

Model Curriculum for PG Degree Course in Logistics and Supply Chain Management

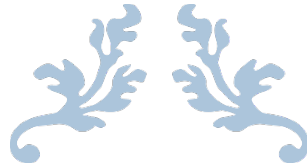
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ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

Nelson Mandela Marg, Vasant Kunj, New Delhi 110070

www.aicte-india.org



**Model Curriculum For
PG Degree Course
in
Logistics and Supply Chain
Management
(Engineering & Technology)**



**ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
NELSON MANDELA MARG, Vasant Kunj, New Delhi –
110070**

www.aicte-india.org

Committee for Model Curriculum

S.No	Name	Designation & Organization
1	Prof. S G Deshmukh	IIT Delhi, Chairman
2	Prof. Manoj Kumar Tiwari	IIM Mumbai, Vice Chairman
3	Prof. Debjit Roy,	Professor of Operations and Decision Sciences, IIM Ahmedabad, Member
4	Sh. Swapan Malpani	VP, Supply chain, Cipla, Member
5	Prof. P K Jain	Director, IIT BHU, Member
6	Mrs Ruma Kishore Digital	SCM executive, HUL, Member
7	Sh. Siddharth Bhagat	Senior executive Amazon , Member
8	Dr. Mamta R. Agarwal	Adviser-I, P& AP,AICTE, Coordinator

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GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits:

In the light of the fact that a typical Model Two-year Post Graduate degree program in Engineering has about 80 credits, the total number of credits proposed for the two-year M. Tech/M.E. in Logistics and Supply Chain Management (Engineering & Technology) is kept as 80.

C. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

Logistics and Supply Chain Management

Program Objectives:

This program's primary objective is to enhance logistics competence by imparting a deep understanding of its core concepts and methodologies, enabling individuals to align supply chain strategies with organizational goals. Students will develop proficiency in transportation and distribution management, including inventory control, warehousing, network planning, and outsourcing. The program also emphasizes effective procurement processes and strategies, preparing individuals to select suppliers, negotiate contracts, and manage supplier performance. Additionally, students will explore technology and innovation's pivotal role in logistics, particularly emerging technologies, and learn how to leverage them for improved supply chain visibility, operational optimization, and value creation for stakeholders.

Distinct Features of the programme:

The program equips students with a strong grasp of logistics and supply chain fundamentals for real-world problem-solving and make them analytically sound as well as industrially groomed. It focuses on practical supply chain strategies aligned with organizational goals, fostering comprehensive expertise across transportation, inventory, warehousing, outsourcing, and procurement.

First Semester:

Students will gain a comprehensive understanding of logistics and supply chain management principles, enriched with expertise in business analytics, digital innovation, finance, operations management, and operations research. They will be proficient in analyzing supply chain data, integrating cutting-edge technologies for improved efficiency, applying financial strategies to optimize costs, streamlining operational processes, and employing advanced problem-solving techniques. Students will be well-equipped to make data-driven decisions, optimize supply chain operations, and solve complex challenges within the dynamic landscape of modern business environments.

S.No.	Course	L-T-P	Credit
1	Logistics & Supply chain management	3-0-0	3
2	Business Analytics	2-0-2	3
3	Digital Innovation and Technology in SCM	3-0-0	3
4	Finance and Accounting	3-0-0	3
5	Operations Management	3-0-0	3
6	Operations Research	1-1-2	3
	Total Credits		18

Second Semester:

Students will acquire a profound understanding of global supply chain and logistics, incorporating advanced AI and ML techniques for data-driven decision-making. They will master procurement and materials management, optimize supply chains through multimodal transportation systems, and gain expertise in supply chain finance strategies. Furthermore, students will develop leadership and entrepreneurship skills, fostering innovation and strategic thinking. Engaging in practical enterprise lab experiences, they will apply theoretical knowledge to real-world scenarios, ensuring they are well-prepared for leadership roles in diverse global supply chain environments.

S.No.	Course	L-T-P	Credit
1	Global Supply chain and Logistics	3-0-0	3
2	AI & ML Techniques for Supply chain and Logistics	2-0-2	3
3	Procurement and Materials Management	3-0-0	3
4	Multimodal Transportation System	3-0-0	3
5	Supply Chain Finance	3-0-0	3
6	Leadership and Entrepreneurship	3-0-0	3
7	Enterprise Lab	0-0-6	3
	Total Credits		21

Third Semester:

Students will demonstrate expertise in global trade management, effectively managing international supply chains. They will develop strategies to mitigate risks, navigate disruptions, and build resilient supply chains, ensuring adaptability in dynamic market scenarios. Proficiency in Indian knowledge systems will enable a culturally nuanced approach to business operations. Additionally, students will master warehouse automation techniques and simulation modeling, enhancing supply chain efficiency. Through electives, they can specialize in areas aligning with their interests, preparing them for diverse roles in the global trade landscape.

S.No.	Course	L-T-P	Credit
1	Global Trade Management	3-0-0	3
2	Risk, Disruption and Resilient Supply Chain	3-0-0	3
3	Indian Knowledge System	2-0-0	2
4	Warehouse Automation and Management	3-0-0	3

5	Simulation Modelling and Supply Chain Digital Twin	2-0-2	3
6	Elective I	3-0-0	3
7	Elective II	3-0-0	3
	Total Credits		20

Fourth Semester:

Students will demonstrate advanced research and problem-solving capabilities through their M.Tech dissertation. They will gain expertise in blockchain and smart contracts, understanding their applications in supply chain management. Additionally, they will master advanced supply chain analytics techniques, enabling data-driven decision-making. Elective courses offer students the opportunity to specialize in specific areas, enhancing their knowledge and preparing them for diverse roles in supply chain research, innovation, and management.

S.No.	Course	L-T-P	Credit
1	M.Tech Dissertation	0-0-12	6
2	Blockchain and Smart Contracts	3-0-0	3
3	Advanced Supply Chain Analytics	3-0-0	3
4	Elective III	3-0-0	3
5	Elective IV	3-0-0	3
6	Elective V	3-0-0	3
	Total Credits		21

SEMESTER WISE STRUCTURE

SEMESTER- I

S.No.	Course	L-T-P	Credit
1	Logistics & Supply chain management	3-0-0	3
2	Business Analytics	2-0-2	3
3	Digital Innovation and Technology in SCM	3-0-0	3
4	Finance and Accounting	3-0-0	3
5	Operations Management	3-0-0	3
6	Operations Research	1-1-2	3
	Total Credits		18

SEMESTER - II

S.No.	Course	L-T-P	Credit
1	Global Supply chain and Logistics	3-0-0	3
2	AI & ML Techniques for Supply chain and Logistics	2-0-2	3
3	Procurement and Materials Management	3-0-0	3
4	Multimodal Transportation System	3-0-0	3
5	Supply Chain Finance	3-0-0	3
6	Leadership and Entrepreneurship	3-0-0	3
7	Enterprise Lab	0-0-6	3
	Total Credits		21

SEMESTER- III

S.No.	Course	L-T-P	Credit
1	Global Trade Management	3-0-0	3
2	Risk, Disruption and Resilient Supply Chain	3-0-0	3
3	Indian Knowledge System	2-0-0	2
4	Warehouse Automation and Management	3-0-0	3
5	Simulation Modelling and Supply Chain Digital Twin	2-0-2	3
6	Elective- I	3-0-0	3
7	Elective-II	3-0-0	3
	Total Credits		20

SEMESTER - IV

S.No.	Course	L-T-P	Credit
1	M.Tech Dissertation	0-0-12	6
2	Block chain and Smart Contracts	3-0-0	3
3	Advanced Supply Chain Analytics	3-0-0	3
4	Elective - III	3-0-0	3
5	Elective- IV	3-0-0	3
6	Elective V	3-0-0	3
	Total Credits		21

SEMESTER – I

Logistics and Supply Chain Management

LSCM-01	Logistics and Supply Chain Management	3L:0T:0P	3 credits
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Course Objective:

The objective of this content is to provide a comprehensive understanding of key concepts in Supply Chain Management (SCM) and Logistics. Participants will gain insights into the strategic importance of Information Technology (IT) and computer simulation in SCM, supply chain performance evaluation, demand and supply management, inventory management, production management, logistics system design, warehousing, transportation, and the integration of various activities for effective supply chain performance. The content aims to equip learners with the knowledge and skills necessary to analyze real-world supply chain challenges and make informed decisions.

Content:

Introduction to Supply Chain Management & Case Analysis; Strategic Importance of IT & Computer Simulation in Supply Chain Management; Supply Chain Performance; Supply Chain System Slacks; Demand Management; Supply Management; Inventory Management; Production Management.

Introduction to Logistics, Logistics System Design, Logistics Channels, Concept of Inventory related to logistics, Transit inventory, Warehousing, Warehousing decision models, Transportation models, Volume flow, India's logistics transportation Sector and its challenges, Total logistics costs, Logistics metrics, Order Management, logistics information systems, Integration of all activities for effective supply chain performance.

Textbooks

1. Supply Chain Management: Strategy, Planning, and Operation (7th Edition), Sunil Chopra, Peter Meindl, Prentice Hall.
2. Integral Logistics Management: Operations and Supply Chain Management within and Across Companies, (4th Edition), Paul Schönsleben, CRC Press, Taylor & Francis Group.
3. Logistics & Supply Chain Management, (2022), Martin Christopher, Prentice Hall.
4. Business Logistics: Supply Chain Management (2007) L Ronald H. Ballou, Prentice Hall.
5. Introduction to Logistics Systems Management (2nd Edition): Gianpaolo Ghiani, Gilbert Laporte, Roberto Musmanno, Wiley.
6. Supply Chain and Logistics Management Made Easy: Methods and Applications for Planning, Operation, Integration, Control and Improvement, and Network Design (1st Edition): Paul A. Myerson, Pearson FT Press.

Course Outcome:

Upon completing this course, participants will be able to:

1. Understand the Strategic Importance of IT and Computer Simulation in Supply Chain Management

2. Evaluate Supply Chain Performance
3. Master Demand and Supply Management
4. Effectively Manage Inventory
5. Comprehend Production Management
6. Explore Logistics System Design and Channels
7. Analyze India's Logistics Transportation Sector and Its Challenges
8. Calculate Total Logistics Costs
9. Utilize Logistics Metrics
10. Implement Effective Order Management and Logistics Information Systems
11. Integrate All Activities for Effective Supply Chain Performance

Business Analytics

LSCM-02	Business Analytics	2L:0T:2P	3 credits
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Course Objective:

This course aims to provide participants with a comprehensive introduction to programming using Python, focusing on its applications in business analytics and data science. Participants will gain proficiency in Python programming, understand the importance of optimization in data science, and acquire the necessary skills to formulate and solve business problems. The course will cover essential data types, functional programming, and widely used libraries like NumPy, Pandas, SK-Learn, Matplotlib, and Seaborn. Additionally, participants will explore statistical concepts and techniques, ranging from descriptive statistics to regression analysis, with a specific focus on their applications in business and economics.

Content:

Python for data science: Introduction to programming and why Python? Overview of Jupyter Instance, Data types in python, functional programming, Useful libraries for data science like NumPy, Pandas, SK-Learn, matplotlib, seaborn and others.

