(Affiliated to University of Mumbai)	***End Semester Examination (R-24/R-25) SH 2026 Answer Key with marking scheme***
Branch: MDM	Course: SCM
Year/ Semester: V	Course code:MDMC5062
Time: 03 hours	Marks: 80

<table>
<tr><td></td><td></td><td>Marks</td></tr>
<tr><td>Q. 1</td><td>All questions are compulsory.</td><td></td></tr>
<tr><td>A.</td><td>
<table>
<tr><th>Expected answer / scoring element</th><th>Marks</th></tr>
<tr><td>Identify inconsistency: under DDP, seller—not buyer—normally bears import duties/taxes under agreed delivery terms.</td><td>1</td></tr>
<tr><td>Seller responsible for import customs clearance and formalities.</td><td>1</td></tr>
<tr><td>Seller pays import duties and applicable import charges/taxes required under DDP (subject to contract details).</td><td>1</td></tr>
<tr><td>Seller bears agreed delivery costs and risks until goods are placed at buyer’s disposal at named destination, ready for unloading.</td><td>1</td></tr>
<tr><td>Buyer ordinarily handles unloading; clarify any agreed contractual variations and resolve request for duty payment against DDP contract.</td><td>1</td></tr>
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</td><td></td></tr>
<tr><td>B.</td><td>Given:
• Quantity transported = 8 tonnes
• Distance = 500 km
• Freight rate = ₹4 per tonne-km
• Fuel surcharge = 10% of line-haul cost
• Loading and unloading charges = ₹3,000
a) Calculate the line-haul freight cost. (2 Marks)
Line-haul cost = Quantity x Distance x Rate per tonne-km = 8 x 500 x ₹4 = ₹16,000

b) Calculate the total freight cost. (2 Marks)
Fuel surcharge = 10% x ₹16,000 = ₹1,600
Total freight cost = Line-haul cost + Fuel surcharge + Loading/unloading charges
=₹16,000+₹1,600+₹3,000 = ₹20,600

c) Calculate the total freight cost per tonne. (1 Mark)
Cost per tonne =₹20,600/8 = ₹2,575 per tonne

Final answers: Line-haul cost = ₹16,000; total freight cost = ₹20,600; total cost per tonne = ₹2,575.</td><td></td></tr>
<tr><td>C.</td><td>a) Identify two major performance gaps. (2 Marks)
1. Low vehicle utilisation: Each supplier dispatches a partially loaded vehicle independently, resulting in unused vehicle capacity and higher transportation cost per unit.
2. Receiving-dock congestion: Multiple separate deliveries create uneven arrivals, increase unloading and handling workload, and may cause delays in receiving and processing goods.
b) Explain milk-run and cross-docking. Recommend the more suitable approach. (3 Marks)
Milk-run system: A vehicle follows a planned route to collect goods from multiple suppliers and brings them to a common destination. Consolidating the six suppliers'</td><td></td></tr>
</table>

shipments into fewer trips can improve vehicle utilisation, reduce the number of vehicle movements, and lower transportation costs.
Cross-docking: Incoming goods are received, sorted or consolidated, and transferred directly to outbound vehicles with minimal storage. It can reduce storage time and unnecessary material handling, particularly when goods are already required for onward dispatch.
Recommendation: Milk-run system.
The milk-run system is the more suitable primary solution because the immediate problem is that six local suppliers are independently dispatching partially loaded vehicles to the same distribution centre. A planned collection route can consolidate these movements and reduce the number of separate vehicle arrivals.
The company should also schedule supplier pickups and receiving slots to prevent congestion. Cross-docking could be introduced as a complementary measure if the incoming goods are required for immediate onward distribution.

Note: Cross-docking can be a valid recommendation if students clearly explain how it addresses the receiving and onward-flow problem. However, it does not automatically consolidate inbound supplier journeys.

D.

