

Curriculum and Credit Framework for Undergraduate Programme

(Single Major) as per NEP-2020

B.Sc. Data Science

5th & 6th Semester

For Batch w.e.f Session: 2021-22



University School for Graduate Studies

Chaudhary Devi Lal University

Sirsa-125055, Haryana

Exit options and Credit requirements

SINGLE-MAJOR

Exit with	Credit requirement
Certificate in Data Science: After successful completion of First year (Two semesters) of the Four-Year Undergraduate Degree Programme.	48 (Including Internship of 4 Credits)
Diploma in Data Science: After successful completion of Two years (Four semesters) of the Four-Year Undergraduate Degree Programme.	94 (Including Internship of 4 Credits)
Bachelor of Data Science: After successful completion of Three years (Six semesters) of the Four-Year Undergraduate Degree Programme.	136
Bachelor of Data Science (Honours/Honours with Research) After successful completion of Four Years (Eight semesters) of the Undergraduate Degree Programme.	184

B.Sc. Data Science (5th & 6th Semester) (Batch : 2021-22 onwards)**SEMESTER-5**

COURSE CODE	COURSE TYPE	COURSE TITLE	T	P	Int. Theory	Ext. Theory	Practical	TOTAL
B.Sc/DS/SM/5/DSC/301	Major	Artificial Intelligence	4	-	30	70	-	100
B.Sc/DS/SM/5/DSC/302	Major	Data Analytics Using Python	2	2	15	35	50	100
B.Sc/DS/SM/5/MIC/301	Minor	Network Security	4	-	30	70	-	100
B.Sc/DS/SM/5/MIC/302	Minor	Wireless Networks	4	-	30	70	-	100
B.Sc/DS/SM/5/MIC/303	Minor	Cloud Computing	4	-	30	70	-	100
B.Sc/DS/SM/5/INT	Internship	Summer Internship	-	4	-	-	100	100

SEMESTER-6

COURSE CODE	COURSE TYPE	COURSE TITLE	T	P	Int. Theory	Ext. Theory	Practical	TOTAL
B.Sc/DS/SM/6/DSC/303	Major	Data Handling & Visualization	2	2	15	35	50	100
B.Sc/DS/SM/6/MIC/304	Minor	Discrete Mathematics	4	-	30	70	-	100
B.Sc/DS/SM/6/MIC/305	Minor	Internet of Things	4	-	30	70	-	100
B.Sc/DS/SM/6/MIC/306	Minor	Business Data Analytics	4	-	30	70	-	100
HIN/1/AECC1	Ability Enhancement Course	Prayojanmoolak Hindi	4	-	30	70	-	100
B.Sc/DS/SM/6/SEC/301	Skill Enhancement Course	Green Computing	3	-	25	50	-	75

Semester 5th

B.Sc/DS/SM/5/DSC/301: Artificial Intelligence							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC	04	04	Lecture	70	30	3 Hours	TEE/MTE/Assignment/Attendance
<p>Instructions to paper setter for Final Term Examination: The question paper will consist of <i>nine</i> questions in all. Question No. 1 will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, 8 more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit. All questions carry equal marks.</p>							
<p>Course Objective: The objective of this course is to understand knowledge representation, search algorithms, expert system and genetic algorithm.</p>							
<p>Course Outcome: After completing this course the students will be able to identify knowledge representation techniques, use search algorithm and learn the expert system and genetic algorithm.</p>							
Course Content Artificial Intelligence							
Unit I	Introduction: Background and history, overview of AI applications areas. The predicate calculus: syntax and semantic for propositional logic and FOPL, clausal form, inference rules, resolution and unification.						
Unit II	Knowledge representation: Network representation, associative network & conceptual graphs, structured representation, frames & scripts. Production system: Types of production system-commutative and non-commutative production systems, decomposable and non-decomposable production systems, control of search in production systems.						
Unit III	Search algorithms: Uninformed search (depth-first, breadth-first, depth-first with iterative deepening) and informed search (hill climbing, best first, A* algorithm, mini-max etc.), computational complexity, properties of search algorithms, admissibility, monotonicity, optimality, dominance.						
Unit IV	Rule-based expert systems: Architecture, development, managing uncertainty in expert systems, Bayesian probability theory, Fuzzy logic. Genetic algorithms: Problem representation, encoding schemes, Operators- selection, crossover, mutation, replacement etc.						
Text/Reference Books							
Text Books	George F. Luger, "Artificial Intelligence", Pearson Education. Dan W. Patterson Introduction to Artificial Intelligence and Expert system, PHI.						
Reference Books	1. Eugene Charniak, Drew McDermott, "Introduction to Artificial Intelligence" Addison Wesley. 2. Wils J. Nilsson, Principles of Artificial Intelligence, Narosa Publishing house. 3. Jackson Peter, Introduction to Expert systems, 3e, Addison Wesley, 2020.						