Optimization algorithms, what is optimization and need for optimization in data science, how to develop mathematical formulations for business problems, Linear, Non-Linear Programming problem, Applications to business and economics.

Types of Data, Scales of measurements, Descriptive Statistics, Measures of Central Tendency, Measures of Variability, Random Variable, Probability and laws of Probability, Conditional and Joint Probability, Bayes Theorem, Discrete and Continuous Probability Distributions, Sampling Techniques, Central limit theorem, Point and Interval Estimation, testing of hypothesis, Type I and Type II errors, Inferences, Regression Analysis.

Text Books

1. Kumar, U. Dinesh. Business analytics: The science of data-driven decision making. Wiley, 2017.
2. Levin, Richard I., and David S. Rubin. Statistics for management. Prentice Hall, 2017.

3. Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D., & Cochran, J. J. (2018). Statistics for Business & Economics. Cengage learning.
4. Hastie, T., Tibshirani, R., Friedman, J. H., & Friedman, J. H. (2009). The elements of statistical learning: data mining, inference, and prediction (Vol. 2, pp. 1-758). New York: springer.
5. Provost, F., & Fawcett, T. (2013). Data Science for Business: What you need to know about data mining and data-analytic thinking. O'Reilly Media, Inc.
6. Géron, Aurélien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow. " O'Reilly Media, Inc.", 2022.

Course Outcome:

Upon completion of the course, participants will possess a strong foundation in Python programming for business analytics and data science. They will be equipped with the skills to apply optimization algorithms, formulate mathematical models for business problems, and make data-driven decisions using statistical techniques.

Digital Innovation and Technology in SCM

LSCM-03	Digital Innovation and Technology in SCM	3L:0T:0P	3 credits
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Course Objective:

This course is designed to provide participants with a profound understanding of the digital transformation of supply chain relationships in the contemporary business landscape. Participants will explore the perspectives, roles, and decisions of key stakeholders involved in reshaping supply chains in the digital era. The course will delve into digital supply chain capabilities, the role of transformative technologies (Blockchain, IoT, AI, Digital Twins), and the impact of Industry 4.0 on supply chain digitization. Participants will learn to leverage digital platforms for enhanced performance and understand the challenges and opportunities presented by Artificial Intelligence in supply chain management.

Content:

Digital transformation of supply chain relationships. In-depth understanding of the perspectives, roles, and decisions of relevant stakeholders in transforming supply chains in the digital era. Digital supply chain capabilities (Visibility, Agility, Collaboration, Omnichannel), the role of technology (Blockchain, IoT, AI, Digital Twins), processes and organizations, as well as digital platforms and performance. Artificial Intelligence Driven SCs: Challenges and Opportunities. Industry 4.0 and Digital Transformation. Supply Chain Digitization: Unified View of Demand, Understand how to integrate internal and external data, Develop an Effective demand forecasting process that brings together supply planning, financial planning, sales, and trade planning, Understand effective mechanisms to ensure adaptability, Supply Chain Segmentation, Smart S&OP, Smart Execution, and Control Tower, Develop a roadmap for a successful supply chain digitization: The Journey to Success;

Organizational structure; Change Management. Relevant case studies of digitally transformed supply chains, long-term competitive advantage of successful case studies, through operations and digital enhanced value generation.

Text Books

1. Designing and Managing the Supply Chain: Concepts, Strategies and Case studies (4th Edition) by David Simchi Levi, Edith Simchi Levi, Ravi Shankar, Philip Kaminsky. McGraw Hill Education. Copyright © 2022
2. MacCarthy, Bart L., and Dmitry Ivanov, eds. The digital supply chain. Elsevier, 2022.

Course Outcome:

Upon completion of the course, participants will have gained a deep understanding of the digital transformation of supply chain relationships, equipped with the knowledge and skills to implement and navigate digital innovations in SCM. They will be able to develop strategies for successful supply chain digitization, leveraging technology, processes, and organizational change to achieve a sustainable competitive advantage.

Finance and Accounting

LSCM-04	Finance and Accounting	3L:0T:0P	3 credits
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Course Objective:

The objective of this course is to provide participants with a comprehensive understanding of key financial and accounting principles, enabling them to interpret and analyze financial statements, make informed investment decisions, and assess the cost of capital. Participants will gain practical knowledge in financial management, including the preparation of balance sheets and income statements, revenue recognition, accounting for inventory and depreciation, and the sources and accounting of capital. Additionally, the course will cover topics related to time value of money, capital investment decisions, risk analysis, and capital budgeting. Participants will also delve into the Capital Asset Pricing Model (CAPM), cost of capital estimation, and the impact of capital structure on firm value.

Content:

Introduction to Balance Sheet, Introduction to Income Statement, Income Statement-Preparation, Balance Sheet- Preparation; Revenue Recognition, Issues in Revenue Recognition, Accounting for Inventory, Accounting for Depreciation, Accounting for Equity, Sources of Capital- Debt Accounting for Debt; Understanding of Annual Report, Understanding of Cash Flow Statement, Financial Statement Analysis.

Introduction: Basic concepts, scope of financial management, Time Value of Money: Discounted Cash Flow valuation, Net Present Value: Meaning, Computation, Application in

Business, Other Investment Rules: Discounted Pay Back, IRR, MIRR, Meaning, Computation, Applications

Making Capital Investment Decisions: Estimation of Cash Flows, Sunk Cost, Opportunity Cost, Depreciation, Effect of Inflation, Alternative Definitions of Operating Cash flow

Risk Analysis and Capital Budgeting: Sensitivity Analysis, Scenario Analysis, Break even analysis.

Capital Asset Pricing Model: Individual securities, expected returns, variance and covariance, diversification, CAPM, Risk, Cost of Capital and Valuation: Cost of Capital – Estimating the Cost of Equity – Risk Free Rate – Estimating Betas – Cost of Capital for Divisions and Projects – Cost of Debt – WACC. Capital Structure: Financial Leverage and Firm value, Modigliani and Miller Theory

Text Books

1. Merchant, Kenneth A., R. N. Anthony, and D. Hawkins. "Accounting: Text and Cases." (2003).
2. Chandra, Prasanna. Financial Management: Theory and Practice, 10e. Vol. 10. McGraw-Hill Education, 2019.
3. Financial Management by I M Pandey, 12th edition, Pearson education, 2021.
4. Essentials of financial accounting, Bhattacharyya (2017), Prentice hall.

Course Outcome:

Upon completion of the course, participants will be equipped with the knowledge and skills necessary to interpret financial statements, make capital investment decisions, and assess the cost of capital. They will have a solid understanding of financial management principles, allowing them to contribute to effective financial decision-making within an organizational context.

Operations Management

LSCM-05	Operations Management	3L:0T:0P	3 credits
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Course Objective:

This course aims to provide participants with a comprehensive understanding of key concepts and practices in operations management and supply chain. Participants will explore topics ranging from project management, manufacturing and service processes, quality management, lean manufacturing, continuous improvement, to integrated business planning (IBP) and practical applications through case studies. The course is designed to equip participants with the knowledge and skills necessary for effective decision-making in operations and supply chain management.

Content:

Introduction to Operations and Supply Management; Project Management; Manufacturing Processes and Facility Layout; Service Processes and Waiting Lines; Quality Management; Lean Manufacturing; Continuous Improvement; Integrated Business Planning (IBP): Demand Management and Forecasting; Aggregate Sales and Operational Planning; Inventory Control; Material Requirements Planning; Scheduling; Case Studies and Practical Applications.

Text Books

1. Operations & Supply Management, (14th Edition), Chase, R. B. Aquilano, N. J. Jacobs, F. R. Boston, McGraw-Hill.
2. Operations Management: Processes and Supply Chains, (12th Edition), Krajewski, L.J., Ritzman, L. P. and Malhorta, M.J., Pearson.
3. Operations Management, (12th Edition), Heizer, Jay; Render, Barry, Upper Saddle River, N.J.: Prentice-Hall.
4. Operations Management, (13th Edition), William J. Stevenson, Tata McGraw Hill education Private Limited.

Course Outcome:

Upon completion of the course, participants will have a comprehensive understanding of operations and supply chain management concepts. They will be equipped with the skills to optimize processes, improve efficiency, and make informed decisions in various operational scenarios. The practical applications and case studies will enhance their problem-solving abilities and prepare them for real-world challenges in operations management and supply chain.

Operations Research

LSCM-06	Operations Research	1L:1T:2P	3 credits
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Course Objective:

This course aims to provide participants with a solid foundation in Operations Research (OR) techniques and methodologies. Participants will learn to formulate real-life decision-making problems as mathematical models, with a specific focus on linear programming. The course will cover various solution methods for optimization problems, including the graphical method and the simplex method. Participants will also explore advanced topics in OR such as sensitivity analysis, duality, transportation, assignment, and transshipment problems, as well as queuing theory, simulation, decision making under risk and uncertainty, and game theory.

Content:

Introduction to Operations Research (OR), Formulation of real-life decision-making problems as linear programming problems, Graphical Method, Simplex Method, Sensitivity Analysis & Duality; Transportation, Assignment and Transshipment Problems and its applications, Queuing Theory, Simulation, Decision Making under Risk & Uncertainty, Game Theory.

Text books:

1. Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D., & Cochran, J. J. (2018). An introduction to management science: quantitative approach. Cengage learning.
2. Winston, W. L. (2003). Operations research: applications and algorithms. Belmont: Thomson Brooks/Cole.
3. Hillier F.S. and Lieberman G.J. (2002). Introduction to Operations Research, McGraw Hill.

4. Taha, Hamdy A. Operations research: an introduction. Pearson Education India, 2013.

Course Outcome:

Upon completion of the course, participants will have a comprehensive understanding of Operations Research techniques and their applications. They will be equipped with the skills to formulate and solve optimization problems, analyze decision-making under various conditions, and apply advanced OR methodologies to real-world scenarios. The course will enhance participants' analytical and problem-solving capabilities in the field of Operations Research.

SEMESTER – II

Global Supply Chain and Logistics

LSCM-07	Global Supply Chain and Logistics	3L:0T:0P	3 credits
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Course Objective:

The objective of this course is to provide participants with a comprehensive understanding of the complexities and considerations involved in managing global supply chain and logistics operations. Participants will explore the need for global sourcing, overcome barriers to global sourcing, and develop the skills necessary to implement and manage a global sourcing program. The course will cover topics such as international supplier qualification and selection, cultural considerations, legal issues, counter trade requirements, and the costs associated with international purchasing. Additionally, participants will gain insights into international transport modes, risk management, and export finance, including payment methods and forms of counter trade.

Content:

Need for Global Sourcing, Barriers to global sourcing, Developing a global sourcing program: information about global sources, types of intermediaries and organizations for global sources, supplier qualification and selection issues, understanding cultural issues, language and communication differences, legal systems, counter trade requirements, cost associated with international purchasing, managing currency risks. International transport: *Modes of international transport, Packing and marking for export, International transport documentation*, Risk management: *Cargo insurance, credit insurance, exchange risk management*, Export Finance: *International payment methods and forms of counter trade*.

