.	Distributed and Cloud Computing, From Parallel Processing to the Internet of Things	Kai Hwang, Jack Dongarra, Geoffrey Fox	MK Publishers		2012

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Programme Name: **M.Sc (Information Technology)**	**Semester: I**
Course Category/Vertical: **Elective**	
Name of the Dept: **Science and Technology**	
Course Title: Security Breaches and Countermeasures Practical	
Course Code: MSSB106	Course Level:6.0
Type: **Practical**	
Course Credit: 4 credits	
Hours Allotted: 120 Hours	
Marks Allotted: 100 Marks	

Course Objectives:

1. To get the insight of the security loopholes in every aspect of computing.
2. To understand the threats and different types of attacks that can be launched on computing systems.
3. To know the countermeasures that can be taken to prevent attacks on computing systems.
4. To test the software against attacks.

Course Outcome:

Upon completing this course, the student will be able to:

CO 1: The student should be able to identify the different security breaches that can occur. The student should be able to evaluate the security of an organization and identify the loopholes. The student should be able to perform enumeration and network scanning.

CO 2: The student should be able to identify the vulnerability in the systems, breach the security of the system, identify the threats due to malware and sniff the network. The student should be able to do the penetration testing to check the vulnerability of the system towards malware and network sniffing.

CO 3: The student should be able to perform social engineering and educate people to be careful from attacks due to social engineering, understand and launch DoS and DDoS attacks, hijack and active session and evade IDS and Firewalls. This should help the students to make the organization understand the threats in their systems and build robust systems.

CO 4: The student should be able to identify the vulnerabilities in the Web Servers, Web Applications, perform SQL injection and get into the wireless networks. The student should be able to help the organization aware about these vulnerabilities in their systems.

CO 5: The student should be able to identify the vulnerabilities in the newer technologies like mobiles, IoT and cloud computing. The student should be able to use different methods of cryptography.

Units	Sr. No	Details
I	a)	1. Use the following tools to perform footprinting and reconnaissance
		2. Recon-ng (Using Kali Linux)
		3. FOCA Tool
		4. Windows Command Line Utilities
		5. Ping
	b)	6. Tracert using Ping
		7. Tracert
		8. NSLookup
		9. Website Copier Tool – HTTrack
		10. Metasploit (for information gathering)
	c)	11. Whois Lookup Tools for Mobile – DNS Tools, Whois, Ultra Tools Mobile
		12. Smart Whois
		13. eMailTracker Pro
		14. Tools for Mobile – Network Scanner, Fing – Network Tool, Network Discovery Tool, Port Droid Tool
	d)	a. Scan the network using the following tools:
		i. Hping2 / Hping3
		ii. Advanced IP Scanner
		iii. Angry IP Scanner
	e)	iv. Masscan
		v. NEET
		vi. CurrPorts
		vii. Colasoft Packet Builder
		viii. The Dude
	f)	b. Use Proxy Workbench to see the data passing through it and save the data to file.
		c. Perform Network Discovery using the following tools:
	g)	i. Solar Wind Network Topology Mapper
		ii. OpManager
		iii. Network View
		iv. LANState Pro
		d. Use the following censorship circumvention tools:
		i. Alkasir
	h)	ii. Tails OS
		e. Use Scanning Tools for Mobile – Network Scanner, Fing – Network Tool, Network Discovery Tool, Port Droid Tool
	a)	a. Perform Enumeration using the following tools:
		i. Nmap

