



**Syllabus for the Courses
planned by the Centre of Excellence in
Logistics and Supply Chain
Management, NIT Calicut
focusing on
Capacity Building to Promote
PM Gati Shakti Scheme**



**Centre of Excellence in
Logistics and Supply Chain Management
NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
NIT Campus PO, Kozhikode 673601, Kerala**

LIST OF COURSES

Sl. No.	Course Code	Course Name
1.	GS3001D	Warehouse Automation
2.	GS3002D	Port Management
3.	GS3003D	E-Commerce Supply Chain
4.	GS3004D	Health Care Supply Chain
5.	GS3005D	Humanitarian Logistics
6.	GS3006D	Shipping Logistics Management
7.	GS3007D	Retail Supply Chain Management
8.	GS3008D	Multimodal Transportation Systems
9.	GS4001D	Transportation Systems and Network Design
10.	GS4002D	Supply Chain Finance
11.	LS4001D	Supply Chain Operation Simulation
12.	GS6001D	Air Cargo Logistics Management
13.	GS6002D	Digital Innovations and Technology in Supply Chain Management
14.	GS6003D	Agri-Food Supply Chain Management
15.	GS6004D	Sustainable Supply Chain

GS3001D WAREHOUSE AUTOMATION

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: The course provides structured explanation and details about warehouse operations. It will be beneficial for the students and the professionals in the middle level who are seeking an advancement in their career to the managerial levels. The course also imparts the hands-on tools and techniques for improving warehouse automation and management.

Course Outcomes:

CO1: Understand the Warehouse Management at different levels of decision phases.

CO2: Apply tools and techniques to improve the warehouse operations.

CO3: Illustrate the application of state-of-the-art technologies in Warehouse automation and management including Geospatial technology.

Module 1: (13 Hours)

Understanding Warehouse Management Function and Operations - Role of a Warehouse and a Warehouse Manager, Major warehouse processes and End-to-End Warehouse Operations, Automation in warehouses. Warehouse Layout and Material Handling - Order picking methods, Warehouse Layout, Material Handling Systems in a Warehouse and Other resources, Dock Leveler and Conveyor- Types and their purposes.

Module 2: (13 Hours)

People Aspects in a Warehouse and Warehouse Safety - People management in Warehouse, Health and Safety issues in a Warehouse. Cost Analysis and Performance Management - Inventory Accounting and Cost analysis, Key Performance Indicators.

Module 3: (13 Hours)

Warehouse Automation - Warehouse Automation Analysis, Warehouse design - RFID leveraged warehouse systems, Application areas and technological advancements in Warehouse automation, Latest trends in Warehouse Automation. Use of Analytics and Optimization in Warehouse Management - Optimizing order picking, Data Analytics in different functions – Inventory, Order fulfilment, Procurement and storage.

References

1. G. Richards, *Warehouse management: a complete guide to improving efficiency and minimizing costs in the modern warehouse*. 3rd Edn. Kogan Page Publishers, 2017.
2. S. B. Keller and B. C. Keller, *The definitive guide to warehousing: managing the storage and handling of materials and products in the supply chain*. 1st Edn. Pearson Education.2013.
3. J. A. Tompkins, J. D. Smith, *The warehouse management handbook*. 2nd Edn. Tompkins press 1998.

GS3001D WAREHOUSE AUTOMATION

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Understanding Warehouse Management Function and Operations - Role of a Warehouse and a Warehouse Manager, Major warehouse processes and End-to-End Warehouse Operations, Automation in warehouses, Warehouse Layout and Material Handling, People Aspects in a Warehouse and Warehouse Safety, Health and Safety issues in a Warehouse, Cost Analysis and Performance Management, Warehouse Automation, Warehouse design - RFID leveraged warehouse systems, Application areas and technological advancements in Warehouse automation, Latest trends in Warehouse Automation, Use of Analytics and Optimization in Warehouse Management, Data Analytics in different functions – Inventory, Order fulfilment, Procurement and storage.

GS3002D PORT MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: India is on a journey to become a \$5 trillion economy by 2026. To achieve this feat, export is an important contributor. 80 percent of the world's goods are traded through sea and port is an integral part of this logistic process. The Port management course will offer a holistic view of port operations, and their challenges at all levels such as technological, financial, commercial, infrastructural, regulatory, environmental, and sociopolitical. Data-driven decision-making for efficient and smooth port management is a necessity in today's era to remain competitive. Implementation of the ESG compliance management framework is another important aspect, this course will offer.

Course Outcomes:

CO1: Demonstrate how different operations are to be performed for smooth and efficient port management.

CO2: Apply analytical tools and emerging technologies for optimum utilization of available resources.

CO3: Implement of optimum schedule of port activities for smooth movement of goods in an efficient and sustainable manner.

CO4: Understand the economic, pricing, and financial part of the port operations.

Module 1: (11 Hours)

Introduction to Port Management - Importance of port management, Understanding basics of port management, Different port activities, Current challenges in the port.

Module 2: (15 Hours)

Managing Port Operations through data-driven models - Demand Forecasting using Analytics, Capacity requirement, Berthing, Ship Scheduling (Real-time and Robust using geo-informatics), Container loading/unloading, Cargo handling. Decision-making using machine learning algorithms, application of deep learning, Artificial Intelligence along with optimization techniques. Uncertainty handling and responsive scheduling, Resources allocation and utilization, Economics, Pricing, and Financing of port operations, Asset integration and management, Performance evaluation and benchmarking.

Module 3: (13 Hours)

Handling, storing, and import of hazardous chemicals, Management and disposal of hazardous waste, Best practices for environmental, social, and governance, Compliance requirement. Different case studies related to port operations.

References

1. M. G. Burns. *Port Management and Operations*. 1st Edn. CRC Press, 2015.
2. T. Notteboom, A. Pallis, J-P Rodrigue. *Port Economics, Management and Policy*. 1st Edn. Routledge, London, 2022.