Expected answer / scoring element	Marks
Original time = 50 minutes; revised time = 35 minutes; reduction = 15 minutes.	1
Correct formula: (old time − new time)/old time × 100.	1
Calculation: (15/50) × 100 = 30% reduction in processing time.	1
Improves speed of order release/dispatch and shortens customer lead time.	1
Supports more reliable order promises, better responsiveness, reduced queue/wait times or customer satisfaction (anyone explained).	1

E.

Expected answer / scoring element	Marks
AI: uses past sales, trends, seasonality or promotions to produce more informed demand forecasts.	1
AI: improves replenishment planning/safety-stock decisions, helping avoid stockouts or overstock.	1
AR: displays digital pick locations, routes, SKU identification or quantity instructions in worker's field of view.	1
AR: enables on-screen verification, reducing wrong picks and search time.	1
Any one credible implementation challenge: cost, system integration, data quality, connectivity, cybersecurity, worker training or ergonomics.	1

F.

Expected answer / scoring element	Marks
Ethical concern 1: no source disclosure impairs raw-material traceability, may conceal unlawful sourcing or environmental harm.	1
Ethical concern 2: unresolved worker-safety complaints indicate possible occupational safety / labour rights violations.	1
Verification of raw-material origin with chain-of-custody documentation or traceability audit.	1

Independent factory/supplier safety and labour compliance audit, including incident records.	1
Review licenses/certifications and corrective-action closure; conditional approval only after verifiable compliance (or similarly suitable approval check).	1

Q.2A

Expected answer / scoring element	Marks
Commercial invoice: identifies buyer/seller, product, quantities, declared transaction value, currency and sale terms; supports customs valuation.	2
Packing list gives package counts, contents, weights, dimensions and markings for inspection and shipment handling.	2
Bill of lading: carrier-issued receipt for goods and evidence of carriage contract; negotiable B/L may serve as document of title.	2
Freight forwarder checks completeness/consistency and coordinates shipment details with exporter/carrier/customs broker.	2
Customs brokers use documents to prepare accurate declarations, confirm regulatory requirements, flag discrepancies early and coordinate corrections/clearance status.	2

OR

Q.2B. a) Explain the major components of freight cost. (3 Marks)

The company should consider the following components when evaluating its transportation expenditure:

1) Line-haul charges: The basic cost of transporting goods between the origin and destination. It may depend on distance, shipment weight, volume, transport mode, and the agreed rate.
2) Fuel and other surcharges: Fuel surcharges and other applicable charges imposed by transporters to account for changes in operating costs or specific service requirements.
3) Handling and terminal charges: Loading, unloading, transshipment, terminal handling, and other charges associated with moving shipments between transport stages.
4) Additional service-related costs: Costs such as tolls, waiting time, detention, documentation, insurance, special handling, and expedited delivery, wherever applicable.
5) Any three well-explained components should receive full credit. Students may also explain how multiple transporters and separate small shipments can increase total freight expenditure.

b) Differentiate between FTL and LTL. Explain when each is suitable. (3 Marks)

Basis	**Full Truck Load (FTL)**	**Less-than-Truck Load (LTL)**
Meaning	The shipment occupies the truck's capacity or is booked as a dedicated truckload.	The shipment uses only part of a truck's capacity and shares space with other shipments.
Cost structure	The company generally pays for the dedicated vehicle or truckload.	The company pays for its share of the vehicle capacity or shipment,

		according to the pricing arrangement.
Transit and handling	Often involves fewer intermediate handling points and can offer more direct transit.	May involve consolidation, sorting, and additional handling, which can increase transit time.
Suitable situation	Large shipments, high-volume orders, urgent direct deliveries, or shipments requiring a dedicated vehicle.	Small or frequent shipments that do not justify booking a full truck.

Application to the company:

- FTL: Suitable when the company has sufficient shipment volume for a destination or can consolidate orders to fill a truck economically.
- LTL: Suitable for smaller customer orders and destinations where the shipment volume is insufficient to justify a dedicated truck.

