DETAILSOF THE COURSE: Honours: Supply Chain Analytics

Course Code	Course Title	Credits	Lecture	Tutorial	Practical	Studio
22MET927	**Data Science for Supply Chain Management**	**3**	**2**	**1**	**0**	**0**

PREREQUISITE : Basic fundamentals of statistics and mathematics

COURSE OUTCOMES:

CO 1	Acquiring a basic knowledge about elements of data science useful in supply chain
CO 2	Learning the general methods of data processing a Supply Chain data
CO 3	Learning standards of data processing on industrial supply chain data
CO 4	Application of data science in real supply chain setup

COURSECONTENTS

Introduction to Data Science: Overview of data science, the data science process, and Types of data. Data Acquisition and Cleaning: Data sources, Data cleaning, and preprocessing, Data integration.

Machine Learning Techniques & AI: Fundamentals of Artificial Intelligence (AI), machine learning (ML), and deep learning (DL), and how to use them for solving real-world supply chain problems.

Data Modeling, Selection, and Evaluation: Learn to select the right data model and evaluate its performance. It includes understanding metrics such as accuracy, precision, and recall, as well as techniques for selecting the most appropriate model based real world supply chain problem.

Data Visualization and Reporting: Various techniques and tools can be used to visualize data effectively, insights into visualizing data using software tools

Data processing in supply chains: Explore tools and techniques used to process, store and analyze large amounts of data generated in real-time supply chain databases. Distributed computing frameworks in supply chains, streaming analytics platforms for supply chains, and other big data technologies useful in supply chains.

TEXTBOOKS/REFERENCEBOOKS(Title,Authors,Publisher&Year):-
1. Introduction to Data Science, Stanton,J., CRCPress, 2013.
2. Introducing Data Science, Cielen, D., Meysman,A.D.B. and Ali,M., Dreamtech Press, 2016.
ONLINE/ERESOURCES
1. https://www.youtube.com/c/joshstarmer
2. https://statquest.org/

DETAILS OF THE COURSE: Honours: Supply Chain Analytics

Course Code	Course Title	Credits	Lecture	Tutorial	Practical	Studio
22MET933	**Modeling Sustainability**	3	2	1	0	0

COURSE OUTCOMES:

CO 1	Use software tools such as MATLAB, Python, and R to implement sustainability models and evaluate the impact of potential solutions.
CO 2	Analyze and interpret sustainability data using statistical techniques, such as regression analysis and factor analysis, to inform decision-making.
CO 3	Apply sustainability modeling to real-world problems in industry areas
CO 4	Design and develop sustainable supply chain strategies and practices based on data-driven insights and modeling techniques
CO 5	Evaluate the environmental, social, and economic impacts of supply chain decisions and propose sustainable solutions to improve overall sustainability performance

COURSE CONTENTS

Introduction to sustainability- Importance of sustainability, three pillars and triple bottom line concept, Key challenges in sustainability, Sustainability index.

Life cycle assessment and sustainable manufacturing- Understanding the concept of Life cycle assessment, Environmental impacts and use of software to evaluate impacts.

Decision-making in Sustainability- Overview of decision making, Importance of economic, social, and environmental factors, corporate sustainability and decision making, the role of public policy in sustainability.

Metrics and process models of Sustainability- Sustainability metrics, Key performance indicators, Process modeling, and simulation techniques, Metrics for resource efficiency and waste reduction, Sustainability performance measurement.

System-level sustainability- System-level sustainability, sustainable energy management, sustainable material selection, Emerging technologies, and methodologies.

TEXT BOOKS/ REFERENCE BOOKS:-
1. Barnsley, Mike J. **Environmental modeling: A practical introduction**. CRC Press, 2007.
2. Horne, Ralph, Tim Grant, and Karli Verghese. **Life cycle assessment: principles, practice, and prospects.** Csiro Publishing, 2009.
3. Davim, J. Paulo, ed. **Sustainable manufacturing**. John Wiley & Sons, 2013.
References
1. Sustainable production management: concepts and practices, IIT Kharagpur
2. (https://erp.iitkgp.ac.in/InfoCellDetails/resources/external/cepdata?course_id=CEP/GIC/18-19/IM/2238)
3. Advanced Green Manufacturing Systems, IIT Kanpur
4. (https://archive.nptel.ac.in/courses/110/104/110104119/)
5. Manufacturing management analytics, IIM Tiruchirappalli
6. (https://www.iimtrichy.ac.in/PGCPMMA02)