B.Sc/DS/SM/5/DSC/302: Data Analytics Using Python							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC	02 (L)	02	Lecture	35	15	2 Hours	TEE/MTE/ Assignment/ Attendance
	02 (P)	04	Practical	50	-	3 Hours	
<p>Note for the Paper Setter: The question paper will consist of <i>five</i> questions in all. The first question will be compulsory and will consist of seven short questions of 1 mark each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting one question from each unit.</p>							
<p>Course Objectives: The objective of this course is to understand the concept of data analytics, techniques of data analysis, clustering and classification. The students will become familiar with tools used for data visualization and data manipulation.</p>							
<p>Course Outcomes: After completing this course the students will be able to use tools such as Python, Pandas and Hadoop for big data applications.</p>							
<p>Course Content Data Analytics Using Python</p>							
<p>Unit I</p>							
<p>Data Analytics and Big Data: Types of data analytics, Phases, Quality and Quantity of data Measurement, Exploratory data analysis, Evolution of Big data, Best Practices for Big data Analytics, Big data characteristics.</p> <p>Introduction to Python: Structure of Python Program, Python data structures, Underlying mechanism of Module Execution-Branching and Looping-Problem Solving Using Branches and Loops-Functions, Object Oriented programming concepts using classes, objects and methods</p> <p>Data Analysis, Clustering and Classification: Regression Modeling, Multivariate Analysis, and Bayesian Modeling.</p> <p>Clustering: Overview and importance of clustering, K-means clustering, Centroid-based Clustering. Density-based Clustering, Distribution-based Clustering, Hierarchical Clustering.</p> <p>Classification: Decision Trees, Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees in R, Naïve Bayes, Bayes' Theorem, Naïve Bayes Classifier.</p>							
<p>Unit II</p>							
<p>Frameworks And Visualization: Introduction to Hadoop, Apache Hadoop, Hadoop Distributed File Systems, Hive, MapReduce, Data Serialization, Data Extraction, Stacking Data, dealing with data.</p> <p>Introduction to data visualization: Visual Data Analysis Techniques Interaction Techniques, Data visualization options.</p> <p>Data Manipulation with Pandas: Introduction to Pandas Objects, Data indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Data Sets, Aggregation and Grouping, Pivot Tables.</p> <p>Visualization and Matplotlib: Basic functions of matplotlib, Simple Line Plot, Scatter Plot, Density and Contour Plots, Histograms, Binnings and Density. Customizing Plot Legends, Colour Bars, Three-dimensional Plotting in Matplotlib.</p>							

Text/Reference Books

Text Books	<ol style="list-style-type: none">1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2021.2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 20193. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
Reference Books	<ol style="list-style-type: none">1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2018.2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2021.3. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2020