II		ii. NetBIOS Enumeration Tool
		iii. SuperScan Software
		iv. Hyena
		v. SoftPerfect Network Scanner Tool
		vi. OpUtils
		vii. SolarWinds Engineer's Toolset
		viii. Wireshark
	b)	b. Perform the vulnerability analysis using the following tools:
		i. Nessus
		ii. OpenVas
		a. Perform mobile network scanning using NESSUS.
		b. Perform the System Hacking using the following tools:
		i. Winrtgen
		ii. PWDump
		iii. Ophcrack
		iv. Flexispy
	c)	v. NTFS Stream Manipulation
		vi. ADS Spy
		vii. Snow
		viii. Quickstego
		ix. Clearing Audit Policies
	d)	x. Clearing Logs
		a. Use wireshark to sniff the network.
		b. Use SMAC for MAC Spoofing.
		c. Use Caspa Network Analyser.
		d. Use Omnipeek Network Analyzer.
		a. Use Social Engineering Toolkit on Kali Linux to perform Social Engineering using Kali Linux.
		b. Perform the DDOS attack using the following tools:
	e)	i. HOIC
		ii. LOIC
		iii. HULK
		iv. Metasploit

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Programme Name: **M.Sc (Information Technology)** **Semester: I**
Course Category/Vertical: **Elective**
Name of the Dept: **Science and Technology**
Course Title: **Data Center Technologies**
Course Code: MSDC107 Course Level:6.0
Type: **Theory**
Course Credit: 4 credits
Hours Allotted: 60 Hours
Marks Allotted: 100 Marks
Course Objectives: 1. Identify important requirements to design and support a data center. 2. Determine a data center environment's requirement including systems and network architecture as well as services. 3. Evaluate options for server farms, network designs, high availability, load balancing, data center services, and trends that might affect data center designs. 4. Assess threats, vulnerabilities and common attacks, and network security devices available to protect data centers. 5. Design a data center infrastructure integrating features that address security, performance, and availability. 6. Measure data center traffic patterns and performance metrics.
Course Outcomes: After completion of the course, a student should be able to: CO 1: Understand basic concepts in Virtualization and use concepts of Load Balancing and Aggregation /virtual switching CO 2: Configure Data center Migration and Fabric Building CO 3: Understand various Changes in Server Architecture CO 4: Use the concepts of Cloud computing and how to move towards a cloud computing technology.

Syllabus: NEP 2020 w.e.f 2024-25

Units	Details	Lectures
	Module I	
I	**a) Virtualization -** Virtualization History and Definitions **b) Virtualization and Network Technologies – I -** Data Center Network Evolution Beginning of Network Virtualization **c) Virtualization and Network Technologies – II -** Ace Virtual Contexts Virtual Device Contexts	**15**
II	**a) Fooling Spanning Tree** **b) Virtualized Chassis with Fabric Extenders -** History of Data Centers **c) Virtualization in Storage Technologies – I -** Storage Evolution	**15**
	Module II	
III	**a) Virtualization in Storage Technologies – II -** Islands in SAN **b) Secret Identities** One Cable to Unite Us All **c) Server Evolution**	**15**
IV	**a) Changing Personalities** **b) Transcending the Rack -** Moving Targets **c) End to End Virtualization -** Virtual Data Center and Cloud Computing	**15**

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Data Center Virtualization Fundamentals	Gustavo Alessandro Andrade Santana	Cisco Press	1st	2014

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Programme Name: **M.Sc (Information Technology)**	**Semester: I**
Course Category/Vertical: **Elective**	
Name of the Dept: **Science and Technology**	
Course Title: **Image Processing**	
Course Code: MSI108	Course Level:6.0
Type: **Theory**	
Course Credit: 4 credits	
Hours Allotted: 60 Hours	
Marks Allotted: 100 Marks	

Course Objectives:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques

Course Outcomes:

On successful completion of this course

CO1 - Students will be able to apply fundamental image processing techniques such as acquisition, enhancement, transformation, and filtering to analyze and improve digital images for various applications.

CO2 - Students will be able to analyze and process images in the frequency and transform domains using techniques such as Fourier, Wavelet, and other transforms for image filtering, restoration, and reconstruction.

CO3 - Students will be able to apply color, compression, and morphological techniques to enhance, analyze, and efficiently represent digital images for practical and multimedia applications.