GS3002D PORT MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Port Management, Importance of port management, Understanding basics of port management, Different port activities, Current challenges in the port. Managing Port Operations through data-driven models, Capacity requirement, Berthing, Ship Scheduling, Container loading/unloading, Cargo handling. Decision-making using machine learning algorithms, application of deep learning, Artificial Intelligence along with optimization techniques. Uncertainty handling and responsive scheduling, Resources allocation and utilization, Economics, Pricing, and Financing of port operations, Performance evaluation and benchmarking. Handling, storing, and import of hazardous chemicals, Management and disposal of hazardous waste, Best practices for environmental, social, and governance, Compliance requirement. Different case studies related to port operations.

GS3003D E-COMMERCE SUPPLY CHAIN

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: The objective of this course is to impart practical knowledge on e-commerce supply chain and operations to upskill students and thereby enabling them to become effective supply chain management professionals in the domain of e-commerce. The course also imparts the tools and techniques for improving e-commerce supply chain performance.

Course Outcomes:

CO1: Understand the e-business/e-commerce models and their supply chain models.

CO2: Apply tools and techniques to carry out effective decision making for e-commerce supply chain

CO3: Illustrate the correlation between supply chain parameters and customer satisfaction in e-commerce.

CO4: Introduce the application of state-of-the-art technologies for e-commerce supply chain integration

Module 1: (13 Hours)

E-commerce business models and supply chain design, B2C vs B2B e-commerce supply chain, Cross-border e-commerce.

Module 2: (13 Hours)

E-commerce inventory management, Fulfilment centre operations, Fulfilment centre automation, robotic material handling.

Module 3: (13 Hours)

Returns management and reverse logistics, Visibility and Traceability in e-commerce supply chain, Information security risks and cyber-attacks, Supply and Demand Disruptions in e-commerce supply chain. e-commerce distribution network design, Last mile e-commerce delivery, Third Party Logistics and Fourth Party Logistics in e-commerce, Drone delivery model, Predictive shipping.

References

1. D. Graham, I. Manikas, D. Folinas, *E-logistics and E-supply Chain Management Applications for Evolving Business*, 1st Edn., Idea Group Publications, 2013.
2. E. Lacka, H. K. Chan , N. Yip, *E-commerce Platform Acceptance: Suppliers, Retailers, and Consumers*, 1st Edn., Springer, 2014.
3. Q. Zhang, *E-Supply Chain Technology and Management*, 1st Edn., Information Science Reference, 2007

GS3003D E-COMMERCE SUPPLY CHAIN

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

e-commerce business models and supply chain design, B2C vs B2B e-commerce supply chain, Cross-border e-commerce, e-commerce inventory management, Fulfilment centre operations, Fulfilment centre automation, robotic material handling, Returns management and reverse logistics, Visibility and Traceability in e-commerce supply chain, Information security risks and cyber-attacks, Supply and Demand Disruptions in e-commerce supply chain. e-commerce distribution network design, Last mile e-commerce delivery, 3PL and 4PL in e-commerce, Drone delivery model, Predictive shipping.

GS3004D HEALTH CARE SUPPLY CHAIN

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: This course aims to impart practical knowledge on healthcare supply chain and operations to upskill students to enable them to become effective healthcare supply chain management professionals. The course also imparts the tools and techniques for improving healthcare supply chain performance.

Course Outcomes:

CO1: Understand the healthcare supply chain ecosystems and its actors.

CO2: Apply tools and techniques for cost optimization and efficiency improvement of healthcare supply chain

CO3: Explain the application of state-of-the-art technologies for healthcare supply chain integration

Module 1: (13 Hours)

Overview of Indian Healthcare Supply Chain, e-business models in health care supply chain, Telemedicine and Omni-channel health care delivery. Medical equipment procurement, Supplier selection, Negotiation, Lifecycle costing, Contracts and Service Level Agreements, Risk assessment

Module 2: (13 Hours)

Pharmaceutical supply chain, Cold chain for drug transportation, Cold chain visibility using GPS, GIS and blood supply chain, Storage of pharmaceuticals and medical supplies. Inventory management of pharmaceuticals and medical supplies.

Module 3: (13 Hours)

Health care SC performance metrics, Lean tools in healthcare, Advanced technologies in healthcare supply chain, Healthcare Supply Chain Integration.

References

1. H. Min, *Healthcare supply chain management: basic concepts and principles*, 1st Edn. Business Expert Press, 2014.
2. G. R. Ledlow, K.B. Manrodt, and D. Schott, *Health Care Supply Chain Management: Elements, Operations, and Strategies*, 1st Edn. Jones & Bartlett Learning. 2016.
3. J.F. Kros, and E.C.Brown, *Health care operations and supply chain management: operations, planning, and control*. 1st Edn. John Wiley & Sons, 2013.

GS3004D HEALTH CARE SUPPLY CHAIN

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Overview of Indian Healthcare Supply Chain, e-business models in health care supply chain, Telemedicine and Omni-channel health care delivery. Medical equipment procurement, Supplier selection, Negotiation, Lifecycle costing, Contracts and Service Level Agreements, Risk assessment, Pharmaceutical supply chain, Cold chain for drug transportation, Cold chain visibility using GPS, GIS and blood supply chain, Storage of pharmaceuticals and medical supplies, Inventory management of pharmaceuticals and medical supplies, Health care SC performance metrics, Lean tools in healthcare, Advanced technologies in healthcare supply chain, Healthcare Supply Chain Integration.

GS3005D HUMANITARIAN LOGISTICS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: Humanitarian Logistics is very central in disaster and emergency operations. It relates to the relocation of affected communities, movement of relief supplies and emergency transfer of casualties and relief workers involved in the operations. In every humanitarian action, logistics take the biggest budget and effort confirming the need for supporting efficient systems to ensure emergency supplies reach those in need in the most effective way. With increasing emergency situations around the world humanitarian logistics has a big demand hence the need for career development in the sector. Data-driven decision-making using ML, AI, and deep learning will immensely help in efficient operations.