The company should select the option based on shipment size, delivery deadline, route, total cost, and customer-service requirements rather than choosing one mode for all shipments.

c) Explain four transportation cost-optimisation strategies. (4 Marks)

1) Shipment consolidation: Combine smaller shipments going to the same or nearby destinations. Better vehicle utilisation can reduce transportation cost per unit.
2) Route optimisation: Use route-planning software to select efficient routes, sequence deliveries, reduce unnecessary kilometres, and avoid avoidable delays.
3) Appropriate FTL/LTL selection: Use FTL for sufficiently large shipments and LTL for smaller consignments. Consolidate compatible shipments where possible to balance cost and delivery requirements.
4) Transporter selection and performance management: Compare transporters on total cost, delivery reliability, shipment visibility, and service quality. Negotiate rates based on shipment volumes and monitor performance through service-level agreements.

Other valid strategies include backhauling, scheduled dispatches, better load planning, reducing empty running, and using a transportation management system (TMS).

The objective is not simply to minimise freight rates, but to minimise total transportation cost while maintaining promised delivery times and service quality.

Q.3A

Expected answer / scoring element	Marks
Capacity per rack = 4 levels × 3 positions = 12 pallet positions.	1
Total capacity = 120 × 12 = 1,440 pallet positions.	2
Occupied = 1,080 pallet positions.	1
Vacant = 1,440 − 1,080 = 360 positions.	2
Utilization formula = occupied positions / available positions × 100.	1
Utilization = 1,080 / 1,440 × 100 = 75%.	1
Concern 1: restricted slot availability creates congestion and additional reshuffling/put-away delays.	1
Concern 2: difficult stock rotation or location assignment, operational inflexibility and risk of unsafe overflow (any reasonable concern).	1

OR

Q.3B

Given:

- Shipment quantity = 10 tonnes
- Distance = 1,400 km

a) Calculate the total road freight cost. (3 Marks)

Road freight rate = ₹3.50 per tonne-km.

Line-haul cost=10×1,400×₹3.50=₹49,000

Fuel surcharge=8%×₹49,000=₹3,920

Total road freight cost =₹49,000+₹3,920=₹52,920

The first-mile and last-mile road transport costs are already included in the road freight rate, so no additional amount is added for them.

b) Calculate the total rail freight cost. (4 Marks)

Rail freight rate = ₹1.80 per tonne-km.

Rail line-haul cost=10×1,400×₹1.80=₹25,200

Terminal handling charges are ₹8,000 at each end.

Total terminal charges=₹8,000×2=₹16,000

First-mile and last-mile transportation charges =₹15,000

Total rail freight cost =₹25,200+₹16,000+₹15,000=₹56,200

c) Compare both alternatives and recommend the more suitable option. (3 Marks)

Particulars	Road	Rail
Line-haul cost	₹49,000	₹25,200
Fuel surcharge	₹3,920	₹0
Terminal handling	Included/not applicable separately	₹16,000
First-mile/last-mile charges	Included	₹15,000
Total cost	₹52,920	₹56,200
Expected transit time	2 days	4 days

Additional rail cost=₹56,200−₹52,920=₹3,280

Rail is ₹3,280 more expensive for this shipment under the given cost assumptions. Road transport is also two days faster.

Recommendation: Road transport is the more suitable option for this shipment because it costs less and has a shorter expected transit time. Rail has a lower line-haul rate, but its terminal handling and first-mile/last-mile charges more than offset that advantage.

The recommendation could change if the shipment's cost structure, service requirements, capacity availability, or environmental objectives change. However, based strictly on the figures provided, road is preferable.

Q.4A

Expected answer / scoring element	Marks
Problem 1: email ordering introduces manual delays/ errors and weak order visibility.	1
Problem 2: weekly batch order processing creates replenishment delays.	1
Problem 3: retailers and manufacturers maintain disconnected inventory records.	1
Problem 4: limited shared sales/inventory information prevents timely replenishment despite finished good stock.	1
Change 1: connect order/inventory information through shared ERP/EDI/platform or synchronized records.	1
Effect 1: reduces errors, gives both parties accurate near-real-time availability.	1