DETAILS OF THE COURSE: Honours: Supply Chain Analytics

Course Code	Course Title	Credits	Lecture	Tutorial	Practical	Studio
22MET938	**Business Logistics**	**3**	**2**	**1**	**0**	**0**

Prerequisite: NIL

COURSE OUTCOMES:

CO 1	Analyze and evaluate logistics systems using optimization techniques such as linear programming and network flow analysis.
CO 2	Use software tools such as Excel Solver and simulation software to model and analyze logistics systems.
CO 3	Apply logistics and supply chain management principles to real-world problems, such as inventory optimization, transportation planning, and distribution network design.
CO 4	Design and implement effective strategies for demand forecasting, inventory management, and warehouse operations to optimize logistics performance
CO 5	Apply advanced tools in logistics processes, leading to improved efficiency and cost savings

COURSE CONTENTS

Importance of Logistics: Logistics Cost, Objectives of business logistics, Approach to study logistics

The Logistics product: Nature of logistics, 80-20 curve, Production characteristics, Product packaging, Some legal concerns, Incentive pricing arrangement

Order Processing and Information System: Defining ordering processing, Logistics information system.

Transportation Fundamentals: Service choices and characteristics, Agencies and Small shipment services, Rate profiles, Line-haul rates, Special service charges, Private carrier costing, documentation.

The storage and handling system: Need, reasons for storage, storage system functions, material handling system design, order picking operation

TEXT BOOKS/ REFERENCE BOOKS: -
1. Ballou, Ronald H., and Samir K. Srivastava. **Business logistics/supply chain management: planning, organizing, and controlling the supply chain.** Pearson Education India, 2007.
2. Mangan, John, and Chandra Lalwani. **Global logistics and supply chain management.**
3. John Wiley & Sons, 2016.
4. Ghiani, Gianpaolo, Gilbert Laporte, and Roberto Musmanno. **Introduction to logistics systems management.** John Wiley & Sons, 2013.

References
1. Professional certification in supply chain management & analytics by IIT Roorkee (https://imarticus.org/professional-certification-in-supply-chain-management-and- analytics-by-IIT-Roorkee)
2. Logistics/Supply Chain Management by University of Florida (https://warrington.ufl.edu/supply-chain-management-center/)
3. Business logistics by Pompeu Fabra University (https://arxiu-web.upf.edu/pro/en/2013/3324/21958ang.pdf)

DETAILS OF THE COURSE: Honours: Supply Chain Analytics

Course Code	Course Title	Credits	Lecture	Tutorial	Practical	Studio
22MET948	**Prescriptive analytics**	**3**	**2**	**1**	**0**	**0**

COURSE OUTCOMES:

CO1	Develop an understanding of optimization techniques and apply them to solve practical decision-making problems.
CO2	Develop the ability to use software tools such as Excel Solver, R, and Python to implement prescriptive analytics models
CO3	Develop the skills necessary to communicate the results of a prescriptive analytics project to for decision- making and potential trade-offs
CO4	Analyze and interpret optimization results to make informed decisions and identify trade-offs in complex decision-making problems
CO5	Apply prescriptive analytics techniques to real-world scenarios in various domains, such as supply chain management, finance, and operations, to optimize resource allocation and improve overall performance

COURSE CONTENTS

Introduction to Prescriptive Analytics in Engineering: Overview of Descriptive, Predictive, and Prescriptive Analytics with applications, Descriptive Models, Simulation models, System dynamics models, activity-based costing

Unified Optimization: Problem Formulation in Prescriptive Analytics, Model Building techniques such as Objective function, Decision variables, Constraints, and Parameters, Model solution using Software.

Analytics for Supply chain practices: Resource Allocation models, Supply Chain Management models, Transportation and Logistics models, Revenue Management models, Optimization-based decision support systems.

Enterprise-level optimization: Case Studies, Emerging Trends, Technologies, Best Practices in Prescriptive Analytics, Impact on Business, society, and the Environment.

Organizational Adaptation: Decision-making in organizations, Contested issues, Role of Information technology, Incentive contracts, Outlook and future of prescriptive analytics.