Text Books

1. Branch, Alan E. Global supply chain management and international logistics. Routledge, 2008.
2. Long, Douglas. International logistics: global supply chain management. Dordrecht, The Netherlands: Kluwer academic publishers, 2003.
3. Mangan, John, and Chandra Lalwani. Global logistics and supply chain management. John Wiley & Sons, 2016.

Course Outcome:

Upon completion of the course, participants will possess the knowledge and skills necessary to effectively manage global supply chain and logistics operations. They will be equipped to navigate the complexities of global sourcing, overcome challenges associated with international business, and implement strategies for risk management and cost optimization in the global marketplace. The course will prepare participants to contribute to the success of global supply chain and logistics initiatives within their organizations.

AI & ML Techniques for Supply chain and Logistics

LSCM-08	AI & ML Techniques for Supply chain and Logistics	2L:0T:2P	3 credits
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Course Objective:

This course aims to provide participants with a deep understanding of Artificial Intelligence (AI) and Machine Learning (ML) techniques specifically tailored for solving complex problems in supply chain and logistics. Participants will learn to apply supervised learning algorithms for regression and classification tasks, explore unsupervised learning techniques for clustering, and understand the nuances of model evaluation and algorithm selection. The course will cover a range of algorithms including linear regression, decision trees, random forests, gradient boosting machines, logistic regression, support vector machines, artificial neural networks, and clustering algorithms. Participants will also gain insights into smart feature engineering, regularization techniques, and methodologies to improve model accuracy in challenging scenarios.

Content:

Artificial Intelligence and Problem Solving

Supervised Learning: Regression Algorithms

Linear Regression, Decision Trees Regression, Random Forests Regression, Gradient Boosting Machines (Light GBM and XG Boost), Comparison of regression algorithms – Right choice of algorithms, Model evaluation metrics and Bias-Variance trade-off, Regularization techniques, Additional techniques on improving the accuracies in challenging scenarios with smart feature engineering and modelling methodologies.

Supervised Learning: Classification Algorithms

Logistic Regression, Decision Trees classification, Random Forest classification, Gradient Boosting Machines, Support Vector Machines, Artificial neural networks, back propagation, Introduction to Deep Learning, Comparison of classification of algorithms – Right choice of algorithms

Unsupervised Learning: Clustering Algorithms

Strategic preparation of data for clustering, K-Means, hierarchical clustering, agglomerative clustering algorithms, Evaluation metrics and right choice based on the business need, Predicting the similarity and differences between the clusters.

Text Books

1. Kumar, U. Dinesh. Business analytics: The science of data-driven decision making. Wiley, 2017.
2. Kelleher, John D., Brian Mac Namee, and Aoife D'arcy. Fundamentals of machine learning for predictive data analytics: algorithms, worked examples, and case studies. MIT press, 2020.
3. Stuart Russell and Peter Norvig. (2015). Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education.

4. George Luger (2017). Artificial Intelligence: Structures and Strategies for Complex Problem solving, 6th edition, Pearson Education.
5. Shai Shalev-Shwartz and Shai Ben-David (2014). Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press.
6. Giuseppe Bonaccorso (2017). Machine Learning Algorithms, Packt Publishing.
7. Géron, Aurélien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow. " O'Reilly Media, Inc.", 2022.

Course Outcome:

Upon completion of the course, participants will possess the skills to apply AI and ML techniques to solve real-world problems in supply chain and logistics. They will be able to select and implement regression, classification, and clustering algorithms based on business requirements, evaluate model performance, and employ advanced techniques to enhance accuracy. The course will prepare participants to leverage cutting-edge technologies for data-driven decision-making in the complex and dynamic field of supply chain and logistics.

Procurement and Materials Management

LSCM-09	Procurement and Materials Management	3L:0T:0P	3 credits
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Course Objective:

The objective of this course is to equip participants with comprehensive knowledge and skills in the field of procurement and materials management. Participants will gain an understanding of the critical role and functions of procurement, including spend analysis, vendor development, inventory policy control, make or buy decisions, negotiations, material costing, budgeting, spare parts planning, legal aspects in procurement, and the concept of total cost of ownership. The course will also cover logistics and transportation cost analysis to provide a holistic view of effective procurement and materials management.

Content:

Role and Functions of Procurement; Spend Analysis; Vendor Development and Rating Systems; Inventory Policy Control Systems; Make or Buy Decisions; Negotiations; Material Costing and Budgeting; Spare Parts Planning and Procurement; Legal Aspects in Procurement and Contracts; Total Cost of Ownership; Logistics/Transportation Cost Analysis.

Text Books

1. Purchasing and Supply Management: Text and Cases, (1996), Dobler DW, Burt, DN, Tata McGraw Hill, New Delhi.
2. Purchasing and Supply Chain. Management, 5e. Robert M. Monczka, Robert B.Handfield,. Larry C. Giunipero, James L. Patterson, Cengage Learning.

Course Outcome:

Upon completion of the course, participants will be equipped with the knowledge and skills necessary to excel in the field of procurement and materials management. They will be able to apply strategic thinking to procurement processes, effectively manage supplier relationships, make informed make or buy decisions, and optimize costs throughout the supply chain. The course will prepare participants to contribute to organizational success through efficient and effective procurement practices.

Multimodal Transportation System

LSCM-10	Multimodal Transportation System	3L:0T:0P	3 credits
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Course Objective:

The objective of this course is to provide participants with a comprehensive understanding of multimodal transportation systems, including the concept, components, and benefits. Participants will explore the role of multimodal transport operators, their responsibilities, and liabilities, as well as the challenges and technologies associated with multimodal transportation. The course will cover various modes of transport, intermodal systems, inland container depots, container freight stations, roll-on/roll-off services, and the development of multimodal transport systems. Additionally, participants will gain insights into city transport, inland waterways, economic corridors, containerization, non-containerization cargo, dry ports, pipelines, palletization, and the Multimodal Transport of Goods Act-1993, along with relevant policies and regulations.

Content:

Concept of Multi Modal Transport, Components of Multi Modal Transportation System, Benefits of Multi Modal Transport, Multi Modal Transport Operator, Responsibilities and Liabilities of the Multi Modal Transport Operator, Challenges of Multi Modal Transport System, Multi Modal Transport Technology. Multi Modal Transport Documents. Difference between Multimodal and Intermodal transport.

Various Modes of Transport. Intermodal systems – road/rail/sea; sea/air; road/air; road/rail, sea/rail, sea/road, Canals/Inland waterways. Inland Container Depot (ICD). Container Freight Station (CFS) Terminals, Roll-on/Roll-Off Service, Development of multi modal transport system in Indian - Metro Rails, Light Rail Transit (LRT), Sub-Urban Trains, Ring Rail and Monorails, Bus Rapid Transit Systems, Bullet Trains. City Transport. Inland Waterways, Economic corridors, Containerization, Non-containerization cargo, dry ports, pipelines, palletization, Channel tunnel.

Multimodal Transport of Goods Act-1993, Private Freight Terminals (PFT) Policy, Draft Coastal Shipping Policy, Cabotage Policy, Policy to permit Operators to move container trains on Indian Railways, Foreign Direct Investment Regulatory Reforms.

Text Books

1. Sinha, Deepankar, ed. "Global Supply Chains and Multimodal Logistics: Emerging Research and Opportunities: Emerging Research and Opportunities." (2019).
2. Logistics & Supply Chain Management, (2022), Martin Christopher, Prentice Hall.
3. Business Logistics: Supply Chain Management (2007) L Ronald H. Ballou, Prentice Hall.
4. Introduction to Logistics Systems Management (2nd Edition): Gianpaolo Ghiani, Gilbert Laporte, Roberto Musmanno, Wiley.
5. Supply Chain and Logistics Management Made Easy: Methods and Applications for Planning, Operation, Integration, Control and Improvement, and Network Design (1st Edition): Paul A. Myerson, Pearson FT Press.
6. Coyle J.J, Bardi E.W., Langley C.J., The Management of Business logistics, A Supply Chain Perspective (2022), Thomson Asia.

Course Outcome:

Upon completion of the course, participants will possess a comprehensive understanding of multimodal transportation systems, including their components, benefits, challenges, and technological aspects. They will be equipped to evaluate and implement efficient multimodal logistics solutions, contributing to the advancement of global supply chain and transportation networks. The course will prepare participants to navigate the complexities of modern logistics and contribute to the development of sustainable and integrated transportation systems.

Supply Chain Finance

LSCM-11	Supply Chain Finance	2L:0T:0P	2 credits
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Course Objective:

This course aims to provide participants with a comprehensive understanding of Supply Chain Finance (SCF) and its role in optimizing working capital, managing costs, and enhancing financial performance within a supply chain. Participants will explore corporate finance, short-term financing, and the impact of working capital on supply chain design. The course will delve into the influence of global regulatory and tax factors on supply chain design, measurement perspectives from both the CFO and CSCO, strategies for making capital improvements, and the critical role of SCF in new product launches. Additionally, participants will gain insights into the Supply Chain Finance industry, including market constituents, challenges, products, stakeholders, and the role of traditional trade finance products.

Content:

Corporate Finance – Short Term Financing – Supply Chain Costs for Design – Role Of Working Capital In Supply Chain Design - Impact of Global Regulatory & Tax Factors Upon Supply Chain Design - Measuring Your Supply Chain: CFO Perspective - Balanced Scorecards For Supply Chain: CSCO Perspective - Making Capital Improvements To The Supply Chain - Driving Working Capital Improvement Supply Chain For A New Product Launch.

The Supply Chain Finance Industry: Market constituents, Market enablers Market challenges Value propositions; State of the Market: Current market size, Prospects for growth, Market penetration, Regions and industries; Products and Solutions: Working Capital, Receivables financing, Reverse factoring, Approved payables financing, Dynamic discounting, Legal considerations; Stakeholders and Market Participants: Buyers Suppliers Global commercial banks Regional banks Development banks Non-banks Technology providers Enablers; Role of traditional trade finance products. Key components of trade cycle analysis, Application and implementation of supply chain finance techniques and associated legal, technological, cost and risk implications, Importance of innovation and strategy, the management of foreign exchange exposures.

Textbooks

1. Simon Templar, Erick Hofmann, Financing the End-to-End Supply Chain: A Reference Guide to Supply Chain Finance (2nd Edition), Kogan Page Publishers.
2. Zhao, Lima, et al. *Supply chain finance*. Springer International Publishing, 2018.
3. Rogers, Dale S., Rudolf Leuschner, and Thomas Y. Choi. *Supply chain financing: Funding the supply chain and the organization*. World Scientific, 2020.

Course Outcome:

Upon completion of the course, participants will be equipped with the knowledge and skills necessary to strategically manage supply chain finance, optimize working capital, and leverage financial tools to enhance supply chain performance. They will understand the complexities of the SCF industry, market dynamics, and the role of various stakeholders. The course will prepare participants to make informed financial decisions that positively impact the overall efficiency and effectiveness of supply chain operations.