	Change 2: increase order-processing/review frequency and implement reorder alerts or agreed replenishment triggers.	1	
	Effect 2: reduces time between inventory depletion and replenishment, lowering stockouts.	1	
	Change 3: introduce CPFR, VMI or regular joint forecasting/replenishment planning.	1	
	Effect 3: improves demand visibility, coordination and shelf availability.	1	
	OR		
Q.4B			

Expected answer / scoring element	Marks
Risk 1: complete supply stoppage after disruption at sole supplier.	1
Risk 2: long/international lead times and customs/geopolitical or disruption exposure.	1
Risk 3: price dependency, no immediate substitute, or production lost sales.	1
Step 1: identify/qualify a second or backup supplier; maintain approved dual-source capability.	1.5
Step 2: maintain risk-based buffer stock for critical electronic component.	1.5
Step 3: share forecasts, purchase schedules and supply alerts with suppliers regularly.	1.5
Step 4: introduce business continuity plans with alternate component specifications/safety stock monitoring/response escalation.	1.5
Disadvantages: duplication/qualification cost, increased working capital, or management complexity of dual sourcing and buffers.	1

Q.5A

a) Recommend three suitable digital technologies or systems. (3 Marks)

1. Transportation Management System (TMS): Supports shipment planning, carrier selection, load consolidation, freight-cost calculation, route planning, and delivery-performance monitoring.
2. GPS-enabled vehicle tracking and telematics: Provides vehicle location and movement information, helping management monitor route deviations, identify delays, and provide estimated arrival times.
3. Route optimisation and scheduling software: Uses delivery locations, vehicle capacity, delivery windows, and road-network information to develop efficient routes and delivery sequences.

One mark may be awarded for each suitable technology with a clear explanation of its role.

b) Design a practical transportation management solution. (4 Marks)

The company should implement an integrated transportation management solution with the following elements:

1. Centralised shipment planning

All customer orders, delivery locations, shipment quantities, vehicle capacities, and delivery deadlines should be entered into a centralised TMS rather than managed through separate spreadsheets and telephone calls.

2. Route optimisation

The system should group deliveries by geographical area and calculate efficient routes and delivery sequences, considering vehicle capacity, traffic conditions, and customer delivery

	windows. Drivers should receive the planned routes digitally, with deviations flagged for review. 3. GPS tracking and delivery visibility Vehicles should be equipped with GPS-enabled tracking. Dispatchers should monitor vehicle locations, delays, and route deviations. Estimated arrival times and delay alerts should be shared with relevant staff and customers where appropriate. 4. Shipment consolidation and load planning Orders going to the same or nearby locations should be consolidated where feasible. The company should assign vehicles according to shipment volume and delivery requirements, using vehicle capacity more effectively while respecting delivery deadlines. Expected improvements: • Fewer unnecessary kilometres and reduced fuel expenditure. • Better vehicle utilisation and fewer avoidable trips. • Improved visibility of shipments in transit. • Earlier identification of delays and faster corrective action. • More reliable deliveries and improved customer communication. The system should allow operational exceptions to be handled by dispatchers rather than relying entirely on automated recommendations. c) Suggest three performance indicators. (3 Marks) 1. On-time delivery rate: Percentage of deliveries completed by the promised delivery time. This measures delivery reliability. 2. Vehicle utilisation rate: Percentage of available vehicle capacity used, measured consistently by weight or volume. This measures how effectively transportation capacity is used. 3. Transportation cost per tonne-kilometre: Total transportation cost divided by tonnes transported multiplied by kilometres travelled. This measures freight-cost efficiency while accounting for shipment volume and distance. Other acceptable indicators include route deviation rate, average delivery delay, empty-running percentage, fuel cost per kilometre, and order cycle time, provided their relevance is explained.	
	OR	
Q.5B	a) Recommend two digital technologies or integrated systems. (3 Marks) 1. Supply Chain Visibility Platform A supply chain visibility platform integrates shipment information from suppliers, freight forwarders, shipping lines, ports, customs agents, and domestic transporters. It can provide shipment status, estimated arrival times, milestone updates, and alerts when shipments are delayed. How it helps: The manufacturer can identify port congestion, international shipping delays, or domestic transport disruptions earlier and coordinate corrective action before they affect customer deliveries. 2. Integrated Supply Chain Management System using APIs or EDI An integrated system using Application Programming Interfaces (APIs) or Electronic Data Interchange (EDI) enables the structured exchange of information such as purchase orders, shipping documents, customs documentation, dispatch details, and delivery confirmations among supply chain partners. How it helps: It reduces manual data entry, improves information consistency, speeds up coordination, and helps the company identify documentation or clearance issues earlier. A student may also recommend a transport management system integrated with shipment tracking, or a suitable port and customs information integration platform, provided its role is clearly explained. Suggested mark allocation: 1.5 marks for each technology and its relevant explanation.	