TEXT BOOKS/ REFERENCE BOOKS: -
1. Shapiro, Jeremy F. Modeling the supply chain. Duxbury Resource Center, 2001.
2. Goodwin, Paul, and George Wright. Decision analysis for management judgment. John Wiley & Sons, 2014.
3. Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
4. Uryasev, Stanislav, and Panos M. Pardalos, eds. Stochastic optimization: algorithms and applications. Vol. 54. Springer Science & Business Media, 2013.

REFERENCES
1. IIT Delhi: Certificate Programme in Business Analytics & Optimization (https://home.iitd.ac.in/show.php?id=69&in_sections=News)
2. NPTEL Course: Practitioners Course In Descriptive, Predictive And Prescriptive Analytics by IIT Kanpur. (https://nptel.ac.in/courses/110104086)
3. IIM Kozhikode Data Analytics for Business Strategy: Essential Tools and Applications (https://iimk.emeritus.org/iimk-professional-certificate-programme-in-data-analytics-for- business-strategy/index.php)

DETAILS OF THE COURSE: Honours: Supply Chain Analytics

Course Code	Course Title	Credits	Lecture	Tutorial	Practical	Studio
22MET966	**Supply Chain 4.0**	3	2	1	0	0

PREREQUISITE: Basic fundamentals of Internet of Things

COURSEOUTCOMES:

CO1	Analyze case studies of companies that have successfully implemented Industry 4.0 technologies in their supply chains and the lessons learned from these experiences.
CO2	Develop critical thinking and problem-solving skills to evaluate and address challenges related to supply chain digitalization
CO3	Understand the ethical and social implications of Industry 4.0 technologies in supply chain management, including issues related to privacy, security, and labor.
CO4	Learning real time implications of digital technology advancement of supply chains of future

COURSE CONTENTS

Digitizing the supply chain: Industry 1.0 to Industry 4.0, A digitized supply chain, drivers for digital transformation, value factor, intangible benefits of digital supply chain.

Digital supply chain network (DSN): Handling big data, rise of industry 4.0 and DSN, smart DSN, innovation in production, shift from linear to dynamic networks, thinking strategically about smart DSNs, making sustainable DSN an integral part of business strategy, trade-offs to customization, transitioning to smart DSN

Industry 4.0 and Smart Supply chain: Fundamentals of Industry 4.0, the smart factory, the visibility challenge, the road ahead towards supply chain 4.0, human element in supply chain management transformation, leading IT to innovate, creating a transformation roadmap.

Supply chain 4.0 ecosystem: The evolution of DSN, core elements and new technologies, integrated planning and execution, logistics visibility, track-and-trace technologies, procurement 4.0, smartware housing, efficient spare parts management with 3-D printing, autonomous and B2C logistics, supply chain maturity

Enabling technologies: Industrial internet of things, blockchain, AI&ML, key requirements for AI in SCM, AI delivering value in SCM today, wearable technology, augmented & virtual reality, drones, robot process automation, additive manufacturing, driverless trucks, wireless communications

TEXTBOOKS/REFERENCEBOOKS: -
1. **Supply Chain 4.0,** Alasdair Gilchrist, 2018, University bookstores, Boston.
2. Supply Chain Management: Strategy, Planning and Operations, Chopra and Meindl, 2016, Pearson, New Delhi.

ONLINE/ERESOURCES
1. https://www.youtube.com/c/joshstarmer
2. https://statquest.org/

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Course Code	Course Title	Credits	Lecture	Tutorial	Practical	Studio
22MEW983	**Mini Project on Supply Chain Analytics**	3	0	0	6	0

COURSE OUTCOMES

CO1	Apply the knowledge of data analytics in real life supply chain management problems
CO2	Apply various tools and techniques used in supply chain analytics
CO3	Apply descriptive, predictive, and prescriptive analytics techniques to supply chain problems
CO4	Perform hands-on experience in implementing supply chain analytics techniques using real-world examples
CO5	Develop a major project proposal, design, and implementation skills

Course Contents

Nil

RECOMMENDED READINGS
1. Polonsky, Michael Jay, and David S. Waller. **Designing and managing a research project: A business student's guide**. Sage publications, 2018.
2. Gregar, Jan. **"Research design (qualitative, quantitative and mixed methods approaches)."** Book published by SAGE Publications 228 (1994).
3. Silvia, Paul J. **How to write a lot: A practical guide to productive academic writing**. American Psychological Association, 2018.