Leadership and Entrepreneurship

LSCM-12	Leadership and Entrepreneurship	2L:0T:0P	2 credits
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Course Objective:

This course is designed to equip participants with the knowledge and skills essential for effective leadership and entrepreneurship. Participants will explore the role of creativity and innovation in organizations, understand different types of innovations, and learn methodologies such as the S-curve, Idea Generation, Lateral Thinking, Eight-Dimensional Approach to Ideation, and TRIZ. The course will also cover recognizing opportunities, creativity in problem-solving, idea evaluation, and the leadership aspects of fostering creativity and innovation. Additionally, participants will develop leadership skills for the 21st century, learn to manage and motivate talent, understand the complexities of managing a global firm, and delve into strategic management for competitive and corporate success.

Content:

What is the role of Creativity(C) and Innovation (I) in organizations- Definition of C&I – Types of Innovations – the S-curve – Idea Generation, Lateral Thinking, Eight-Dimensional Approach to Ideation – TRIZ Methodology – Recognizing Opportunities – Creativity and Creative Groups – Enhancing Creativity – Creativity in Problem Solving – Idea Evaluation – Teams, the Environment, and Creativity – Leading for Creativity and Innovation – Creativity to Innovation – The Role of Champions – Moving Innovation to Market.

Leadership in the 21st Century - Develop leadership skills to organise the firm's management and culture to promote efficient and productive workplace environments.

Managing and Motivating Talent - Develop key people management skills to motivate, organize, and reward people in an organization for corporate and social success.

Managing the Global Firm - Leverage new mindsets, new decision models, new business models, and new products and services to maximize firm's potential in fast-moving, interconnected, and global markets.

Strategic Management: Competitive and Corporate Strategy - Design and implement strategies that drive growth for organizations and maintain competitive advantage in the marketplace using the tools and frameworks required to evaluate, develop and execute a successful strategy, both inside and outside the corporation.

Text Books

1. Managing Creativity and Innovation, Harvard Business School Press. Thinkertoys, by Michael Michalko, Ten Speed Press.
2. The Art of Innovation, by Tom Kelley, Crown Business
3. Richter, Nancy, Paul Jackson, and Thomas Schildhauer, eds. Entrepreneurial innovation and leadership: preparing for a digital future. Springer, 2018.
4. McCauley, Pamela. Essentials of engineering leadership and innovation. CRC Press, 2017.
5. Northouse, Peter G. Leadership: Theory and practice. Sage publications, 2021.

Course Outcome:

Upon completion of the course, participants will have a holistic understanding of leadership, entrepreneurship, and innovation. They will be equipped with practical skills to lead teams, foster creativity, manage talent, and strategically position organizations in the global marketplace. The course will prepare participants for the dynamic challenges of the modern business landscape, instilling the ability to drive innovation and ensure sustainable success.

Enterprise Lab

LSCM-13	Enterprise Lab	0L:0T:4P	2 credits
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Course Objective:

The objective of the Enterprise Lab course is to provide students with hands-on, real-world experience in solving complex challenges in logistics, e-commerce, port management, inventory control, supply chain disruptions, and demand planning. The course aims to leverage mathematical and AI models, utilizing industry-standard software tools like CPLEX/GUROBI. It will incorporate generative AI and deep learning techniques for problem-solving, with a special emphasis on creating informative dashboards. Students will gain practical insights by addressing challenges faced by startup owners, MSME (Micro, Small, and Medium-sized Enterprises) owners, and through well-documented case studies. The course will utilize operations research (OR), AI, simulation, and various modeling tools, including anylogistix. Visualization tools such as Power BI and Tableau will be employed to enhance the presentation and communication of solutions.

Content:

Real-world challenges in logistics, e-commerce, port management, inventory control, supply chain disruptions, and demand planning. It leverages mathematical and AI models, along with industry-standard software tools like CPLEX/GUROBI. Generative AI and deep learning techniques will be applied to problem-solving, with a focus on creating informative dashboards. Students will gain hands-on experience by tackling practical issues faced by startup owners, MSME (Micro, Small, and Medium-sized Enterprises) owners, and well-documented case studies, using operations research (OR), AI, simulation, and various modeling tools such as anylogistix. Visualization tools - Power BI, Tableau.

References

- Ivanov, Dmitry. "Supply chain simulation and optimization with anyLogistix." (2021).

Course Outcome:

Upon completion of the Enterprise Lab course, students will have acquired practical skills in solving real-world challenges in logistics and supply chain management. They will be proficient in using mathematical and AI models, simulation, and various tools to optimize operations. The course will prepare students for dynamic roles in industries where data-driven decision-making and innovative solutions are essential for success.

SEMESTER – III

Global Trade Management

LSCM-14	Global Trade Management	3L:0T:0P	3 credits
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Course Objective:

The objective of the Global Trade Management course is to provide students with a comprehensive understanding of international trade dynamics, policies, and strategies. The course aims to explore the need and importance of international trade, recent trends in world trade, and the role of leading players. Students will delve into India's foreign trade, examining commodity composition, destinations, and the country's position in world merchandise trade and services. The course will cover essential aspects such as project exports, deemed exports, India's foreign trade policy, trade agreements, and tariff benefits. Comparative advantage, offshoring and outsourcing, customs controls, INCOTERMS, and payment settlement methods for exports and imports will be thoroughly examined. Additionally, students will learn about EXIM strategies, export marketing, and incentive schemes to promote global trade.

Content:

International Trade: Need and importance of International Trade, Recent Trends in World Trade, Leading players, India's Foreign Trade, Commodity composition and Destination, India's Export and Import position in World merchandise trade and services, Project Exports Deemed Exports, India's Foreign Trade Policy, India Trade Agreements and tariff benefits. Comparative advantage: *technology, factor proportions*, Offshoring and outsourcing: *offshoring, horizontal FDI, Vertical FDI*, Customs controls: *Export procedures and documents, Import procedures and documents*, INCOTERMS: Terms of payment and Letter of Credit, Payment settlement of exports and Imports, Methods of payments of Incoterms: *Methods of payments, financing exporters and importers, instruments of payment*, EXIM strategies and export marketing: *EXIM business plan and strategy, export financing, import strategy, international marketing*, Export incentive schemes: *Duty exemption scheme, duty remission scheme, export promotion capital good scheme, special economic zones*.

Text Books

1. McBride, Stephen, and John Richard Wiseman, eds. Globalization and its Discontents. London: Macmillan, 2000.
2. Gerber, James. International economics. Prentice Hall, 2010.
3. Helpman, Elhanan. Understanding global trade. Harvard University Press, 2011.

Course Outcome:

Upon completion of the Global Trade Management course, students will have a comprehensive understanding of international trade, policies, and strategies. They will be equipped with practical knowledge to navigate the complexities of global trade, analyze trade dynamics, and implement effective strategies for export and import activities. The course will prepare students for roles in international business, trade analysis, and strategic planning in the context of a global marketplace.

Risk, Disruption and Resilient Supply Chain

LSCM-15	Risk, Disruption and Resilient Supply Chain	3L:0T:0P	3 credits
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Course Objective:

The objective of the Risk, Disruption, and Resilient Supply Chain course is to provide students with a comprehensive understanding of the challenges posed by risk and disruptions in supply chain operations. The course aims to introduce students to the fundamentals of supply chain risk and disruption, explore risk management strategies, and delve into business continuity management (BCM). Students will learn the principles of designing and managing resilient supply chains, including resilience modeling and measurement. The course will equip students with strategies for mitigating operational and disruption risks, ensuring the viability of supply chains even in adverse conditions.

Content:

Introduction to supply chain risk and disruption, Risk management in Supply Chain, Business continuity management (BRM), Supply Chain Resilience: Design & Management, Resilience modeling in Supply Chain, Measuring Supply Chain Resilience, Strategies for mitigating operational and disruption risks, Supply Chain Viability.

Text books:

Designing and Managing the Supply Chain: Concepts, Strategies and Case studies (4th Edition) by David Simchi Levi, Edith Simchi Levi, Ravi Shankar, Philip Kaminsky. McGraw Hill Education. Copyright © 2022

Introduction to supply chain resilience: Management, modelling, technology, by Dmitry Ivanov. Springer Nature, 2021.

Cachon, Gerard, and Christian Terwiesch. Matching supply with demand. McGraw-Hill Publishing, 2018.

Course Outcome:

Upon completion of the Risk, Disruption, and Resilient Supply Chain course, students will have a solid understanding of the complexities and challenges associated with supply chain risk management. They will be equipped with practical skills in designing resilient supply chains, modeling resilience, and implementing strategies to mitigate risks. The course will prepare students to contribute to the development of supply chain resilience strategies and ensure the continuity and viability of supply chains in dynamic and unpredictable environments.

Indian Knowledge System

LSCM-16	Indian Knowledge System	2L:0T:0P	2 credits
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Course Objective:

The objective of the Indian Knowledge System course is to provide students with a comprehensive introduction to the rich and diverse knowledge systems that have evolved in India. The course aims to explore various facets of the Indian knowledge tradition, including the Vedic corpus, mathematics, astronomy, engineering, technology, town planning, architecture, knowledge frameworks, and linguistics. Students will gain insights into the historical development of knowledge in ancient India and appreciate the contributions made in diverse fields.

Content:

Indian Knowledge System – An Introduction, The Vedic Corpus, Number System and Units of Measurements, Mathematics, Astronomy, Engineering and Technology: Metals and Metalworking, Engineering and Technology: Other Applications, Town Planning and Architecture, Knowledge Framework and Classification, Linguistics.

Text books

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), “Introduction to Indian Knowledge System: Concepts and Applications”, PHI Learning Private Ltd. Delhi.
2. Pride of India: A Glimpse into India’s Scientific Heritage, Samskrita Bharati, New Delhi.
3. Bag, A.K. (1979). Mathematics in Ancient and Medieval India, Chaukhamba Orientalia, New Delhi.
4. Bag, A.K. (1997). History of Technology in India, Vol. I, Indian National Science Academy, New Delhi.
5. Kapoor Kapil, Singh Avadhesh (2021). “Indian Knowledge Systems Vol – I & II”, Indian Institute of Advanced Study, Shimla, H.P

Course Outcome:

Upon completion of the Indian Knowledge System course, students will have a deep appreciation for the intellectual heritage of ancient India. They will be equipped with knowledge about the diverse contributions made in mathematics, astronomy, engineering, technology, town planning, architecture, and linguistics. The course will foster a holistic understanding of the interdisciplinary nature of Indian knowledge systems, providing a foundation for further exploration and research in these fields.

Warehouse Automation and Management

LSCM-17	Warehouse Automation and Management	3L:0T:0P	3 credits
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Course Objective:

The objective of the Warehouse Automation and Management course is to provide students with a comprehensive understanding of warehouse operations, automation technologies, and management practices. The course aims to introduce the concept of warehouses, their role in the supply chain, and various types and functions. Students will explore warehouse location and layout considerations, operational processes, and the latest technologies employed in warehouse management. The course will cover handling, storage, retrieval processes, as well as automation technologies such as robotics, AGVs, sorters, and warehouse management systems. Additionally, students will learn about safety, cost management, performance improvement, workforce design, and world-class practices in warehouse management.

Content:

Concept of warehouse, role of warehouse in supply chain, types of warehouses, functions of warehouse, warehouse location, warehouse layouts, warehouse operations, Receiving and Putaway, Pallet storage and handling systems, Case picking systems, equipment used in warehouse, storage & retrieval systems, warehouse automation, Handling, Storage and Retrieval Process including Kitting and packaging.