Course Outcomes:

- CO1: Outline the humanitarian supply chain actors, and describe the interactions between them.
- CO2: Describe the concepts of crisis management and humanitarian aid in the context of logistics and supply chain management
- CO3: Evaluate and interpret logistics and supply chain management practices in different phases of disaster management cycle
- CO4: Explain the concept of disaster threat and effects of disasters

Module 1: (13 Hours)

Humanitarian Context and Humanitarian Systems, Logistics Planning for Emergency Supplies, Impact and management of disasters worldwide, brief history of emergency management, types of hazards, existence and assessment of vulnerability and risk, mitigation of hazard risk.

Module 2: (13 Hours)

Information and Communication Protocols for Emergency Situations. Humanitarian Partners, Cooperation and Management, Disaster preparedness. Disaster response and Recovery period, Supply and Demand Planning, Warehousing and material handling, Pre-positioning.

Module 3: (13 Hours)

Transportation planning, Coordination and prioritization, challenges and behavioral aspects of consumers, Case studies on emergency management and logistics responsiveness, Emerging and Global Trends in Humanitarian Logistics.

References

1. P. Tatham and M. Christopher, *Humanitarian Logistics: Meeting the Challenge of Preparing for and Responding to Disasters*. 3rd Edition. Kogan Page Publishers, 2018.
2. D.P. Coppola, *Introduction to International Disaster Management*, 3rd Edn. Elsevier Publications. 2015.
3. D G. Maxwell and K. Gelsdorf. *Understanding the Humanitarian World*. 1st Edn. Routledge, 2019.
4. J. Darcy and C. Hofmann. "According to Need? Needs assessment and decision-making in the humanitarian sector." *Humanitarian Policy Group Report 15*. Overseas Development Institute. London. September 2003.
5. J. Bartholdi and S. Hackman. *Warehouse and Distribution Science*. 2019. Available online: <http://www.warehouse-science.com/>.

GS3005D HUMANITARIAN LOGISTICS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Humanitarian Context and Humanitarian Systems, Logistics Planning for Emergency Supplies, Information and Communication Protocols for Emergency Situations. Humanitarian Partners, Cooperation and Management, Disaster preparedness. Disaster response and Recovery period, Transportation planning, Coordination and prioritization, challenges and behavioral aspects of consumers, Emerging and Global Trends in Humanitarian Logistics.

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GS3006D SHIPPING LOGISTICS MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: The course provides structured explanation and details the maritime logistics and shipping transportation. It also deals with port operations.

Course Outcomes:

CO1: Understand the overall role of maritime logistics in international trade.

CO2: Analyze challenges in maritime logistics and transportation – coordination, safety, human

CO3: Evaluate shipping economics for profitable operations

Module 1: (13 Hours)

Introduction and Role of Maritime Logistics in International Trade - Introduction to Shipping Logistics, Maritime logistics as a trade facilitator, Global trade and maritime industry.

Coordination in Maritime Logistics - Intermodal freight transport and logistics, Supply chain integration of shipping companies

Module 2: (13 Hours)

Types of shipping loads - Container shipping, Tanker shipping, Dry and bulk shipping logistics.

People, safety, and environmental aspects in Shipping Logistics - Hazards and Safety on Ships and Ports, Health issues and overall wellbeing, Skill requirement in shipping logistics, Environmental impact of shipping transportation

Module 3: (13 Hours)

Port Logistics - Dry ports, Port centric logistics, Container hub ports

Economics of Shipping Logistics - Principles of maritime economics, The economics of shipping

References

1. D.W. Song, and P. Panayides, *Maritime logistics: A guide to contemporary shipping and port management*. 2nd Edn. Kogan Page Publishers, 2015.
2. M.G. Burns, *Port management and operations*. 1st Edn. CRC press, 2015.
3. Y.H.V. Lun · K.-H. Lai · T.C.E. Cheng. *Shipping and logistics management*. 1st Edn. Springer, 2010.
4. D-P Song, *Container logistics and maritime transport*. 1st Edn. Routledge Taylor and Francis Group, 2021.
5. U. Tapaninen, *Maritime Transport: Shipping Logistics and Operations*. 2nd Edn. Kogan Page Publishers, 2010.

GS3006D SHIPPING LOGISTICS MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction and Role of Maritime Logistics in International Trade, Maritime logistics as a trade facilitator, Global trade and maritime industry, Coordination in Maritime Logistics, Supply chain integration of shipping companies, Types of shipping loads - Container shipping, Tanker shipping, Dry and bulk shipping logistics, People, safety, and environmental aspects in Shipping Logistics, Health issues and overall wellbeing, Skill requirement in shipping logistics, Environmental impact of shipping transportation, Port Logistics, Economics of Shipping Logistics.

GS3007D RETAIL SUPPLY CHAIN MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: A strong and efficient 'Retail Supply Chain Management provides a firm foundation and backbone for success in any kind of retail business whether the retailer comprises of street vendors, local grocery stores, supermarkets, automobile showrooms, internet kiosks, home appliance showrooms, direct marketers, etc. A 'Supply Chain' is also known as 'Value Chain' encompassing the flow and management of resources across the retail enterprise for the purpose of maintaining the retail operation profitably. Retail SCM is the art of management of providing the Right Product, At the Right Time, Right Place, and at the Right Cost to the Customer.

Course Outcomes:

CO1: Understand the nuances of retail supply chain management.

CO2: Illustrate the integrative role of technology in driving the retail Supply chain

CO3: Demonstrate how to build a customer-driven retail supply chain for efficient and effective distribution strategies.