B.Sc/DS/SM/5/MIC/301: Network Security							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/Assignment/Attendance
<p>Instructions to paper setter for Final Term Examination: The question paper will consist of <i>nine</i> questions in all. Question No. 1 will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, 8 more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit. All questions carry equal marks.</p>							
<p>Course Objective: The objective of this course is to understand concepts of security attacks, cryptography techniques, digital signature, web security and email security.</p>							
<p>Course Outcome: After completing this course the students will be able to define security attacks, architecture of IP addresses, encryption standards and email security.</p>							
Course Content Network Security							
Unit I	Overview and Security Attacks: Introduction to Network Security, Principals of Security, Security Approaches, Security Threats, Types of Attacks, Malware, Virus, Worms, Trojan Horse, Logic Bombs, DoS, Major attacks of history, Data Security, Phishing, Trapping.						
Unit II	Authentication and Cryptography: Overview of Authentication, Authentication of People, Message Authentication, Public Key Infrastructure, Digital Signature, Kerberos, Overview of Cryptography, Application of Cryptography, Data Encryption Standard, Advance Encryption Standard.						
Unit III	IP and Web Security: IP Security Overview, Architecture, Authentication Header, Encapsulation Security Payload, Key Management, IKE, Web Security Considerations, Secure Socket Layer, Transport Layer Security, Secure Electronic Transaction, Web issues.						
Unit IV	System and Email Security: Intruders, Intrusion Detection, Password Management, Malicious Software, Firewalls, Firewall Design Principles, Firewall Configurations, Trusted Systems, Email Security, PEM, S/MIME, PGP.						
Text/Reference Books							
Text Books	<ol style="list-style-type: none"> 1. Cryptography and Network Security, Principles and Practice Sixth Edition, William Stallings, Pearson. 2. Cryptography & Network Security, Forouzan, Mukhopadhyay, McGrawHill. 3. Cryptography and Network Security, Atul Kahate, TMH. Dan W. Patterson Introduction to Artificial Intelligence and Expert system, PHI.						
Reference Books	<ol style="list-style-type: none"> 1. Information Systems Security, Godbole, Wiley India. 2. Information Security Principles and Practice, Mark Stamp, Willy India. 						

B.Sc/DS/SM/5/MIC/302: Wireless Network							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance
<p>Instructions to paper setter for Final Term Examination: The question paper will consist of <i>nine</i> questions in all. Question No. 1 will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, 8 more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit. All questions carry equal marks.</p>							
<p>Course Objective: The objective of this course is to study fundamental concepts in wireless network, various LAN standards, IP and IPV6 Layer, Transmission protocols and WAN standards.</p>							
<p>Course Outcome: After completing this course the students will be able to analyze WLAN technologies, IEEE 802.16, IPV6, Routing, TCP improvements, UMTS core network architecture, firewall, 3G, 4G and 5G networks.</p>							
Course Content Wireless Network							
Unit I	Multiple Radio Access: Medium Access Alternatives: Fixed-Assignment for voice oriented networks, random access for data oriented networks, Handoff and Roaming Support, Security and Privacy.						
Unit II	Wireless WANs: First Generation Analog, Second Generation TDMA- GSM, Short Messaging Service in GSM, Second Generation CDMA- IS-95,GPRS, Third Generation Systems- WCDMA, CDMA2000, Introduction to LTE.						
Unit III	Wireless LANs: Introduction to Wireless LANs- IEEE 802.11 WLAN-Architecture and Services, Physical Layer, MAC Sub layer, MAC Management Sub layer, Other IEEE 802.11standards, Wi-Max standard.						
Unit IV	System and Email Security: Intruders, Intrusion Detection, Password Management, Malicious Software, Firewalls, Firewall Design Principles, Firewall Configurations, Trusted Systems, Email Security, PEM, S/MIME, PGP.						
Text/Reference Books							
Text Books	<ol style="list-style-type: none"> 1. Vijay. K. Garg, Wireless Communication and Networking, Morgan Kaufmann Publishers. 2. Kaveth Pahlavan, Prashant Krishnamurthy, Principles of Wireless Networks, Pearson Education. 						
Reference Books	<ol style="list-style-type: none"> 1. Adrian Farrel, Bruce S. Davie, P.Z & Larry L. Peterson, Wireless Networking Complete, Morgan Kaufmann Publishers. 2. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks, Pearson Education. 3. William Stalling, Wireless Communications and Networks, Pearson/Prentice Hall of India. 						