b) Propose three measures to improve supply chain resilience. (4 Marks)

1. Develop alternative transport routes and logistics partners

The company should identify alternative ports, shipping services, freight forwarders, and domestic transporters. Where feasible, it should maintain pre-agreed alternatives for critical routes so that shipments can be redirected when a disruption occurs.

Benefit: Reduces dependence on a single port, carrier, route, or service provider.

2. Improve inventory planning and maintain appropriate safety stock

The company should identify critical imported components and establish safety-stock levels based on demand variability, replenishment lead time, and the consequences of stockouts. It should also use demand and shipment information to revise replenishment plans when delays occur.

Benefit: Provides a buffer against international shipping delays and prevents disruptions from immediately stopping production or customer deliveries.

3. Establish proactive risk monitoring and contingency planning

The company should monitor port congestion, shipment milestones, customs documentation status, and domestic transport performance. It should define escalation procedures and contingency actions for delays, including alternative routing, revised delivery commitments, and selective use of expedited freight.

Benefit: Enables earlier intervention and reduces avoidable emergency freight costs and service failures.

Other valid measures include qualifying alternative suppliers, improving customs-documentation readiness, conducting periodic disruption simulations, and establishing clear coordination protocols with logistics partners.

c) Recommend three performance indicators covering cost, reliability, and responsiveness. (3 Marks)

Performance dimension	Suggested KPI	What it measures
Cost	Transportation cost per shipment	Tracks the average transportation expenditure per shipment and helps identify changes in normal and emergency freight costs.
Reliability	On-time delivery rate	Measures the percentage of shipments delivered by the committed delivery date.
Responsiveness	Average order-to-delivery lead time	Measures the average time from order placement to delivery and helps assess how quickly the supply chain responds to demand.

The company should compare these indicators before and after implementation. It should also track emergency freight expenditure separately to determine whether resilience measures are reducing the cost of disruptions.

Q.6A

Expected answer / scoring element	Marks
Misleading origin labelling: false or deceptive traceability representation, possible trade/consumer-law violation.	2
Failure to safeguard product designs: breach of confidentiality/IP obligations, risk of copying and competitive loss.	2
Explain one consequence: penalties, recall/reputational harm, loss of trust, data/IP leakage.	1

	Control 1: enforce supplier code of conduct and written truthful-origin disclosures.	1	
	Control 2: regular documentation, origin/traceability checks and third-party audits.	1	
	Control 3: nondisclosure agreement, access restrictions and secure design-data handling.	1	
	Control 4: contractual corrective-action deadlines, escalation and termination rights.	1	
	Control 5: periodic compliance review, worker training, incident reporting or sample verification.	1	
OR			
Q.6B			

Expected answer / scoring element	Marks
Environmental compliance: avoids pollution/regulatory violations and supports responsible resource use.	2
Employee safety: reduces harm, disruptions and exposure to labour-law/reputational risks.	2
Confidentiality: protect proprietary specifications/designs and business information.	1
Monitoring 1: check valid environmental permits and audit compliance records.	1
Monitoring 2: conduct safety inspections or verify training/accident reports.	1
Monitoring 3: sign and periodically verify NDAs/security controls.	1
Monitoring 4: implement supplier scorecards and periodic onsite/remote audits.	1
Monitoring 5: monitor corrective actions, grievance reports and evidence of closure.	1

*********** All the Best***********