CO4: Apply analytical tools and emerging technologies for effective omni-channel and digital channel supply chain profitable strategies

Module 1: (13 Hours)

Introduction to Retail Supply Chain Management - Retail Supply Chain-Basics, Consumer Behaviour, Consumption and its impact on Retail Supply chain. Customer Driven Retailing Strategy - Retail Formats, Rural Retailing, Retail Analytics; Customer-Driven Retailing Strategy Framework

Module 2: (13 Hours)

Supply Chain Management in Retailing - Inventory Planning, Integrated Supply Chain, Efficient Consumer Response, Collaborative Planning, Forecasting and Replenishment (CPR), Retail Automation

Module 3: (13 Hours)

Omni-channel Retailing, Distinguishing Multichannel and Omni-channel, Omni-channel Retailing Strategies. Online Retailing (E-Commerce and M-Commerce) - Online Retailing, Online Retailing Models, Drivers and Barriers of Online Retailing

References

1. J. B. Ayers and M.A. Odegaard, *Retail supply chain management*. 2nd Edn. CRC Press, 2017.
2. M. Levy, B. Weitz and D. Grewal. *Retailing Management*, 10th Edn. McGraw-Hill, 2019.

GS3007D RETAIL SUPPLY CHAIN MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Retail Supply Chain Management, Consumer Behaviour, Consumption and its impact on Retail Supply chain, Customer Driven Retailing Strategy, Supply Chain Management in Retailing, Integrated Supply Chain, Efficient Consumer Response, Collaborative Planning, Forecasting and Replenishment (CPR), Retail Automation, Omni-channel Retailing, Distinguishing Multichannel and Omni-channel, Omni-channel Retailing Strategies, Online Retailing (E-Commerce and M-Commerce) - Online Retailing, Online Retailing Models, Drivers and Barriers of Online Retailing

GS3008D MULTIMODAL TRANSPORTATION SYSTEMS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: The unprecedented modernization and expansion of Multimodal Transportation Systems will require substantial new knowledge and understanding of field-deployable technologies. The course aims to provide mid-level managers and frontline executives insights into modern concepts and management of Multimodal Transportation Systems. The course promotes the exchange of the latest scientific and technological innovations in Multimodal Transportation Systems, and to advance the state-of-the-art management and practices for various types of Multimodal based transportation systems.

Course Outcomes:

- CO1: Identify the methods to capitalize on the comparative efficiencies of various modes of transportation
- CO2: Streamline the process of getting products to market, optimizing the secondary transportation services that complement intra-modal and inter-modal supply chain operations.
- CO3: Optimize the use of specialized intermediaries, knowing when to use them, how to evaluate them and learn ways to minimize the time spent coordinating their services.
- CO4: Apply operational insight to negotiate more effectively and confidently with all stakeholder groups.

Module 1: (13 Hours)

Introduction to Multi-Modal Transport - Concept of Multi-Modal Transport, Multi modal network and transportation and multi modes transport planning - Logistics Infrastructure Management, Rail, Road, Air, Ship and container transportation. Terminal management, Transport Safety, Transport Policy and Planning.

Parking and cargo Management - Parking and cargo management of train, truck and container. Design, network and space utilization during container and cargo management and vehicle scheduling.

Module 2: (13 Hours)

Financial and costing in multimodal transportation system - Documentation and Custom Procedures. Costing & Pricing of Multimodal Transport Services

Module 3: (13 Hours)

Logistics & Sustainable Supply Chain Management - Transportation Sustainability, Evaluation and Indexing of logistics, Dangerous good transportation risk and safety,

Role of IT in Transportation systems - Intelligent Transportation Systems

References

1. C. Hyldager. *Logistics and Multi-Modal Transport*, 1st Edn. Institute of Chartered Shipbrokers, 2015.
2. S. Hammadi and M. Ksouri. *Multimodal Transport Systems*. 1st Edn. Wiley publication, 2013.
3. E. Lee. *Geographic Information Systems for Intermodal Transportation: Methods, Models, and Applications*, 1st Edn., Elsevier Publications, 2022.
4. J. Monios and R. Bergqvist, *Intermodal Freight Transport and Logistics*. 1st Edn. CRC Press, 2017.
5. M. Sarder, *Logistics Transportation Systems*, 1st Edn. Elsevier Publications, 2020.
6. P. K. Sarkar and A. K. Jain, *Intelligent Transport Systems*, 1st Edn. PHI Learning, 2018.

GS3008D MULTIMODAL TRANSPORTATION SYSTEMS

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Multi-Modal Transport, Multi modal network and transportation and multi modes transport planning, Logistics Infrastructure Management, Rail, Road, Air, Ship and container transportation. Terminal management, Transport Safety, Transport Policy and Planning, Parking and cargo Management, Design, network and space utilization during container and cargo management and vehicle scheduling. Financial and costing in multimodal transportation system, Logistics & Sustainable Supply Chain Management, Transportation Sustainability, Evaluation and Indexing of logistics, Dangerous good transportation risk and safety, Role of IT in Transportation systems, Intelligent Transportation Systems

GS4001D TRANSPORTATION SYSTEMS AND NETWORK DESIGN

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: Transportation cost is a key component of logistic cost. An efficient, integrated, and seamless transportation system is the need of the hour to achieve the ambitious growth rate. Network design is fundamental to effective transportation systems. This course will provide the necessary understanding and required knowledge to design a robust transportation system to address the challenges faced by the nation. It is also vital to consider the sustainability aspect of transportation systems. Flawless integration of various transportation modes is another important dimension. Data-driven decision-making based on Machine Learning, Artificial Intelligence, and Deep Learning techniques will immensely help in efficient operations.

Course Outcomes:

CO1: Demonstrate the criticality of the transportation system and network design in economic development.

CO2: Apply data analytics tools and emerging technologies for estimating demand and develop effective models for optimal decision-making for transportation systems and network design.

CO3: Implement seamless transportation schedules across different modes of transportation to reduce cost and delivery time.

CO4: Identify and suggest ways to implement sustainable practices in transport operations

Module 1: (13 Hours)

Introduction to Transportation Systems and Network Design - Importance of transportation systems and network design in logistics and economy at large, Understanding movement and freight transportation in India, Requirements and challenges of various modes of transportation, Understanding network design.

Module 2: (13 Hours)

Intelligent Data-Driven Transportation System and Effective Network Design - Demand prediction through real-time data-driven model, Integrated capacity planning, Use of Machine Learning, Artificial Intelligence, and Deep Learning techniques in decision-making, Infrastructure planning for seamless movement and equitable access, Robust network design, Dynamic and responsive scheduling in real-time, Fare pricing, and revenue modelling, Infrastructure management, Planning and promoting best practices.