B.Sc/DS/SM/5/MIC/303: Cloud Computing							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final Term Examination: The question paper will consist of *nine* questions in all. Question No. 1 will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, 8 more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit. All questions carry equal marks.

Course Objective: The objective of this course is to understand the fundamental concepts of cloud computing, Cloud models, management, solutions and offerings. During this course the students also learn architecture of cloud and virtualization technology.

Course Outcome: After completing this course the students will be able to know about cloud computing architecture, storage on cloud, virtualization and security issues.

Course Content Cloud Computing

Unit I	<p>Introduction: Essentials, Benefits and need for Cloud Computing - Business and IT Perspective, Cloud and Virtualization, Cloud Services Requirements, Cloud Computing Characteristics.</p> <p>Cloud Models: Cloud Characteristics, Measured Service, Cloud Models, Security in a Public Cloud Public versus Private Clouds.</p>
Unit II	<p>Cloud Solutions: Cloud Ecosystem, Cloud Business Process Management, Cloud Service Management, Cloud Stack</p> <p>Cloud Offerings: Information Storage, Retrieval, Archive and Protection, Cloud Analytics Testing under Cloud, Information Security, Storage Cloud.</p> <p>Cloud Management: Resiliency, Provisioning, Asset Management, Cloud Governance, High Availability and Disaster Recovery.</p>
Unit III	<p>Cloud Virtualization Technology: Virtualization Defined, Virtualization Benefits, Server Virtualization, Virtualization for x86 Architecture, Hypervisor Management Software, Logical Partitioning (LPAR)</p> <p>Cloud Virtualization: Storage virtualization, Storage Area Networks, Network-Attached storage, cloud server Virtualization, Virtualized data center.</p>
Unit IV	<p>Cloud and SOA: SOA Journey to Infrastructure, SOA and Cloud, SOA Defined, SOA and IaaS, SOA-based Cloud Infrastructure Steps.</p> <p>Cloud Infrastructure Benchmarking: OLTP Benchmark, Business Intelligence Benchmark, e-Business Benchmark, ISV Benchmarks.</p>

Text/Reference Books

Text Books	<ol style="list-style-type: none"> 1. Kailash Jayaswal and Jagannath Kallakurchi , Cloud Computing Black Book, Dreamtech press, 2020 2. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, Cloud Computing: A Practical Approach, 1e, Tata McGraw Hill Education, 2022.
Reference	1. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for

Books	Dummies, Wiley Publishing, 2021
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B.Sc/DS/SM/5/INT

INTERNSHIP

CREDIT: 4

MAX MARKS: 100

MIN. MARKS: 40

Each student will have to undergo an internship of credits having atleast 120 hours (1 Credit : 30 hours of engagement) with involvement/working with local industry/organization (Govt./Private), Business Organization, Artist, Craft Persons and similar entities during summer vacations.

Student will have to submit a certificate in office within one month after the commencement of 5th semester, issued by the competent signatory of the Industry/Organization regarding their performance, discipline and activities during the courses of internship.

A panel of experts constituted by the Dean/Chairperson will conduct the Viva-Voce for the assessment of Internship.