Latest Technologies in Warehouse Management - Robotics, AGV, Sorters, Pick to Light and Put to Light systems, warehouse management system, safety and insurance issues in warehouse, warehouse cost management, warehouse performance management and improvement, warehouse design, seven principles of world-class warehousing, use of ICT in warehouse management, warehouse workforce design and development, warehouse maintenance, world-class practices in warehouse management.

Text Books

1. Edward H. Frazelle, World-Class Warehousing and Material Handling (2nd edition), McGraw-Hill Publishers. ISBN: 978-0-07-178559-4.
2. Gwynne Richards, Warehouse Management: A complete guide to improving efficiency and minimizing costs in modern warehouses (2nd edition), Kogan Page Ltd, New Delhi. ISBN:978-0-7494-6934-4.

Course Outcome:

Upon completion of the Warehouse Automation and Management course, students will have acquired a comprehensive skill set in designing, implementing, and managing warehouse operations. They will be well-versed in the latest technologies, safety practices, cost management, and performance improvement strategies essential for effective warehouse management. The course will prepare students for roles in warehouse design, automation, and optimization in diverse industries.

Simulation Modelling and Supply Chain Digital Twin

LSCM-18	Simulation Modelling and Supply Chain Digital Twin	2L:0T:2P	3 credits
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Course Objective:

The objective of the Simulation Modeling and Supply Chain Digital Twin course is to provide students with a comprehensive understanding of simulation techniques, modeling principles, and the application of digital twin technology in supply chain management. The course aims to introduce students to the basics of system and simulation, probability, and principles of modeling. Students will learn about Monte-Carlo simulation, discrete event simulation, and the steps involved in designing and conducting simulation experiments. The course will also cover the application of simulation in manufacturing systems, supply chain optimization, and the emerging concept of Supply Chain Digital Twins.

Content:

Introduction to System and simulation, Review of probability, Principles of modeling and simulation, Monte- Carlo simulation, Discrete event simulation, Steps in simulation, Random numbers generation, Test for random numbers, Random variate, Design of simulation experiment: analysis of input data, output data, Validation and verification etc., Overview of simulation languages, Modeling and analysis of manufacturing systems and simulation experiments.

Introduction to Supply Chain Optimization and Simulation, Introduction to Digital Supply Chain Twins, Supply chain network design using simulation software, Supply chain simulation using simulation software, Supply chain resilience and its modelling using simulation software, Supply chain resilience analysis using simulation software, Future trends.

Text Books

1. Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, and P. Shahabudeen, Discrete Event System Simulation, Prentice Hall of India, New Delhi, 2008.
2. Averill M. Law and W. David Kelton, Simulation Modeling and Analysis, Tata McGraw Hill, New Delhi, 2006.
3. MacCarthy, Bart L., and Dmitry Ivanov, eds. The digital supply chain. Elsevier, 2022.

Course Outcome:

Upon completion of the course, students will have gained practical skills in simulation modeling, optimization, and the application of digital twin technology in supply chain management. They will be prepared to apply simulation techniques to address complex system challenges and contribute to the optimization and resilience of supply chain operations.

SEMESTER – IV

Blockchain and Smart Contracts

LSCM-19	Blockchain and Smart Contracts	3L:0T:0P	3 credits
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Course Objective:

The objective of the Blockchain and Smart Contracts course is to provide students with a comprehensive understanding of blockchain technology, cryptography, consensus algorithms, and the application of smart contracts in various business scenarios. The course aims to cover the basics of blockchain, types of blockchains, and the challenges of adoption. Students will explore supply contracts, contracts for different supply chain models, and delve into the fundamentals of smart contracts, Ethereum, and Solidity programming. The course will also cover smart contract security, deployment, legal considerations, and emerging trends in blockchain technology.

Content:

Basics of blockchain: *blockchain fundamentals, defining blockchain, elements of a blockchain, qualities of blockchains*, Blockchain technology: *types of blockchains, evolving the blockchain stack, hurdles of adoption*, Basics of Cryptography, Consensus algorithm: *proof-of-work consensus algorithm, proof-of-stake consensus algorithm, decentralized autonomous organizations*.

Supply contracts: *buy-back contracts, revenue sharing contracts, quantity-flexibility contracts, sales rebate contracts*, Contracts for Make-to-stock/make-to-order supply chains: *payback contracts, cost sharing contracts*, Contracts with asymmetric information: *capacity reservation contracts, advanced purchase contracts*, Contracts for non-strategic components: *long-term contracts, flexible or option contracts, Spot purchase, Portfolio contract*.

Introduction to Smart Contracts, Ethereum and Solidity, Components of Smart Contracts, Smart Contract Security, Smart Contract Deployment, Legal and Regulatory Considerations, Smart Contract Development Tools, Future Trends: Emerging technologies and trends in smart contracts (e.g., non-fungible tokens, DeFi, DAOs), Integration with IoT and AI.

Text Books

1. Lantz, Lorne, and Daniel Cawrey. Mastering blockchain. O'Reilly Media, 2020.
2. Compagnucci, Marcelo Corrales, Mark Fenwick, and Stefan Wrba, eds. Smart contracts: Technological, business and legal perspectives. Bloomsbury Publishing, 2021.
3. Corrales, Marcelo, Mark Fenwick, and Helena Haapio, eds. Legal tech, smart contracts and blockchain. Singapore: Springer, 2019.
4. Imran, B. "Mastering Blockchain: Deeper insights into decentralization, cryptography." Bitcoin, and popular Blockchain frameworks (2017).

Course Outcome:

Upon completion of the course, students will have acquired a comprehensive understanding of blockchain fundamentals, smart contract development, and the practical application of these technologies in supply chain and other industries. They will be well-prepared to navigate legal considerations, deploy secure smart contracts, and stay informed about emerging trends in blockchain technology.

Advanced Supply Chain Analytics

LSCM-20	Advanced Supply Chain Analytics	3L:0T:0P	3 credits
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Course Objective:

The objective of the Advanced Supply Chain Analytics course is to provide students with an advanced understanding of supply chain analytics, covering descriptive, predictive, and prescriptive analytics. The course aims to explore strategies for controlling the Bullwhip effect, enhancing supply chain integration, managing complexity, and implementing segmentation. Students will delve into the application of big data to improve supply chain performance, focusing on resiliency, flexibility, inventory management, risk pooling, and supply contracts. The course will also cover transportation decisions, network planning, demand and supply analytics, as well as location and network design models for effective supply chain management.

Content:

Introduction to Supply chain Analytics, Descriptive, Predictive and Prescriptive analytics, Controlling the Bullwhip and the Value of Information, Supply Chain Integration, Push-Pull and Complexity Reduction, Supply Chain Segmentation, Using Big Data to improve Performance of Supply Chain, Supply Chain Resiliency, Supply Chain Flexibility, Inventory Management and Risk Pooling Strategies, Supply Contracts and Risk Sharing Strategies, Network Planning, Demand and Supply Analytics.

Transportation decisions: *Multistage transportation problems, fixed charge transportation problem (FCPP): heuristic solution to FCPP, multiple items and fixed charge, heuristic solution for multiple items*, Truck allocation problem: *integer programming formulation, branch and bound algorithm*, Point to point transportation- multiple customers to a single vehicle: *formulation, heuristic algorithms*, Location and network design models: *important factors in location decisions, models for discrete space location problems, model for continuous space location problems*, Multi-echelon and single product location allocation models, Facilities layout: *Computerized algorithm for layout CRAFT*.

Text Books

1. Tipi, N. (2021). Supply chain analytics and modelling: Quantitative tools and applications. Kogan Page Publishers.
2. Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E., & Shankar, R. (2008). Designing and managing the supply chain: concepts, strategies and case studies. Tata McGraw-Hill Education.
3. Shapiro, J. F. (2001). Modeling the supply chain. Duxbury Resource Center.
4. Watson, Michael. Supply chain network design: applying optimization and analytics to the global supply chain. Pearson education, 2013.
5. Liu, Kurt Y. Supply Chain Analytics: Concepts, Techniques and Applications. Palgrave Macmillan, 2022.
6. Srinivasan, G. Quantitative models in operations and supply chain management. PHI Learning Pvt. Ltd., 2017.

Course Outcome:

Upon completion of the Advanced Supply Chain Analytics course, students will have acquired advanced skills in leveraging analytics for strategic supply chain decision-making. They will be able to apply sophisticated models and strategies to address challenges related to inventory, transportation, risk management, and network design, contributing to the optimization and efficiency of supply chain operations.

Appendix - 1

Program Elective Courses:

List of Elective Courses

1. Advanced AI for Supply chain and Logistics
2. Advanced Operations Research
3. Retail and e-commerce Supply Chain Management
4. Modern-day SCM for E-commerce in India
5. Green Logistics
6. Business law and Contract Management
7. Lean Six Sigma in Logistics and Supply Chain
8. Managing people and organizations
9. Logistics for Naya Bharat
10. Applied GIS & Spatial Data Analytics
11. Behavioural SCM
12. AR/VR in Logistics
13. Innovations in Waste Management
14. Management of Intellectual Property Rights (IPR) for Logistics
15. Materials Handling Systems
16. Supply Chain Network Design
17. Supply Chain Contracts
18. Robotic Process Automation
19. Negotiations & Stakeholder Management
20. Case studies of successful startups/Unicorns in Logistics
21. Case studies related to PM Gati Shakti NMP.

Advanced AI for Supply chain and Logistics

EL-01	Advanced AI for Supply chain and Logistics	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Advanced AI for Supply Chain and Logistics course is to provide students with an in-depth understanding of how artificial intelligence (AI), machine learning (ML), and deep learning techniques can be applied to optimize supply chain and logistics operations. The course aims to cover key concepts such as supervised and unsupervised learning, time series forecasting, anomaly detection, recommender systems, ensemble learning, and various neural network architectures. Students will explore real-world case studies, applications of AI in supply chain optimization, and the use of natural language processing (NLP) for sentiment analysis and customer support.

Content:

Overview of Supply Chain Management (SCM) and Logistics; Challenges and Opportunities in Supply Chain Optimization; Case Studies: Real-world Applications of AI in SCM; Introduction to AI, ML, and Deep Learning; Supervised and Unsupervised Learning; Time Series Forecasting; Anomaly Detection in Supply Chain Data; Recommender Systems for Demand Forecasting; Ensemble Learning and Model Stacking; Introduction to Neural Networks and Deep Learning; Recurrent Neural Networks (RNNs); Convolutional Neural Networks (CNNs) for Image-Based Logistics; Sequence-to-Sequence Models for Demand Forecasting; Introduction to Reinforcement Learning (RL); Q-Learning and Deep Q Networks (DQN) for Inventory Management; Applications of RL; Introduction to NLP; Text Mining for Supplier and Customer Sentiment Analysis; Chatbots and Virtual Assistants for Customer Support.