Module 3: (13 Hours)

Sustainable and Safe Transportation - Efficient use of energy, Green transportation, Best practices for environmental, social, and governance, Guideline formulation for Compliance. Emerging energy technologies. Renewable energy and future of supply chain.

Case Studies/Real-life applications - Different case studies related to modern, intelligent transportation system.

References

1. M.G.H. Bell, Y. Iida, *Transportation network analysis*. 1st Edn., Wiley, 1997.
2. G. Cantarella, D. Watling, S. De Luca, R. Di Pace, *Dynamics and Stochasticity in Transportation Systems: Tools for Transportation Network Modelling* 1st Edn., Elsevier, 2019.
3. T. G. Crainic, M. Gendreau, B. Gendron, *Network Design with Applications to Transportation and Logistics*, 1st Edn. Springer, 2021.
4. M. Sarder, *Logistics Transportation Systems*, 1st Edn. Elsevier Publications, 2020.

GS4001D TRANSPORTATION SYSTEMS AND NETWORK DESIGN

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Introduction to Transportation Systems and Network Design, Understanding movement and freight transportation in India, Requirements and challenges of various modes of transportation, Understanding network design, Intelligent Data-Driven Transportation System and Effective Network Design, Integrated capacity planning, Use of Machine Learning, Artificial Intelligence, and Deep Learning techniques in decision-making, Infrastructure planning for seamless movement and equitable access, Robust network design, Dynamic and responsive scheduling in real-time, Fare pricing, and revenue modelling, Infrastructure management, Planning and promoting best practices, Sustainable and Safe Transportation - Efficient use of energy, Green transportation, Best practices for environmental, social, and governance, Guideline formulation for Compliance. Emerging energy technologies. Renewable energy and future of supply chain. Case Studies/Real-life applications to modern, intelligent transportation system.

GS4002D SUPPLY CHAIN FINANCE

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: Supply Chain Finance (SCF) implies more recently developed financing and risk mitigation techniques. It is far more likely to be used in open account trade where the buyer and seller have done business together before. Supply Chain Finance deals with a set of solutions within trade finance implemented by numerous financial institutions, leading corporate buyers, and trading partners worldwide. The critical characteristic of the SCF is that the various techniques available are driven by the nature of the physical supply chain. This Program provides background on the growing importance of Supply Chain Finance, delving into the key elements, available options from which solutions are implemented, and an in-depth view of success factors.

Course Outcomes:

CO1: Understand the supply chain finance ecosystem

CO2: Illustrate how to assess the funding gaps as a result of trade cycle analysis

CO3: Explain the supply chain finance techniques in a global setting

CO4: Become familiar with the FinTech in Supply Chain Finance

Module 1: (13 Hours)

Supply Chain Finance - Introduction to Supply Chain -Collaborative Supply Chain, Financing Operations and Inventory, Supply Chain Efficiency and Firm Performance.

Trade Cycle Analysis - Estimation of Working Capital in Manufacturing Vs Trading Firm. Review of Bank Finance, Trade Finance, and Instruments of Finance

Module 2: (13 Hours)

Supply Chain Finance Options - Institutional Finance Vs Instruments, Trade Finance, Supply Chain Finance in a Global Setting – Financing Foreign Trade, Understand the Forex Risk

Module 3: (13 Hours)

Cost and Benefits analysis of Supply Chain Finance arrangements and options, Value Creation through SCF arrangements, Legal aspects of SCF contracts.

Fintech and its relevance to Supply Chain, Future of Supply Chain Finance in the Digital era, FinTech Products and Evaluation – Case analysis

References

1. S. Templar, E. Hofmann, and C. Findlay. *Financing the End-to-End Supply Chain*. 2nd Edn. Kogan Page Publishers, 2020.
2. R. J. Trent. *Supply Chain Financial Management: Best Practices, Tools, and Applications for the improved Performance*. 1st Edn. Springer, 2015.
3. M. Miller, *Global Supply Chain Ecosystems: Strategies for Competitive Advantage in a complex, connected World*. 1st Edn. Kogan Page Publishers, 2015.
4. W. Tate, L. Bals, and L. Ellram. *Supply Chain Finance: Risk Management, Resilience and Supplier Management*. 1st Edn. Kogan Page Publishers, 2018.
5. J. B. Rice Jr., A. Serrano, S.D. Lekkakos, *Practical Finance for Operations and Supply Chain Management*, 1st Edn. The MIT Press, 2020.

GS4002D SUPPLY CHAIN FINANCE

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Supply Chain Finance, Collaborative Supply Chain, Financing Operations and Inventory, Supply Chain Efficiency and Firm Performance, Trade Cycle Analysis, Estimation of Working Capital in Manufacturing Vs Trading Firm. Review of Bank Finance, Trade Finance, and Instruments of Finance, Supply Chain Finance Options - Institutional Finance Vs Instruments, Trade Finance, Supply Chain Finance in a Global Setting – Financing Foreign Trade, Understand the Forex Risk, Cost and Benefits analysis of Supply Chain Finance arrangements and options, Value Creation through SCF arrangements, Legal aspects of SCF contracts. Fintech and its relevance to Supply Chain, Future of Supply Chain Finance in the Digital era.

LS4001D SUPPLY CHAIN OPERATION SIMULATION

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Outcomes:

- CO1: Create awareness on supply chain management and collaboration, and application of AI/ML and blockchain in supply chain management through fun using different roleplay games.
- CO2: Compare the performance of supply chains using different operation simulations under various supply chain parameters and environments.
- CO3: Experience the coordination problems between supply chain members and identify the bullwhip effect present in a supply chain.
- CO4: Demonstrate the role of inventory in supply chain and the need for coordination and collaboration

Module 1: (13 Hours)

Supply chain process analysis – different approaches, Uncertainty in supply chain and supply chain strategies, General supply chain structures, Role of inventory - order cost, carrying cost, shortage costs, Supply performance matrices, Supply chain operation simulation: Revealing implied demand uncertainty.