Semester 6th

B.Sc/DS/SM/6/DSC/303: Data Handling & Visualization							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC	02 (L)	02	Lecture	35	15	2 Hours	TEE/MTE/ Assignment/ Attendance
	02 (P)	04	Practical	50	-	3 Hours	
<p>Note for the Paper Setter: The question paper will consist of five questions in all. The first question will be compulsory and will consist of seven short questions of 1 mark each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting one question from each unit.</p>							
<p>Course Objective: The objective of this course is to discuss about the designing and evaluation of color palettes for visualization based on principles of perception.</p>							
<p>Course Outcomes: After completing this course students will be able to use knowledge of perception and cognition to evaluate visualization design alternatives.</p>							
<p>Course Content Data Handling & Visualization</p>							
<p>Unit I</p>							
<p>Visualizing Data: Mapping Data onto Aesthetics-Aesthetics and types of Data, Scales Map Data values onto Aesthetics. Coordinate Systems and Axes: Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes. Color Scales: Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight. Directory of Visualizations: Amounts, Distributions, Proportions, x-y relationships, Geospatial Data. Visualizing Amounts: Bar Plots, Grouped and Stacked Bars, Dot Plots and Heat maps. Visualizing Distributions: Single Distribution, Multiple Distributions at the Same Time.</p>							
<p>Unit II</p>							
<p>Visualizing Many Distributions at Once: Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis. Visualizing Proportions: Pie Charts, Side-by-Side Bars, Stacked Bars and Stacked Densities. Visualizing Nested Proportions: Mosaic Plots and Tree-maps, Nested Pies, Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables: Scatter plots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable: Individual Time Series, Multiple Time Series. The Principle of Proportional Ink: Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations.</p>							
<p>Text/Reference Books</p>							
Text Books	<p>1. Claus Wilke: “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, O’Reilly.</p>						
Reference Books	<p>1. Tony Fischetti, Brett Lantz: “R: Data Analysis and Visualization”, O’Reilly. 2. OssamaEmbarak: “Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems”, Apress.</p>						

B.ScDS/SM/6/MIC/304: Discrete Mathematics							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance
<p>Instructions to paper setter for Final Term Examination: The question paper will consist of <i>nine</i> questions in all. Question No. 1 will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, 8 more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit. All questions carry equal marks.</p>							
<p>Course Objective: The objective of this course is to enable students to learn set theory, relations, function and graph theory. Boolean algebra, counting and lattice are also covered in this course.</p>							
<p>Course Outcome: After completing this course the students will be able to illustrate sets and elements, representation of relations, graphs and multigraphs, Boolean algebra operations, group and subgroups lattices.</p>							
<p>Course Content Discrete Mathematics</p>							
Unit I	<p>Set Theory: Set introduction, Universal set, Empty set, subset, Venn Diagrams, set operations, finite set, infinite set, power set, Inclusion-Exclusion principle, Proof techniques. Relations: Introduction, Composition of relation, Types of relations, closure properties, Equivalence relation, Partial ordering relation, n-ARY relations. Functions: introduction, one-to-one, onto, invertible functions, mathematical functions, recursively Defined functions, Cardinality.</p>						
Unit II	<p>Graph theory: Introduction to graphs, graph terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, planar graphs, graph coloring, introduction to trees, application of trees. Algebraic systems: Operations, Properties on operations, Groups, subgroups, Semi group, permutation groups, isomorphism, homomorphism and normal subgroups.</p>						
Unit III	<p>Boolean Algebra: Basic definitions, duality, truth tables, Boolean functions, basic logical operations on propositions, proposition and truth tables, tautologies and contradictions, algebra of propositions, Logical implication, Normal forms, predicate logics.</p>						
Unit IV	<p>Ordered sets and Lattice theory: Ordered set, Hasse diagram, Lattices and algebras systems, principles of duality, distributive and complimented lattices. Counting: The basics of counting, the pigeonhole principle, permutations and combinations, inclusion-exclusion principle, application of inclusion-exclusion.</p>						
<p>Text/Reference Books</p>							
Text Books	1. Seymour Lipschutz, Marc Lars Lipson, Discrete Mathematics, McGraw-Hill International Editions, Schaum's Series.						
Reference Books	1. Bernard Kolman, Robert C. Busbym, Discrete Mathematical Structures for Computer Science, Prentice-Hall of India Pvt. Ltd.						