CO4 - Students will be able to implement segmentation and feature extraction techniques to identify, isolate, and describe meaningful regions and objects in digital images for advanced image analysis and recognition tasks.

Syllabus: NEP 2020 w.e.f 2024-25

Unit No.	Content	Hours
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, **Intensity Transformations and Spatial Filtering:** Basics, Basic Intensity Transformation Functions, Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Low pass) Spatial Filters, Sharpening (High pass) Spatial Filters, High pass, Band reject, and Band pass Filters from Low pass Filters, Combining Spatial Enhancement Methods, Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering	15
II	**Filtering in the Frequency Domain**: Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform of One Variable,Extensions to Functions of Two Variables, Properties of the 2-D DFT and IDFT, Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters, Selective Filtering,Fast Fourier Transform **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 Wavelet and Other Image Transforms: Preliminaries, Matrix based Transforms, Correlation, Basis Functions in the Time Frequency Plane, Basis Images, Fourier-Related Transforms, Walsh-Hadamard Transforms, Slant Transform, Haar Transform, Wavelet Transforms	15
III	**Color Image Processing:** Color Fundamentals, Color Models, Pseudo color 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 and Watermarking: 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, Digital Image Watermarking,	15

	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.	
IV	**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 Super pixels, Region Segmentation Using Graph Cuts, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation **Image Segmentation II: Active Contours: Snakes and Level Sets:** Background, Image Segmentation Using Snakes, Segmentation Using Level Sets. Feature Extraction: Background, Boundary Preprocessing, Boundary Feature Descriptors, Region Feature Descriptors, Principal Components as Feature Descriptors, Whole-Image Features, Scale-Invariant Feature Transform (SIFT)	15
	Total Hours	**60**

References:

Sr.No	Title	Author	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

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Sheth N.K.T.T College of Commerce and
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Programme Name: **M.Sc (Information Technology)**	**Semester: I**
Course Category/Vertical:	
Name of the Dept: **Science and Technology**	
Course Title: **Research Methodology**	
Course Code: MSR109	Course Level:6.0
Type: **Theory**	
Course Credit: 4 credits	
Hours Allotted: 60 Hours	
Marks Allotted: 100 Marks	
Course Objectives: 1. To be able to conduct business research with an understanding of all the latest theories. 2. To develop the ability to explore research techniques used for solving any real world or innovate problem.	
Course Outcomes : A learner will be able to: CO 1: Solve real world problems with scientific approach and develop analytical skills by applying scientific methods. CO 2: Recognize, understand and apply the language, theory and models of the field of business analytics CO 3: Foster an ability to critically analyze, synthesize and solve complex unstructured business problems and understand and critically apply the concepts and methods of business analytics CO 4: Identify, model and solve decision problems in different settings and interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity and create viable solutions to decision making problems	

Syllabus: NEP 2020 w.e.f 2024-25

Unit No.	Content	Hours
I	a) Introduction: Role of Business Research, Information Systems and Knowledge Management, Theory Building, Organization ethics and Issues b) Beginning Stages of Research Process: Problem definition, Qualitative research tools, Secondary data research	15
II	a) Research Methods and Data Collection: Survey research, communicating with respondents, Observation methods, Experimental research	15
III	a) Measurement Concepts, Sampling and Field work: Levels of Scale measurement, attitude measurement, questionnaire design, sampling designs and procedures, determination of sample size	15
IV	a) Data Analysis and Presentation: Editing and Coding, Basic Data Analysis, Univariate Statistical Analysis and Bivariate Statistical analysis and differences between two variables. Multivariate Statistical Analysis	15
	Total Hours	**60**

References:

Sr.No	Title	Author	Publisher	Edition	Year
1.	Business Research Methods	William G.Zikmund, B.J Babin, J.C. Carr, Atanu Adhikari, M.Griffin	Cengage	8e	2016
2.	Business Analytics	Albright Winsto	Cengage	5e	2015
3.	Research Methods for Business Students Fifth Edition	Mark Saunders			2011

Evaluation Scheme

Theory courses of 4 credits: Total marks 100. Out of the total, 50% each for internal and external evaluation.