Module 2: (13 Hours)

Experiential learning, Roleplay game, Roleplay based operation simulation under different supply chain parameters such as lead times, lost sales and backorder, Evaluation of fill rate, total supply chain inventory costs, and bullwhip effect, Comparison of performance of supply chain under different scenarios, System dynamics – supply chain as a multi-agent system, AI/ML application in supply chain order management and coordination.

Module 3: (13 Hours)

Basic inventory models – Q-system and P-system of inventory control, Simulation of a serial supply chain under P-system of inventory control using Excel, Operation simulation of divergent supply, Bullwhip slope analysis.

Collaborative approaches: Concept of Vendor Managed Inventory (VMI), Operational simulation for analyzing the effect of VMI in supply chain, Blockchain-based secure information sharing platform for supply chain management, Demonstration of blockchain based operation simulation.

References:

1. S. Chopra and D. V. Kalra, *Supply Chain Management: Strategy, Planning and Operations*. 7th Edn., Pearson Education (Singapore) Pte. Ltd., 2019.
2. Dony S. Kurian, V. Madhusudanan Pillai and J. Gautham, Data-driven imitation learning-based approach for order size determination in supply chains, *European Journal Industrial Engineering* (In press)
3. Justin Sunny, V. Madhusudanan Pillai, Hiran V. Nath, Kenil Shah, Prajwal Pandurang Ghoradkar, Manu Jose Philip and Malhar Shirswar, Blockchain-enabled beer game: a software tool for familiarizing the application of blockchain in supply chain management, *Industrial Management & Data Systems*, Vol. 122, No. 4, pp. 1025-1055, 2022
4. V. Madhusudanan Pillai, Supply Chain Role Play Game (SCRPG) exercise handout and user manuals of SCRPG and VMI-SCRPG, Department of Mechanical Engineering, 2017
5. V. Madhusudanan Pillai, Supply chain management game: revealing implied demand uncertainty, white paper, Department of Mechanical Engineering, 2022
6. V. Madhusudanan Pillai, Performance analysis of a four-echelon supply chain under order up-to policy using SCIPA software package, Department of Mechanical Engineering, 2016

Pedagogy:

Lectures, More sessions on Hands-on, Demo, and Roleplay Simulations for concept transfer, Discussions in the class and handout for data collection during the simulation.

LS4001D SUPPLY CHAIN OPERATION SIMULATION

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Supply chain process analysis, Uncertainty in supply chain and supply chain strategies, Role of inventory - order cost, carrying cost, shortage costs, Supply performance matrices, Experiential learning, Roleplay game, Supply chain operation simulation: Revealing implied demand uncertainty, Roleplay based operation simulation under different supply chain parameters such as lead times, lost sales and backorder, Comparison of performance of supply chain under different scenarios, System dynamics – supply chain as a multi agent system, AI/ML application in supply chain order management and coordination, Basic inventory models, Simulation of a serial supply chain under P-system of inventory control using Excel, Operation simulation of divergent supply, Bullwhip slop analysis, Concept of Vendor Managed Inventory (VMI), Operational simulation for analyzing the effect of VMI in supply chain, Demonstration of blockchain based operation simulation..

GS6001D AIR CARGO LOGISTICS MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: This course aims to impart both theoretical and practical knowledge related to air cargo handling and management to upskill students and logistics professionals. It has been designed keeping in mind the various techno-managerial aspects that need to be implemented by the participants. The course also explores how new and existing business strategies related to air cargo handling can be improved through the introduction of technologies, digital systems and data analytics.

Course Outcomes:

CO1: Demonstrate the concept of air cargo operations.

CO2: Build data analytics tools and techniques for air cargo handling and management.

CO3: Discover best practices across the industry.

CO4: Illustrate how technology is transforming traditional ways of doing business.

Module 1: (13 Hours)

Basics of Air Cargo Operations - Understanding basics of air cargo operations; Activity/operation of key players in air cargo service such as Shipper, Forwarder, Airline, Airports, Consignee, Coordination and contract in air cargo supply chain; Complexity in air cargo operations

Module 2: (12 Hours)

Role of Analytics & Digitization in Air Cargo Management - Demand analytics, Capacity planning, Revenue management, Terminal operations & Cargo Handling, Fleet routing and flight scheduling, Decision making under risk and uncertainty, Applications of various AI/ML and optimization models in air cargo operations, Information technology and GIS for managing air cargo operations

Module 3: (14 Hours)

Case Studies/ Real life applications - Cold Logistics – food, flower and medicines, Heavy-lift air transportation, Humanitarian operations using Air Transport, Applications of Geospatial Technologies in Air Cargo Handling and Management, Sustainable Intermodal Freight Transportation, Optimizing Periodic Maintenance Operations

References

1. M. Sales, *Air cargo management: Air freight and the global supply chain*. 2nd Edition, Routledge Taylor & Francis Publications, 2016.
2. M. Sales, *Aviation logistics: the dynamic partnership of air freight and supply chain*. 1st Edition, Kogan Page Publishers, 2016.
3. J. F. Thompson, P. E. Brecht, T. Hinsch., *Refrigerated trailer transport of perishable products* (Vol. 21615). UCANR Publications, 2002.

GS6001D AIR CARGO LOGISTICS MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Basics of Air Cargo Operations - Understanding basics of air cargo operations; Activity/operation of key players in air cargo service, Coordination and contract in air cargo supply chain; Complexity in air cargo operations; Role of Analytics & Digitization in Air Cargo Management, Capacity planning, Revenue management, Terminal operations & Cargo Handling, Fleet routing and flight scheduling, Decision making under risk and uncertainty, Applications of various AI/ML and optimization models in air cargo operations, Information technology and GIS for managing air cargo operations; Case Studies/ Real life applications, Applications of Geospatial Technologies in Air Cargo Handling and Management, Sustainable Intermodal Freight Transportation, Optimizing Periodic Maintenance Operations

GS6002D DIGITAL INNOVATIONS AND TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: Digital technologies have penetrated every aspect of modern business. The ability to execute any business model depends heavily on the approach adopted by firms in organizing their information architecture. This course will explore the role of information architecture on Supply Chain and Logistics functions. The course will discuss dominant technologies traditionally used in planning, forecasting, scheduling and managing supply chains.

