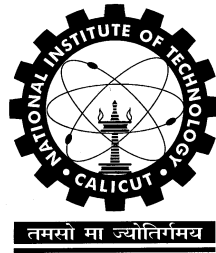




**Syllabus for the UG Elective Courses  
Offered by the Centre of Excellence in  
Logistics and Supply Chain  
Management, NIT Calicut  
focusing on  
Capacity Building to Promote  
PM Gati Shakti Scheme  
(Applicable from 2023 Admission onwards)**



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

## LIST OF COURSES

Following courses may be credited under the categories mentioned in the table below.

Sl. No.	Course Code	Course Title	L	T	P	O	Credits	Categories			
								OE	EI	DA	HM
1	GS3001E	Warehouse Automation	3	0	0	6	3	✓		✓	✓
2	GS3002E	Port Management	3	0	0	6	3	✓			✓
3	GS3003E	E-Commerce Supply Chain	3	0	0	6	3	✓			✓
4	GS3004E	Health Care Supply Chain	3	0	0	6	3	✓			✓
5	GS3005E	Humanitarian Logistics	3	0	0	6	3	✓			✓
6	GS3006E	Shipping Logistics Management	3	0	0	6	3	✓			✓
7	GS3007E	Retail Supply Chain Management	3	0	0	6	3	✓			✓
8	GS3008E	Multimodal Transportation Systems	3	0	0	6	3	✓			✓
9	GS4001E	Transportation Systems and Network Design	3	0	0	6	3	✓			✓
10	GS4002E	Supply Chain Finance	3	0	0	6	3	✓			✓
11	LS4001E	Supply Chain Operation Simulation	3	0	0	6	3	✓		✓	✓

Open Elective (OE); Entrepreneurship Innovation (EI); Digital / Automation Technologies (DA); Humanities, Social Science, Management (HM).

## GS3001E WAREHOUSE AUTOMATION

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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.

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.

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*. 3<sup>rd</sup> 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*. 1<sup>st</sup> Edn. Pearson Education.2013.
3. J. A. Tompkins, J. D. Smith, *The warehouse management handbook*. 2<sup>nd</sup> Edn. Tompkins press 1998.

## GS3002E PORT MANAGEMENT

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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 - 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.

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*. 1<sup>st</sup> Edn. CRC Press, 2015.
2. T. Notteboom, A. Pallis, J-P Rodrigue. *Port Economics, Management and Policy*. 1<sup>st</sup> Edn. Routledge, London, 2022.

## GS3003E E-COMMERCE SUPPLY CHAIN

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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

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, 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*, 1<sup>st</sup> Edn., Idea Group Publications, 2013.
2. E. Lacka, H. K. Chan , N. Yip, *E-commerce Platform Acceptance: Suppliers, Retailers, and Consumers*, 1<sup>st</sup> Edn., Springer, 2014.
3. Q. Zhang, *E-Supply Chain Technology and Management*, 1<sup>st</sup> Edn., Information Science Reference, 2007

## GS3004E HEALTH CARE SUPPLY CHAIN

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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.

### References

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

## GS3005E HUMANITARIAN LOGISTICS

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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.

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.

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*. 3<sup>rd</sup> Edition. Kogan Page Publishers, 2018.
2. D.P. Coppola, *Introduction to International Disaster Management*, 3<sup>rd</sup> Edn. Elsevier Publications. 2015.
3. D G. Maxwell and K. Gelsdorf. *Understanding the Humanitarian World*. 1<sup>st</sup> 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/>.

## GS3006E SHIPPING LOGISTICS MANAGEMENT

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### Course Outcomes:

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

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

CO3: Evaluate shipping economics for profitable operations.

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.

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.

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



## GS3007E RETAIL SUPPLY CHAIN MANAGEMENT

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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.

Supply Chain Management in Retailing - Inventory Planning, 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.

### References

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

## GS3008E MULTIMODAL TRANSPORTATION SYSTEMS

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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.

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

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

## GS4001E TRANSPORTATION SYSTEMS AND NETWORK DESIGN

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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.

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.

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*. 1<sup>st</sup> 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* 1<sup>st</sup> Edn., Elsevier, 2019.
3. T. G. Crainic, M. Gendreau, B. Gendron, *Network Design with Applications to Transportation and Logistics*, 1<sup>st</sup> Edn. Springer, 2021.
4. M. Sarder, *Logistics Transportation Systems*, 1<sup>st</sup> Edn. Elsevier Publications, 2020.

## GS4002E SUPPLY CHAIN FINANCE

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 39**

### 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.

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.

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, FinTech Products and Evaluation – Case analysis.

### References

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

## LS4001E SUPPLY CHAIN OPERATION SIMULATION

Pre-requisites: Nil

L	T	P	O	C
3	0	0	6	3

**Total Lecture Sessions: 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.

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.

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.

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*. 7<sup>th</sup> 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.