Text Books

1. Tipi, N. (2021). Supply chain analytics and modelling: Quantitative tools and applications. Kogan Page Publishers.
2. Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E., & Shankar, R. (2008). Designing and managing the supply chain: concepts, strategies and case studies. Tata McGraw-Hill Education.
3. Shapiro, J. F. (2001). Modeling the supply chain. Duxbury Resource Center.
4. Watson, Michael. Supply chain network design: applying optimization and analytics to the global supply chain. Pearson education, 2013.
5. Liu, Kurt Y. Supply Chain Analytics: Concepts, Techniques and Applications. Palgrave Macmillan, 2022.
6. Srinivasan, G. Quantitative models in operations and supply chain management. PHI Learning Pvt. Ltd., 2017.

Course Outcome:

Upon completion of the Advanced AI for Supply Chain and Logistics course, students will have gained advanced knowledge and practical skills in leveraging AI technologies for optimizing supply chain and logistics operations. They will be equipped to apply a wide range of AI

techniques to address challenges in demand forecasting, anomaly detection, inventory management, and customer support within the context of supply chain management.

Advanced Operations Research

EL-02	Advanced Operations Research	3L:0T:0P	3 credits
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Course Objective:

The objective of the Advanced Operations Research course is to provide students with an advanced understanding of operations research techniques and methodologies. The course aims to cover problem formulation, model building techniques, and various advanced optimization methods. Students will explore nonlinear programming, convex optimization, integer linear programming, network optimization, unconstrained and constrained optimization, stochastic processes, stochastic programming, Markov decision processes, multi-objective optimization, game theory, and simulation techniques. The course is designed to equip students with advanced analytical tools to solve complex decision-making problems in various domains.

Content:

Introduction to Advanced Operations Research; Problem Formulation and Model Building Techniques; Introduction to Nonlinear Programming and Convex Optimization; Duality and Sensitivity Analysis; Integer Linear Programming and Mixed-Integer Linear Programming (MILP); Network Optimization: Shortest Path, Max Flow, and Assignment Problems; Unconstrained Optimization: Gradient Descent, Newton's Method; Constrained Optimization: Lagrange Multipliers, KKT Conditions; Convex Optimization: Properties, Algorithms, and Applications; Introduction to Stochastic Processes; Stochastic Programming: Two-Stage and Multi-Stage Problems; Markov Decision Processes and Reinforcement Learning; Multi-Objective Optimization; Pareto Optimality and Efficiency; Goal Programming; Evolutionary Algorithms for Multi-Objective Optimization; Introduction to Game Theory; Cooperative and Non-Cooperative Games; Applications of Game Theory in Supply Chain; Monte Carlo Simulation; Discrete-Event Simulation for Complex Systems.

Text Books

1. Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D., & Cochran, J. J. (2018).
2. An introduction to management science: quantitative approach. Cengage learning. Winston, W. L. (2003). Operations research: applications and algorithms. Belmont: Thomson Brooks/Cole.
3. Hillier F.S. and Lieberman G.J. (2002). Introduction to Operations Research, McGraw Hill.
4. Taha, Hamdy A. Operations research: an introduction. Pearson Education India, 9th edition.

Course Outcome:

Upon completion of the Advanced Operations Research course, students will possess advanced skills in mathematical modeling, optimization, stochastic processes, game theory, and

simulation. They will be well-equipped to address complex decision-making problems in diverse fields, including supply chain management, finance, engineering, and logistics.

Retail and e-commerce Supply Chain Management

EL-03	Retail and e-commerce Supply Chain Management	3L:0T:0P	3 credits
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Course Objective:

The objective of the Retail and E-commerce Supply Chain Management course is to provide students with a comprehensive understanding of the unique challenges and strategies involved in managing supply chains within the retail and e-commerce sectors. The course aims to cover key topics such as facility location, network design, vendor management, sustainability practices, inventory optimization, order fulfillment strategies, last-mile delivery challenges, and the integration of technologies like robotics, big data, IoT, RFID, and blockchain. Students will gain insights into the dynamic landscape of retail and e-commerce supply chains, focusing on efficiency, customer experience, and compliance considerations.

Content:

Overview of Retail and E-commerce Supply Chain Landscape; Key Differences Between Traditional Retail and E-commerce Supply Chains; Facility Location and Layout Planning; Network Design for Omnichannel Operations; Vendor Selection and Management; Sustainability and Green Supply Chain Practices in Retail; Facility Location and Layout Planning; Network Design for Omnichannel Operations; Vendor Selection and Management; Sustainability and Green Supply Chain Practices in Retail; Inventory Models; Demand Forecasting Techniques: Time Series Analysis, Machine Learning; Inventory Optimization in E-commerce: JIT, Drop-shipping, Cross-docking; Order Processing and Fulfillment Strategies; Warehousing and Distribution Center Management; Last-Mile Delivery Challenges and Solutions; Robotics and Automation in Order Fulfillment; Role of Big Data and Predictive Analytics in Retail; IoT and RFID Applications in Supply Chain Visibility; Blockchain Technology for Supply Chain Transparency; E-commerce Platforms and Payment Systems; Customer Experience and Returns Management; Regulatory Compliance and Ethical Considerations.

Text Books

1. Agrawal, Narendra, and Stephen A. Smith. *Retail supply chain management*. Springer, 2015.
2. Schniederjans, M. J., Cao, Q., & Triche, J. H. (2013). *E-commerce operations management*. World Scientific Publishing Company.

Course Outcome:

Upon completion of the Retail and E-commerce Supply Chain Management course, students will have acquired a comprehensive skill set to navigate the complexities of retail and e-commerce supply chains. They will be equipped to design and optimize supply chain processes, implement sustainable practices, leverage technology for visibility, and address challenges related to

customer experience and regulatory compliance in the dynamic retail and e-commerce environments.

Modern-day SCM for E-commerce in India

EL-04	Modern-day SCM for E-commerce in India	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Modern-day Supply Chain Management for E-commerce in India course is to provide students with a specialized understanding of the unique challenges and opportunities in managing supply chains within the e-commerce industry in the Indian context. The course aims to cover key topics such as the Indian e-commerce landscape, logistics and transportation challenges, warehouse management, last-mile delivery strategies, technology integration, regulatory compliance, and customer-centric supply chain practices. Students will gain insights into the rapidly evolving e-commerce sector in India and develop skills to design and optimize supply chain processes tailored to its specific dynamics.

Content:

Overview of Indian E-commerce Market: Trends and Growth; Regulatory Environment and E-commerce Policies in India; Market Players: From Startups to Established Players; Consumer Behavior and Cultural Influences; Supply Chain Design for Indian E-commerce: Network Optimization for Indian Geography; Vendor Management and Negotiation in Indian Context; Warehousing Strategies: Centralized vs. Decentralized; Sustainable Supply Chain Practices: Green Warehousing and Packaging; Demand Forecasting Techniques for Diverse Indian Markets; Inventory Optimization: Balancing Storage Costs and Demand Variability; Seasonal Demand Management: Festivals and Special Events in India; JIT Inventory Systems for Lean E-commerce Operations; Selection and Management of Logistics Partners; Challenges in Urban and Rural Last-Mile Delivery; Technology Integration in Logistics: GPS, IoT, and Real-time Tracking; Crowdsourced Delivery Models and Hyperlocal Logistics; Mobile Commerce; AI and Machine Learning Applications; E-commerce Platforms and Payment Gateways in India; Case Studies and Industry Practices.

Text Books

1. Joseph, Pulitarambil Thomas. *E-commerce: An Indian perspective*. PHI Learning Pvt. Ltd., 2023.
2. Laudon, Kenneth C., and Carol Guercio Traver. *E-commerce 2019: Business, technology, society*. Pearson, 2020.
3. Varma, Anil, and Samrat Ray. "The case of amazons E-commerce digital strategy in India." (2023).

Course Outcome:

Upon completion of the Modern-day Supply Chain Management for E-commerce in India course, students will possess specialized knowledge and skills to navigate the complexities of the Indian e-commerce supply chain. They will be equipped to design, implement, and optimize

supply chain processes that align with the unique characteristics and challenges of the Indian e-commerce industry.

Green Logistics

EL-05	Green Logistics	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Green Logistics course is to provide students with a comprehensive understanding of sustainable practices and strategies in logistics and supply chain management. The course aims to cover key topics such as green supply chain strategies, life cycle assessment, eco-design, sustainable packaging, green transportation modes, last-mile delivery solutions, urban logistics, reverse logistics, waste reduction techniques, renewable energy sources, energy-efficient warehousing, smart technologies, and the circular economy. Students will gain insights into designing and managing environmentally responsible logistics processes and systems.

Content:

Introduction to Green Logistics; Green Supply Chain Strategies: From Procurement to Distribution; Life Cycle Assessment (LCA) in Supply Chain Design; Eco-design and Sustainable Packaging; Supplier Evaluation and Sustainability Criteria; Sustainable Transportation Modes: Rail, Maritime, and Green Shipping; Electric and Hybrid Vehicles: The Future of Green Transportation; Last-Mile Delivery Solutions: Bicycles, Drones, and Electric Vehicles; Urban Logistics and Low Emission Zones; Reverse Logistics and Product Returns; Waste Reduction Techniques: Reuse, Repair, and Remanufacturing; Recycling and Waste-to-Energy Solutions; E-waste Management and Responsible Disposal; Renewable Energy Sources: Solar, Wind, and Biomass; Energy-efficient Warehousing and Distribution Centers; Smart Technologies: IoT and Sensors in Energy Management; Green IT: Sustainable Practices in Information Technology; Circular Economy and Sustainable Practices; Case Studies: Successful Green Logistics Initiatives.

Text Books

1. Grant, D. B., Trautrim, A., & Wong, C. Y. (2013). *Sustainable Logistics: Responses to a Global Challenge*. Springer.
2. Gonzalez-Feliu, Jesus. *Sustainable urban logistics: Planning and evaluation*. John Wiley & Sons, 2018.
3. Macharis, Cathy, et al., eds. *Sustainable logistics*. Emerald Group Publishing, 2014.

Course Outcome:

Upon completion of the Green Logistics course, students will possess the knowledge and skills to design and implement environmentally sustainable logistics practices. They will be equipped to address the environmental challenges in the supply chain and contribute to the development of a greener and more sustainable logistics industry.

Business law and Contract Management

EL-06	Business law and Contract Management	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Business Law and Contract Management course is to provide students with a comprehensive understanding of the legal principles governing business transactions and equip them with the skills necessary for effective contract management. The course aims to cover key topics such as the overview of business law, types of business entities, legal rights and obligations, ethical considerations, contract formation, interpretation, drafting, negotiation, management, dispute resolution, international business contracts, and the legal aspects of import and export business. Students will develop the knowledge and practical skills required for successful contract management in both domestic and international business environments.

Content:

Overview of Business Law: Definitions and Scope; Types of Business Entities: Sole Proprietorship, Partnership, Corporation; Legal Rights and Obligations in Business Transactions; Ethical Considerations in Business Law; Contract Formation and Elements; Contract Terms and Interpretation; Contract Drafting and Negotiation; Contract Management; Dispute Resolution and Legal Remedies; International Business Contracts; International Contracts and Cross-Border Transactions; Legal Aspects of Import and Export Business; International Arbitration and Dispute Resolution; Cultural and Jurisdictional Challenges in International Contracts.