Course Outcomes:

- CO1: Understanding of existing supply chain and its challenges.
- CO2: Illustrate the opportunities for supply chain transformation.
- CO3: Application of innovation and IT frameworks in the supply chain context of their domain.
- CO4: Designing appropriate strategies to mitigate the cyber risk towards efficient modern supply chain.

Module 1: (13 Hours)

Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) Environment & Business Needs; Understanding IT challenges and integrated business processes in supply chain and logistics; Opportunity Identification for Digital Transformation; Business models and Innovation frameworks for supply chain; Enterprise Systems for Supply chain, Data Lake and Data Integration

Module 2: (13 Hours)

Emerging technologies for Digital Transformation of supply chain; Application of AI, ML, IOT, Blockchain, Robotics & Automation, and Drone technologies; Platform Economy and Eco Systems. Product life cycle management for supply chain; Technology life cycle for supply chain management

Module 3: (13 Hours)

Web technologies & e-SCM applications, Understanding Risk & Cyber-attacks in supply chain; Security Controls and Information Security Posture; Cryptographic Algorithms and hashing systems, Analyzing and assessing the risks; Strategies for successful implementation and use-cases.

References

1. S. Carnovale, and S. Yenyurt, (Eds.), *Cyber Security and Supply Chain Management: Risks, Challenges, And Solutions* (Vol. 1). World Scientific, 2021.
2. S. Chopra and D. V. Kalra, *Supply Chain Management: Strategy, Planning and Operations*. 7th Edn., Pearson Education (Singapore) Pte. Ltd., 2019.
3. H. Delfs and H. Knebl, *Introduction to Cryptography: Principles and Applications*. 2nd Edn. Springer, 2007.
4. A. M. Pagano and M. Liotine, *Technology in supply chain management and logistics: Current practice and future applications*. 1st Edn., Elsevier, 2019.
5. D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, R. Shankar, *Designing and Managing the Supply Chain: Concepts, Strategies and Case studies*, 3rd Edn., McGrawHill, 2019.
6. N. Vyas, A. Beije, and B. Krishnamachari, *Blockchain and the supply chain: concepts, strategies and practical applications*. 1st Edn., Kogan Page Publishers, 2019.

**GS6002D DIGITAL INNOVATIONS AND TECHNOLOGY IN SUPPLY CHAIN
MANAGEMENT**

L	T	P	C
3	0	0	3

Pre-requisites: Nil

Total hours: 39

Brief Syllabus:

Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) Environment & Business Needs; Understanding IT challenges and integrated business processes in supply chain and logistics; Opportunity Identification for Digital Transformation; Business models and Innovation frameworks for supply chain; Enterprise Systems for Supply chain, Data Lake and Data Integration, Emerging technologies for Digital Transformation of supply chain; Application of AI, ML, IOT, Block chain, Robotics & Automation, and Drone technologies; Platform Economy and Eco Systems. Product life cycle management for supply chain; Web technologies & e-SCM application; Understanding Risk & Cyber-attacks in supply chain; Security Controls and Information Security Posture; Cryptographic Algorithms and hashing systems; Analyzing and assessing the risks; Strategies for successful implementation and use-cases.

GS6003D AGRI-FOOD SUPPLY CHAIN MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: Agri-food supply chains are becoming complex. The globalization of economy has facilitated the migration of peoples for work. This has led to the demand for food products from across the globe and service providers are keen to oblige. The style of retailers, the technology advancements in tracking, operations management and packaging have made it possible to import a food item from any part of the world of the right quality specifications. One possible enabler will be the use of Geospatial technology. The term geospatial technology refers to global positioning systems, remote sensing, and geographical information systems for assisting the user in the collection, analysis, and interpretation of spatial of data. This course will provide the participants to understand the scope and challenges of an agri-food supply chain.

Course Outcomes:

CO1: Understand the fundamentals and cross-functional perspectives of agri-food supply chain.

CO2: Apply the best practices in agri-food supply chain management for performance improvement.

CO3: Demonstrate Geospatial technology in an agri-food supply chain.

Module 1: (13 Hours)

Concept of agricultural food supply chain - Introduction to agri-food supply chain management, Food production - Entities in the agriculture supply chain, Agriculture and poverty alleviation, The barriers to the development of the agri-industry. Operations Management in an agri-food supply chain - agri-food silos, storage of agri-food, interdepartmental linkage, public procurement and distribution system, Railway Vs Airways, issues in interface complexities of vegetable supply chain, cold supply chain management. Food manufacturing - The importance of food processing, Changing market conditions, Food processing, Application of Geospatial Technologies for agriculture.

Module 2: (12 Hours)

Resource Utilization - Essentials of farm business management and sustainability, Efficient, effective, and sustainable use of resources. Human resource management in an agri-food supply chain management. Food safety and quality - Food laws and regulation, Food innovation - Classification of innovation methods, Product development in food supply chains, Innovations within food supply chains.

Module 3: (14 Hours)

Infrastructure development for the food sector - Food hubs, Food Logistics - Movement of food, Applications of logistics in agri-food supply chain. Digital supply chain management in the era of circular and sustainable economy - ICT future trends in agri-food logistics, Application of Geospatial Technologies to map and track Food Supply Chains, Circular economy in agri-food supply chain. Packaging in logistics, Temperature-controlled supply chains. International food supply chains, Food security and future challenges - challenges in international food supply chains, Factors affecting the future of international food systems, Managing challenges in international food supply chains.