B.Sc/DS/SM/6/MIC/305: Internet of Things							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance
<p>Instructions to paper setter for Final Term Examination: The question paper will consist of <i>nine</i> questions in all. Question No. 1 will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, 8 more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit. All questions carry equal marks.</p>							
<p>Course Objective: The objective of this course is to understand the framework and architecture of IoT. This course also aim to explain communication challenges, application and design principles for web connectivity.</p>							
<p>Course Outcomes: After completing this course the students will be able to find applications of IoT in real world and use concepts of IoT.</p>							
<p>Course Content Internet of Things</p>							
Unit I	<p>Internet of Things: what is the IOT and why is it important, IoT conceptual framework, IoT architectural view, layered architecture (3 & 5 Layered) of IoT, technology behind IoT, sources of IoT, examples of IoT, physical design and logical design, security issues of IoT.</p>						
Unit II	<p>Challenges & Issues: Communication challenges related to IoT, enabling technologies for IoT. Applications of IoT: Home automation, smart cities, social life and entertainment, health & fitness, smart environment and agriculture, supply chain and logistics, energy conservation. Design principles for web connectivity: web communication protocols for connected devices, message communication protocols for connected devices.</p>						
Unit III	<p>IoT Architecture: State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model.</p>						
Unit IV	<p>IoT Reference Architecture: Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Design Constraints: Real-World Design Constraints, introduction, data representation and visualization, Interaction and remote control, Service-oriented architecture based device integration.</p>						
<p>Text/Reference Books</p>							
Text Books	<p>1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2022.</p>						
Reference Books	<p>1. Vijay Madiseti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), 1stEdition, VPT, 2021.</p>						

B.Sc/DS/SM/6/MIC/306: Business Data Analytics							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
MIC	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance
<p>Instructions to paper setter for Final Term Examination: The question paper will consist of <i>nine</i> questions in all. Question No. 1 will be compulsory and will consist of seven short questions of 2 marks each covering the whole syllabus. In addition, 8 more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit. All questions carry equal marks.</p>							
<p>Course Objective: The objective of this course is to understand the analysis of data, detailed concept of probability and sampling.</p>							
<p>Course Outcome: After completing the course Students will be able to understand the important concepts of Business Data Analytics.</p>							
<p>Course Content Business Data Analytics</p>							
Unit I	Introduction to data analysis and decision making (model, graphical models, algebraic model, spreadsheet model) Describing the distribution of a single variable (introduction, basic concepts, descriptive measures, time series data, outliers)						
Unit II	Finding relationship among variables (introduction, relationship among variables). Probability and probability distributions (probability essentials, probability distribution of a single random variable, introduction to simulation)						
Unit III	Normal, Binomial, Poisson and Exponential Distribution (normal distribution, application of normal distribution, binomial distribution, Poisson and exponential distribution), Decision making under uncertainty (elements of decision analysis, bayes' rule, multistage decision problems, risk aversion and expected utility)						
Unit IV	Sampling and Sampling Distribution (sampling terminology, methods of selecting random samples, introduction to estimation) Hypothesis Testing (introduction, hypothesis test for population Mean, hypothesis test for other parameters, chi-square test for Independence).						
<p>Text/Reference Books</p>							
Text Books	1. Business Analytics (Data Analysis and Decision Making) 5e, S. Christian Albright, Wayne L. Winston, Cengage Learning.						
Reference Books	1. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking by Foster Provost and Tom Fawcett, O'Reilly Media						

HIN/I/AECC1 - प्रयोजनमूलक हिन्दी

क्रेडिट: 4
व्याख्यान: 60
परिक्षा अवधि: 3 घंटे

अधिकतम अंक: 100
अंतिम परिक्षा अंक: 70
आंतरिक मूल्यांकन: 30

नोट: प्रश्न पत्र में कुल 9 प्रश्न हैं। प्रथम प्रश्न अनिवार्य है, जिसमें समस्त पाठ्यक्रम से 2 अंक वाले 5 संक्षिप्त प्रश्न हैं। प्रश्न पत्र में 4 ईकाई है, जिसमें प्रत्येक ईकाई में 15 अंको वाले 2 प्रश्न हैं। विद्यार्थी को प्रत्येक ईकाई में से 1 प्रश्न करना अनिवार्य है।