Text Books

- 1 August, Ray, Don Mayer, and Michael B. Bixby. *International business law: text, cases, and readings*. Pearson, 2013.
- 2 Mann, R. A., & Roberts, B. S. (2013). *Business Law and the Regulation of Business*. South-Western College Publishing.
- 3 Corrales, Marcelo, Mark Fenwick, and Helena Haapio, eds. *Legal tech, smart contracts and blockchain*. Singapore: Springer, 2019.

Course Outcome:

Upon completion of the Business Law and Contract Management course, students will be well-versed in the legal foundations of business transactions and possess practical skills for effective contract management. They will be prepared to navigate legal complexities, draft and negotiate contracts, manage disputes, and ensure compliance with ethical and legal standards in both domestic and international business contexts.

Lean Six Sigma in Logistics and Supply Chain

EL-07	Lean Six Sigma in Logistics and Supply Chain	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Lean Six Sigma in Logistics and Supply Chain course is to provide students with a comprehensive understanding of Lean Six Sigma methodologies and their application in optimizing logistics and supply chain processes. The course aims to cover key topics such as data collection and analysis, cause and effect analysis, failure mode and effects analysis, hypothesis testing, Lean tools for waste reduction, design of experiments, solutions implementation and validation, change management, control charts, advanced Lean Six Sigma tools, and real-world case studies. Students will gain practical skills to identify and eliminate inefficiencies, reduce waste, and enhance overall supply chain performance.

Content:

Introduction to Lean Six Sigma in Logistics; Data Collection and Analysis; Cause and Effect Analysis (Fishbone Diagram); Failure Mode and Effects Analysis (FMEA); Regression Analysis and Correlation; Hypothesis Testing: t-tests, ANOVA, Chi-Square Tests; Lean Tools for Waste Reduction: Kanban, Poka-Yoke, SMED; Design of Experiments (DOE); Solutions Implementation and Validation; Change Management in Lean Six Sigma Projects; Control Charts and Process Monitoring; Advanced Lean Six Sigma Tools; Case Studies and Industry Applications.

Text Books

- 1 Baker, B. (2003). Lean Six Sigma: Combining Six Sigma Quality With Lean Speed. *Quality Progress*, 36(10), 96.
- 2 Taghizadegan, S. (2010). *Essentials of lean six sigma*. Elsevier.
- 3 Antony, J. (2023). *Design of experiments for engineers and scientists*. Elsevier.
- 4 Montgomery, D. C. (2017). *Design and analysis of experiments*. John Wiley & sons.

Course Outcome:

Upon completion of the Lean Six Sigma in Logistics and Supply Chain course, students will possess the knowledge and skills needed to apply Lean Six Sigma methodologies to improve efficiency, reduce waste, and optimize logistics and supply chain processes. They will be prepared to lead and contribute to continuous improvement initiatives in various industry settings.

Managing people and organizations

L-08	Managing people and organizations	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Managing People and Organizations course is to provide students with a comprehensive understanding of the principles and practices involved in effectively managing

individuals and groups within organizational settings. The course aims to cover key topics such as leadership theories, communication skills, conflict resolution, motivation, performance appraisal, employee engagement, team dynamics, organizational culture, diversity and inclusion, ethical leadership, strategic human resource management, and real-world case studies. Students will develop the knowledge and skills necessary to lead, motivate, and manage people within diverse organizational contexts.

Content:

Introduction to Managing People and Organizations; Leadership and Communication: Leadership Theories: Trait, Behavioral, and Contingency Approaches; Communication Skills for Effective Leadership; Conflict Resolution Strategies; Emotional Intelligence and Leadership; Theories of Motivation: Maslow, Herzberg, Expectancy Theory; Performance Appraisal and Feedback Techniques; Employee Engagement and Job Satisfaction Rewards and Recognition Programs; Team Dynamics and Collaboration; Organizational Culture and Change Management; Diversity, Inclusion, and Ethical Leadership; Strategic Human Resource Management; Case studies.

Text Books

- 1 Griffin, Ricky W., and Jean Phillips. *Organizational behavior: Managing people and organizations*. CENGAGE learning, 2023.
- 2 Martin, Graeme, and Sabina Siebert. *Managing people and organizations in changing contexts*. Routledge, 2016.

Course Outcome:

Upon completion of the Managing People and Organizations course, students will possess the knowledge and skills needed to effectively lead and manage people in organizational settings. They will be equipped to navigate leadership challenges, foster a positive work environment, and contribute to the success and sustainability of the organizations they serve.

Logistics for Naya Bharat

EL-09	Logistics for Naya Bharat	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Logistics for Naya Bharat course is to provide students with specialized knowledge and skills to navigate the logistics landscape in the evolving and dynamic context of New India. The course aims to cover key topics such as the introduction to logistics in New India, supply chain optimization for the Indian market, transportation and warehousing strategies, e-commerce logistics, last-mile delivery, sustainable and green logistics practices, regulatory compliance, international logistics, and real-world case studies. Students will gain insights into the unique challenges and opportunities in the logistics sector in the context of the evolving Indian market.

Content:

Introduction to Logistics in New India; Supply Chain Optimization for Indian Market; Transportation and Warehousing Strategies; E-commerce Logistics and Last-Mile Delivery; Sustainable and Green Logistics Practices; Regulatory Compliance and International Logistics; Case Studies and Industry Applications.

Text Books

- 1 Manoj K. Tiwari (2023), Towards Naya Bharat: a study of infrastructure, community and development.
- 2 Logistics & Supply Chain Management, (Latest edition), Martin Christopher, Prentice Hall.
- 3 Business Logistics: Supply Chain Management (Latest Edition) L Ronald H. Ballou, Prentice Hall.
- 4 Introduction to Logistics Systems Management (2nd Edition): Gianpaolo Ghiani, Gilbert Laporte, Roberto Musmanno, Wiley.

Course Outcome:

Upon completion of the Logistics for Naya Bharat course, students will be equipped with specialized knowledge and skills to navigate the logistics challenges and opportunities in the evolving context of New India. They will be prepared to contribute to the optimization of supply chains, implement sustainable logistics practices, address regulatory compliance, and make informed decisions in the unique landscape of the Indian logistics sector.

Applied GIS & Spatial Data Analytics

EL-10	Applied GIS & Spatial Data Analytics	3 L:0T:0P	3 Credits
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Course Objective:

The objective of the Applied GIS & Spatial Data Analytics course is to equip students with practical skills and knowledge in Geographic Information Systems (GIS) and spatial data analytics. The course aims to cover fundamental concepts such as GIS introduction, spatial data acquisition, preprocessing, visualization tools, geospatial analysis techniques, advanced spatial data analytics, and applications across various fields. Students will engage in real-world case studies to understand the practical applications of GIS and explore future trends in the industry.

Content:

Introduction to GIS and Spatial Data; Spatial Data Acquisition and Preprocessing; Spatial Data Visualization tools; Geospatial Analysis Techniques; Advanced Spatial Data Analytics; Applications in Various Fields; Real-world GIS Applications: Case Studies; Future Trends and Industry Applications.

Text Books

- 1 Stillwell, John, and Graham Clarke, eds. *Applied GIS and spatial analysis*. Chichester: Wiley, 2004.
- 2 Bivand, Roger S., et al. *Applied spatial data analysis with R*. Vol. 747248717. New York: Springer, 2008.
- 3 Fischer, Manfred M., and Arthur Getis, eds. *Handbook of applied spatial analysis: software tools, methods and applications*. Berlin: Springer, 2010.

Course Outcome:

Upon completion of the Applied GIS & Spatial Data Analytics course, students will possess practical skills in utilizing GIS tools, acquiring and preprocessing spatial data, conducting geospatial analysis, and applying spatial data analytics across various domains. They will be well-prepared to contribute to industries where spatial information and analysis play a crucial role, and they will be aware of the future trends shaping the GIS landscape.

Behavioral SCM

EL-11	Behavioral SCM	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Behavioral Supply Chain Management course is to provide students with a comprehensive understanding of the role of human behavior in supply chain decision-making. The course aims to cover key topics such as the introduction to Behavioral Supply Chain Management, the influence of human behavior on decision-making, cognitive biases in SCM, motivation and team dynamics, behavioral aspects of supplier and customer relationships, sustainable supply chain and social responsibility, the impact of technology and innovation, and future trends in Behavioral SCM. Students will explore real-world case studies to apply behavioral concepts to supply chain scenarios.

Content:

Introduction to Behavioral Supply Chain Management; Human Behavior in Supply Chain Decision Making; Cognitive Biases in SCM; Motivation and Team Dynamics; Behavioral Aspects of Supplier and Customer Relationships; Sustainable Supply Chain and Social Responsibility; Technology and Innovation in Behavioral SCM; Future Trends in Behavioral SCM; Industry 4.0; Case studies.

Text Books

- 1 Donohue, K., Katok, E., & Leider, S. (Eds.). (2018). *The handbook of behavioral operations*.
- 2 Bendoly, E., Van Wezel, W., & Bachrach, D. G. (Eds.). (2015). *The handbook of behavioral operations management: Social and psychological dynamics in production and service settings*. Oxford University Press.

Course Outcome:

Upon completion of the Behavioral Supply Chain Management course, students will be equipped with the knowledge and skills to understand, analyze, and address the behavioral aspects of supply chain decision-making. They will be prepared to navigate the human dynamics in supply chain teams, manage relationships effectively, and contribute to sustainable and socially responsible supply chain practices. Students will also be aware of the impact of technology and future trends shaping Behavioral SCM in the era of Industry 4.0.

AR/VR in Logistics

EL-12	AR/VR in Logistics	3L:0T:0P	3 Credits
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Course Objective:

The objective of the AR/VR in Logistics course is to provide students with a comprehensive understanding of Augmented Reality (AR) and Virtual Reality (VR) technologies and their applications in the logistics industry. The course aims to cover key topics such as the introduction to AR/VR technologies, their use in warehouse management and transportation, virtual reality simulations, hands-on sessions for developing AR applications, industry adoption, case studies, and exploration of future trends such as AR Cloud and Mixed Reality. Students will gain practical experience and insights into the transformative impact of AR/VR in optimizing logistics operations.

Content:

Introduction to AR/VR Technologies; AR/VR in Warehouse Management; AR/VR in Transportation and Logistics; Virtual Reality Simulations; Hands-on Session: Developing AR Applications for Customer Interaction; Industry Adoption and Case Studies; Future Trends: AR Cloud, Mixed Reality and others.

Text Books

- 1 Hunter, Leah. *Augmented Reality for the Industrial Enterprise: A Hands-on Introduction to Rapid AR Development*. O'Reilly Media, 2017.
- 2 Ma, Dengzhe, et al., eds. *Virtual reality & augmented reality in industry*. Berlin, Heidelberg: Springer Berlin Heidelberg, 2011.
- 3 Rejeb, Abderahman, et al. "The potentials of augmented reality in supply chain management: A state-of-the-art review." *Management review quarterly* (2020): 1-38.

Course Outcome:

Upon completion of the AR/VR in Logistics course, students will be equipped with the knowledge and skills to leverage AR/VR technologies for optimizing logistics operations. They will understand the practical applications of AR/VR in warehouse management, transportation, and customer interaction. Additionally, students will be aware of industry adoption trends, learn from real-world case studies, and explore future developments in AR/VR technologies within the logistics sector.