References

1. M. Pullman and Z. Wu, *Food supply chain management: Economic, Social and Environmental Perspectives*. 1st Edn. Routledge Taylor & Francis Group Publications, 2011.
2. D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, R. Shankar, *Designing and Managing the Supply Chain: Concepts, Strategies and Case studies*, 3rd Edn., McGrawHill, 2019.
3. P. Schönsleben, *Integral Logistics Management: Operations and Supply Chain Management within and Across Companies*, 5th Edn., CRC Press, Taylor & Francis Group, 2016.
4. M. Govil and J-M Proth, *Supply Chain Design and Management: Strategic and Tactical Perspectives*, 1st Edn., Academic Press, San Diego, 2002.
5. J. D. Wisner, K-C. Tan, and G.K. Leong, *Principles of Supply Chain Management: A Balanced Approach*. 4th ed. Cengage, 2016.

GS6003D AGRI-FOOD SUPPLY CHAIN MANAGEMENT

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Brief Syllabus:

Concept of agricultural food supply chain, Food production, The barriers to the development of the agri-industry, Operations Management in an agri-food supply chain, storage of agri-food, interdepartmental linkage, public procurement and distribution system, Railway Vs Airways, issues in interface complexities of vegetable supply chain, cold supply chain management. Food manufacturing, Changing market conditions, Food processing, Application of Geospatial Technologies for agriculture, Resource Utilization, Efficient, effective, and sustainable use of resources. Human resource management in an agri-food supply chain management, Food safety and quality, Food laws and regulation, Food innovation, Product development in food supply chains, Innovations within food supply chains, Infrastructure development for the food sector, Food Logistics, Applications of logistics in agri-food supply chain, ICT future trends in agri-food logistics, Application of Geospatial Technologies to map and track Food Supply Chains, Circular economy in agri-food supply chain, Packaging in logistics, Temperature-controlled supply chains. International food supply chains, Food security and future challenges, Factors affecting the future of international food systems, Managing challenges in international food supply chains.

GS6004D SUSTAINABLE SUPPLY CHAIN

Pre-requisites: Nil

L	T	P	C
3	0	0	3

Total hours: 39

Course Description: Sustainable logistics aims to lower the ecological footprint of its tasks, such as CO2 emissions, noise pollution, and accidents. In this sense, logistics suppliers must look for a balance between financial growth, environment care, and the health of society. Sustainability is an essential issue for logistics, especially when it comes to lowering carbon emissions, and must be incorporated to the corporate strategies because clients all over the world are increasingly demanding more environmental-friendly logistics.

Course Outcomes:

CO1: Understand the aspects in sustainable supply chains.

CO2: Analyse performance measures to achieve sustainability in supply chain operations

CO3: Evaluate environmental, social, and governance risks in end-to-end supply chains

CO4: Develop a diagnostic analysis of sustainability in supply chain operations using relevant policies and standards

Module 1: (13 Hours)

Sustainable development frameworks - Sustainable Development Goals, other frameworks, inclusiveness and resilience in supply chain.

Sustainability strategies - Cases, examples, best practices, Statement on sustainable development strategy, Policy commitments Embedding policy commitments, Processes to remediate negative impacts, Mechanisms for seeking advice and raising concerns, Compliance with laws and regulations 28 Membership associations

Module 2: (13 Hours)

Sustainable logistics - Cases, examples, best practices, Activities, stakeholders, Types and Environmental Management, Concept of Green Logistics, Green Transportation, Carbon Foot print Analysis, Vehicle Routing, Tools For modelling environmental Impacts LCA.

Environmental dimension - Materials, Energy, Water and Effluents, Biodiversity Emissions, Waste, Supplier Environmental Assessment. Emerging energy technologies in supply chain operations.

Social (including safety) dimension - Employment, Labor/Management Relations, Occupational Health and Safety, Training and Education, Diversity and Equal Opportunity, Non-discrimination, Freedom of Association and Collective Bargaining, Child Labor, Forced or Compulsory Labor, Security Practices, Rights of Indigenous Peoples, Local Communities, Supplier Social Assessment

Module 3: (13 Hours)

Governance - Governance structure and composition, Nomination and selection of the highest governance body, Chair of the highest governance body, Role of the highest governance body in overseeing the management of impacts, Delegation of responsibility for managing impacts, Role of the highest governance body in sustainability reporting, Conflicts of interest, Communication of critical concerns, Collective knowledge of the highest governance body, Evaluation of the performance of the highest governance body, Remuneration policies, Process to determine remuneration, Annual total compensation ratio.

Value creation - Financial, manufactured, intellectual, human, social and relationship, natural capitals and value creation from these with the business model

References

1. A. McKinnon, M. Browne, M. Poecyk and A. Whiteing, *Green Logistics: Improving the Environmental Sustainability of Logistics*, 3rd Edn. Kogan Page Publishers, 2015.
2. P. Modak, *Practicing Circular Economy*, 1st Edn. CRC Press, 2021.
3. D. B. Grant, A. Trautrim, C. Y. Wong, *Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management*, 2nd Edn Kogan Page Publishers, 2017.

GS6004D SUSTAINABLE SUPPLY CHAIN

Pre-requisites: Nil

Total hours: 39

L	T	P	C
3	0	0	3

Brief Syllabus:

Sustainable development frameworks, Sustainable Development Goals, other frameworks, Sustainability strategies, Statement on sustainable development strategy, Policy commitments Embedding policy commitments, Sustainable logistics, Concept of Green Logistics, Green Transportation, Carbon Foot print Analysis, Vehicle Routing, Tools For modelling environmental Impacts LCA, Environmental dimension, Supplier Environmental Assessment, Emerging energy technologies in supply chain operations. Social (including safety) dimension, Occupational Health and Safety, Training and Education, Diversity and Equal Opportunity, Non-discrimination, Freedom of Association and Collective Bargaining, Child Labor, Forced or Compulsory Labor, Governance, Nomination and selection of the highest governance body, Chair of the highest governance body, Role of the highest governance body in overseeing the management of impacts, Delegation of responsibility for managing impacts, Role of the highest governance body in sustainability reporting, Conflicts of interest, Annual total compensation ratio, Value creation, natural capitals and value creation from these with the business model.