ईकाई-I

पत्र-लेखन-सहकारी पत्र, परिपत्र, कार्यालय आदेश, शिकायत पत्र, आवेदन पत्र, मूलपत्र, पत्रोत्तर, पावती, अनुस्मारक, सरकारी पत्र, ईमेल-लेखन, शासकीय आदेश, अधिसूचना, पृष्ठांकन, प्रेस विज्ञापित, संक्षेपण लेखन- अर्थ परिभाषा प्रक्रिया, नियम (लेखन विधि)

ईकाई-II

अभिनव काव्य गरिमा (काव्य पुस्तक) संप्रसंग व्याख्या व प्रश्नोत्तर

ईकाई-III

कम्प्यूटर- परिभाषा स्वरूप, महत्व

परिभाषिक शब्दावली - बैंकिंग, वाणिज्य, मंत्रालय, उपक्रमो, निगमों, औद्योगिक क्षेत्रों व मीडिया क्षेत्र

अनुवाद लेखन - अर्थ परिभाषा, स्वरूप, महत्व, प्रक्रिया, प्रकार

टिप्पण लेखन - अर्थ परिभाषा, नियम, लेखन विधि, उदाहरण

ईकाई-IV

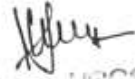
प्रयोजनमूलक हिन्दी - अर्थ, सरचनात्मक स्वरूप महत्व, हिन्दी भाषा की प्रयोजनीयता

प्रयोजनमूलक हिन्दी के विविध रूप

शब्द कोश का अर्थ, परिभाषा, उद्देश्य प्रकार क्षेत्र व उपयोगिता

सन्दर्भ पुस्तकें :

- 1 प्रयोजनमूलक हिन्दी: डॉ नरेश मिश्रा (2017) राजपाल एण्ड सन्ज, करमीरी गेट, दिल्ली
- 2 हिंदी साहित्य का इतिहास: डॉ रामसजन पाण्डेय (2012) संजय प्रकाशन, दिल्ली
- 3 अभिनव काव्य गरिमा: डॉ नरेश मिश्रा (2012) राजकमल प्रकाशन, दिल्ली
- 4 प्रयोजनमूलक हिन्दी: सिद्धांत और प्रयोग दंगल झाल्टे, वाणी प्रकाशन, दिल्ली
- 5 राजभाषा हिंदी: विवेचना और प्रयुक्ति: डा किशोर वासवानी, वाणी प्रकाशन, दिल्ली
- 6 राजभाषा हिंदी और उसका विकास: हीरालाल बाछोटिया, किताब घर प्रकाशन, दिल्ली
- 7 अनुवाद विज्ञान: सिद्धांत एवं प्रविधि, भोलानाथ तिवारी, किताब घर प्रकाशन, दिल्ली


Dean, USGS
GDLU, Sirsa

B.Sc/SM/DS/6/SEC/301: Green Computing

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
SEC	03	03	Lecture	50	25	3 Hours	TEE/MTE/ Assignment/ Attendance

Note for the Paper Setter: The question paper will consist of five questions in all. The first question will be compulsory and will consist of seven short questions of 1 mark each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting one question from each unit.

Course Content
SEC -01: Green Computing

Unit I	The concept, importance and issues involved in Green Computing/ Information Technology; Carbon footprint in manufacturing of computing and IT products; other effluents in IT manufacturing; the concept of design for environment;
Unit II	Carbon footprint in operations of IT/computing gadget; green IT usage; Data centre and server farms design, power, cooling and location; virtualization; BPR for sustainable IT/computing.
Unit III	Disposal practices in e-waste; e-waste recycling, formal vs. informal e-waste recycling; extended producer responsibility; IT for paperless offices; IT for saving travel cost, time and environment; Electronic waste management regulations in India; IEEE 1680 standard for green computing.

Text/Reference Books

Text Books	1. John Lamb, The Greening of IT – How Companies Can Make a Difference for the Environment” IBM Press, 2009.
Reference Books	1. Toby J. Velete, Anthony T. Velete, Robert Elsenpeter, Green IT – Reduce Your Information System’s Environmental Impact While Adding to the Bottom Line” 1e, McGraw-Hill, 2008.