Innovations in Waste Management

EL-13	Innovations in Waste Management	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Innovations in Waste Management course is to provide students with an in-depth understanding of contemporary challenges in waste management and explore innovative solutions to address them. The course aims to cover key topics such as waste-to-energy technologies, advanced recycling techniques, circular economy principles, sustainable waste management practices, waste reduction and minimization strategies, and the integration of smart technologies and data analytics in waste management. Students will gain insights into real-world case studies and industry applications to apply innovative approaches to waste management challenges.

Content: Introduction to Waste Management Challenges; Waste-to-Energy Technologies; Advanced Recycling Techniques; Circular Economy and Sustainable Waste Management; Waste Reduction and Minimization; Smart Technologies and Data Analytics in Waste Management; Case Studies and Industry Applications.

Text Books

- 1 Bilitewski, B., Härdtle, G., & Marek, K. (2013). *Waste management*. Springer Science & Business Media.
- 2 Liu, L., & Ramakrishna, S. (Eds.). (2021). *An introduction to circular economy*. Springer.
- 3 Singh, N. K., Pandey, S., Sharma, H., & Goel, S. (Eds.). (2020). *Green innovation, sustainable development, and circular economy*. CRC Press.

Course Outcome:

Upon completion of the Innovations in Waste Management course, students will be equipped with the knowledge and skills to address contemporary challenges in waste management using innovative and sustainable approaches. They will understand waste-to-energy technologies, advanced recycling techniques, circular economy principles, and the integration of smart technologies. Students will be able to critically analyze case studies and apply industry-relevant solutions to optimize waste management practices.

Management of Intellectual Property Rights (IPR) for Logistics

EL-14	Management of Intellectual Property Rights (IPR) for Logistics	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Management of Intellectual Property Rights (IPR) for Logistics course is to provide students with a comprehensive understanding of Intellectual Property Rights and their

strategic management within the logistics industry. The course aims to cover key topics such as the introduction to IPR, patents and innovations in logistics, trademarks and brand protection, copyrights and creative works, trade secrets and confidential information, and the development of intellectual property management strategies. Students will analyze case studies and explore industry applications to apply intellectual property concepts to logistics scenarios.

Content: Introduction to Intellectual Property Rights (IPR); Patents and Innovations in Logistics; Trademarks and Brand Protection; Copyrights and Creative Works in Logistics; Trade Secrets and Confidential Information; Intellectual Property Management and Strategy; Case Studies and Industry Applications.

Text Books

- 1 Radhakrishnan, R., Radhakrishnan, R., & Balasubramanian, S. (2008). *Intellectual Property Rights: Text and Cases*. Excel Books India.
- 2 Ramakrishna, B., & HS, A. K. (2017). *Fundamentals of intellectual property rights: for students, industrialist and patent lawyers*. Notion Press.

Course Outcome:

Upon completion of the Management of Intellectual Property Rights for Logistics course, students will be equipped with the knowledge and skills to navigate intellectual property challenges within the logistics sector. They will understand the legal frameworks surrounding patents, trademarks, copyrights, and trade secrets. Students will be able to develop effective intellectual property management strategies and apply their knowledge to address industry-specific issues through the analysis of case studies and practical scenarios.

Materials Handling Systems

EL-15	Materials Handling Systems	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Materials Handling Systems course is to provide students with a comprehensive understanding of materials handling equipment and systems used in logistics and supply chain operations. The course aims to cover key topics such as the introduction to materials handling, types of equipment including conveyor systems, industrial trucks, overhead cranes, AGVs, and robotics, automated storage and retrieval systems, warehouse design and optimization, hazardous materials handling, sustainability, and green materials handling. Students will gain insights into the application of IoT, sensors, and case studies to analyze industry-specific materials handling challenges.

Content: Introduction to Materials Handling; Types of Materials Handling Equipment: Conveyor Systems: Belt, Roller, Screw Conveyors, Industrial Trucks: Forklifts, Pallet Jacks, Order Pickers, Overhead Cranes and Hoists, Automated Guided Vehicles (AGVs) and Robotics; Automated Storage and Retrieval Systems (AS/RS); Robotic Material Handling; IoT and Sensors application; Warehouse Design and Optimization; Cold Storage and Refrigerated Materials Handling; Hazardous Materials Handling and Compliance; Bulk Materials Handling: Silos,

Hoppers, and Conveying Systems; Sustainability and Green Materials Handling; Case Studies and Industry Applications.

Text Books

- 1 Reese, C. (2000). *Material Handling Systems: Designing for Safety and Health*. CRC Press.
- 2 Frazelle, E. H. (2016). *World-class warehousing and material handling*. McGraw-Hill Education.

Course Outcome:

Upon completion of the Materials Handling Systems course, students will possess a thorough understanding of materials handling equipment and systems used in logistics. They will be equipped to analyze and optimize warehouse design, implement automated solutions, and address challenges related to hazardous materials. The application of IoT, sensors, and a focus on sustainability will prepare students to contribute to efficient and environmentally conscious materials handling practices in various industries.

Supply Chain Network Design

EL-16	Supply Chain Network Design	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Supply Chain Network Design course is to equip students with the knowledge and skills needed to design, model, and optimize supply chain networks. The course will cover key concepts, methodologies, and tools in supply chain network design, including facility location, capacity planning, inventory management, transportation optimization, and demand-sensitive network strategies. Students will explore real-life applications, industry best practices, and the role of outsourcing and collaboration in designing resilient supply chain networks.

Content: Introduction to Supply Chain Network Design; Network Modeling and optimization; Facility Location and Capacity Planning; Inventory and Transportation in Network Design; Demand Forecasting and Demand-Sensitive Networks; Outsourcing, Collaboration, and Network Resilience; Real-life Applications and Industry Best Practices.

Text Books

- 1 Watson, M. (2013). *Supply chain network design: applying optimization and analytics to the global supply chain*. Pearson education.
- 2 Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E., & Ji, J. (2000). *Designing and managing the supply chain*.

Course Outcome:

Upon completion of the Supply Chain Network Design course, students will be equipped to analyze, model, and optimize supply chain networks for efficiency and responsiveness. They will understand the role of various components such as facility location, capacity planning,

inventory management, and transportation optimization in designing resilient and adaptable supply chain networks. Students will be prepared to apply these concepts to real-world scenarios and contribute to the strategic decision-making processes within supply chain management.

Supply Chain Contracts

EL-17	Supply Chain Contracts	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Supply Chain Network Design course is to equip students with the knowledge and skills needed to design, model, and optimize supply chain networks. The course will cover key concepts, methodologies, and tools in supply chain network design, including facility location, capacity planning, inventory management, transportation optimization, and demand-sensitive network strategies. Students will explore real-life applications, industry best practices, and the role of outsourcing and collaboration in designing resilient supply chain networks.

Content: Introduction to Supply Chain Contracts; Types of Supply Chain Contracts; Contract Negotiation and Drafting; International Supply Chain Contracts; E-Contracts and Digital Signatures; Contract Management and Performance; Case Studies and Industry Applications.

Text Books

- 1 Sieke, M. (2008). *Supply Chain Contract Management: A Performance Analysis of Efficient Supply Chain Contracts*. Kölner Wissenschaftsverlag.
- 2 Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E., & Ji, J. (2000). *Designing and managing the supply chain*.
- 3 Shah, J. (2009). *Supply chain management: text and cases*. Pearson Education India.

Course Outcome:

Upon completion of the Supply Chain Contracts course, students will possess a comprehensive understanding of the role of contracts in supply chain management. They will be equipped to navigate various types of contracts, negotiate effectively, and adapt to the changing landscape of digital contracts. The course will prepare students to address international considerations in supply chain contracts and apply their knowledge to real-world situations through case studies and industry applications.

Robotic Process Automation

EL-18	Robotic Process Automation	2L:0T:0P	2 Credits
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Course Objective:

The objective of the Robotic Process Automation (RPA) course is to provide students with a comprehensive understanding of RPA technology, development, implementation, and management. The course aims to equip students with the skills to design, deploy, and manage robotic processes in various business environments. Through advanced techniques, integration strategies, and exploration of future trends, students will gain insights into the evolving landscape of RPA and its applications.

Content: Introduction to RPA; RPA Development and Implementation; Advanced RPA Techniques; RPA Deployment and Management; RPA Integration with Enterprise Systems; Future Trends in RPA: Intelligent Automation, Hyperautomation, and Beyond; Case Studies and Industry Applications.

Text Books

- 1 Taulli, T. (2020). The robotic process automation handbook. *The Robotic Process Automation Handbook*. <https://doi.org/10.1007/978-1-4842-5729-6>.
- 2 Supply Chain Management: Strategy, Planning, and Operation (7th Edition), Sunil Chopra, Peter Meindl, Prentice Hall.

Course Outcome:

Upon completion of the RPA course, students will possess the skills and knowledge needed to leverage RPA technology for process automation in diverse business settings. They will understand advanced RPA techniques, integration strategies, and be prepared to navigate the evolving landscape of intelligent automation. The course will provide practical insights through case studies and industry applications, allowing students to apply their RPA expertise in real-world scenarios.

Negotiations & Stakeholder Management

EL-19	Negotiations & Stakeholder Management	3L:0T:0P	3 Credits
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Course Objective:

The objective of the Negotiations & Stakeholder Management course is to equip students with the essential skills and strategies required for effective negotiations and stakeholder management in various professional contexts. The course aims to provide a deep understanding of negotiation processes, stakeholder analysis, and the psychological aspects influencing decision-making during negotiations. Through advanced negotiation techniques and real-world case studies, students will develop the expertise to navigate complex negotiation scenarios and manage stakeholders effectively.

Content: Introduction to Negotiations and Stakeholder Management; Stakeholder Analysis: Identifying and Prioritizing Stakeholders; Negotiation Preparation and Strategy; Cognitive Biases and Their Impact on Decision Making; Advanced Negotiation Techniques; Advanced Negotiation Techniques; Case Studies and Industry Applications.

Text Books

- 1 Fells, R., & Sheer, N. (2019). *Effective negotiation: From research to results*. Cambridge University Press.
- 2 Lewicki, R. J., Saunders, D. M., Minton, J. W., Roy, J., & Lewicki, N. (2018). *Essentials of negotiation* (p. 304). Boston, MA, USA: McGraw-Hill/Irwin.
- 3 Rockmann, K. W., Langfred, C. W., & Cronin, M. A. (2019). *Negotiation: Moving from conflict to agreement*. SAGE Publications.

Course Outcome:

Upon completion of the Negotiations & Stakeholder Management course, students will possess the skills and knowledge needed to navigate complex negotiations, manage stakeholders effectively, and contribute to successful organizational outcomes. They will understand the psychological aspects influencing negotiations, apply advanced techniques, and communicate strategically with stakeholders. The course will provide practical insights through case studies, enabling students to apply negotiation and stakeholder management expertise in real-world scenarios.

Case Studies

- 1 Case studies of successful startups/Unicorns in Logistics.
- 2 Case studies related to PM Gati Shakti NMP.



ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
Nelson Mandela Marg, Vasant Kunj, New Delhi 110070
www.aicte-india.org