A. Internal Evaluation (30m + 10m + 10m = 50 Marks)

The internal assessment marks shall be awarded as follows:

1. 30 marks (Any one of the following):

a. Written Test of 30 Marks

b. SWAYAM (Advanced Course) of minimum 20 hours and certification exam completed or

c. NPTEL (Advanced Course) of minimum 20 hours and certification exam completed or

d. Valid International Certifications (Prometric, Pearson, Certiport, Coursera, Udemy and the like)

e. Certification marks of one completed exam shall be awarded to one course only. For four courses, the students will have to complete four certifications.

(Note: Only those certification/courses suggested by the department shall be deemed valid, Student cannot do any certification on their own)

2. 10 marks

10 marks from every course (Two 4 credits mandatory courses, one 2 credits mandatory course, one 4 credits elective course) coming to a total of 40 marks, shall be awarded on publishing of research paper in UGC approved / Other Journal with plagiarism less than 15%. The marks can be awarded as per the impact factor of the journal, quality of the paper, importance of the contents published, social value.

3. 10 marks

Open Book examination based on problem solving related to the respective subject.

Suggested format of Question paper of 20 marks for the written test.

Q1. Attempt any two of the following: 16 marks

a.

b.

c.

d.

Q2. Attempt any two of the following: 14 marks

a.

b.

c.

d.

B. External Examination: (50 marks) Duration : 2 hrs

All questions are compulsory

Q1 (Based on all units) Attempt any two of the following: 10 marks

a. Unit 1

b. Unit 2

c. Unit 3

d. Unit 4

Q2 (Based on Unit 1) Attempt any two of the following: 10 marks

Q3 (Based on Unit 2) Attempt any two of the following: 10 marks

Q4 (Based on Unit 3) Attempt any two of the following: 10 marks

Q5 (Based on Unit 4) Attempt any two of the following: 10 marks

Theory courses of 2 credits: Total marks 50. Out of the total, 50 % each for internal and external evaluation.

A. Internal Evaluation (25 Marks)

The internal assessment marks shall be awarded as follows:

1. 10 marks from every course (Two 4 credits mandatory courses, One 2 credits mandatory course, One 4 credits elective course) coming to a total of 40 marks, shall be awarded on publishing of research paper in UGC approved / Other Journal with plagiarism less than 15%. The marks can be awarded as per the impact factor of the journal, quality of the paper, importance of the contents published, social value.

2. 10 marks - Open Book examination based on problem solving related to the respective subject.

3. 5 marks - Assignment/Group discussion.

B. External Examination: (25 marks) Duration : 1 hr

All questions are compulsory

Q1 (Based on Unit 1) Attempt any two of the following: 13 marks

Q2 (Based on Unit 2) Attempt any two of the following: 12 marks

Practical courses of 2 credits: Total marks 50. Out of the total, 50 % each for internal and external evaluation.

A. Practical Evaluation Internal (25 marks)

1. Performance during all practical sessions 10
2. Problem solving with the acquired programming skills 10
3. Viva Voce 05

B. Practical Evaluation External (25 marks)

A Certified copy of hard-bound journal is essential to appear for the practical examination.

1. Practical Question 15
2. Journal 05
3. Viva Voce 05

Practical courses of 4 credits: Total marks 100. Out of the total, 50 % each for internal and external evaluation.

A. Practical Evaluation Internal (50 marks)

1. Performance during all practical sessions 20
2. Problem solving with the acquired programming skills 25
3. Viva Voce 05

B. Practical Evaluation External (50 marks)

A Certified copy of hard-bound journal is essential to appear for the practical examination.

1. Practical Question 20
2. Practical Question 20
3. Journal 05
4. Viva Voce 05