(297)

SET 1

Double side (11)

Scoring Indicators

COURSE NAME: Material Handling

COURSE CODE: 5023B **QID:** 21092 40178

Q. No.	Scoring Indicators	Split Score	Sub Tot	Tot
	PART A			**9**
I. 1	Minimize material handling cost, Reduce production time, Reduce overhead, Conserve floor space etc. **(Any one)**	1	1	1
I. 2	Pallet racks, Shelves, bins and drawers, Mezzanines etc. **(Any one)**	1	1	1
I. 3	Loading and unloading system	1	1	1
I. 4	Flexible	1	1	1
I. 5	Load handling attachment	1	1	1
I. 6	Arresting gear	1	1	1
I. 7	AGV, Industrial trailers, Hand Trucks etc. **(Any one)**	1	1	1
I. 8	Input effort	1	1	1
I. 9	Floating cranes	1	1	1
	PART B			**24**
II. 01	1. Storage and handling equipment - Storage equipment is equipment that is used to hold products and materials when they are not being used, or when they are waiting to enter or leave the production process 2. Engineered systems- Storage and handling equipment that is automated falls under the term 'engineered systems'. 3. Industrial trucks - Industrial trucks are used to move materials over variable paths, with no restrictions on the area covered by the movement	3x1	3	3

II. 02	1. Palletized Loads- Goods are stacked and secured on a pallet, a flat transport structure that supports goods in a stable fashion. Pallets can be made of wood, plastic, or metal. 2. Slip Sheets - Thin pallet-sized sheets made of plastic or fibre board used to create a unit load without the bulk of a pallet. 3. Containers - Large standard-sized metal boxes used for transporting goods over long distances, particularly for sea and rail transport.	3x1	3	3
II. 03	**Main components of a hemp rope** **1. Hemp Fibres**: The primary component of hemp rope is the fibres extracted from the stem of the hemp plant. **2. Strands:** Multiple strands of twisted hemp fibres are then twisted together to form the rope. **3. Core**: Some hemp ropes may have a core made of natural or synthetic fibres. ***(Marks may be awarded for answering parts of any hoisting machinery)***	3x1	3	3
II. 04	**Eye Hook:** This type of hook has a closed loop at one end, forming an eye that can accommodate a hook, shackle, or other attachment point. **Swivel Hook**: Swivel hooks have a hook with a rotating mechanism, allowing the load to rotate freely without twisting the lifting equipment.	1.5 1.5	3	3
II. 05	**Safety Hooks and Latches:** These are designed to securely attach the load to the lifting device and prevent accidental detachment. **Emergency Brake Systems:** Some hoisting devices are equipped with emergency brakes that automatically engage if the primary lifting mechanism fails, preventing the load from falling.	1.5 1.5	3	3
II. 06	**Types of Brakes:** **Mechanical Brakes:** These are typically friction-based brakes that use pads or shoes to create friction against a drum or disc attached to the hoisting mechanism. They are reliable and can provide precise control over the lifting and lowering of loads. **Electromagnetic Brakes:** These brakes use an electromagnetic field to control the braking action. They are often used in applications where quick	1.5 1.5	3	3

	response times and precise control are required, such as in electric hoists.			
II. 07	Trackless material handling equipment is designed to move materials within industrial, commercial and logistics environments without relying on fixed tracks or rails. This equipment offers flexibility and efficiency in handling a wide range of materials, making it suitable for diverse applications. **Applications** 1. Warehousing and Distribution 2. Manufacturing 3. Healthcare	2 1	3	3
II. 08	Guided Vehicles (AGVs) are mobile robots used to transport materials within a facility without human intervention. They operate based on the following principles to navigate and perform tasks efficiently. 1. Navigation and Guidance 2. Control Systems 3. Obstacle Detection and Avoidance 4. Path Planning and Routing 5. Communication Systems	3	3	3
II. 09	Lever-operated hoists, also known as lever hoists or chain hoists are mechanical devices used to lift heavy loads. They rely on a lever mechanism to create mechanical advantage, allowing users to lift weights with minimal effort. Components **Frame:** The sturdy outer structure that houses the internal components. **Lever Arm:** The handle that the operator pulls to lift the load. It's designed to provide leverage. **Load Chain:** A durable chain that wraps around the load hook and connects to the lifting mechanism.	3x 1	3	3
II. 10	Industrial lifts are mechanical devices used to raise and lower heavy loads in factories, warehouses, and other industrial settings. Their construction is designed to handle heavy weights and ensure safety and efficiency. Key Components of an industrial lift are : 1.Frame/Chassis 2.Lift Platform 3.Lifting Mechanism		3	3
PART C				42

III. 01	A .Horizontal flow line a)I-flow or Line flow-It is the simplest form of flow. In this, materials are fed at one end and components leave the line at the other end. b)L-flow-It is similar to the I-Flow and is used where I-line cannot be accommodated in the available space. c) U-flow-In this, both feeding and output take place at the same end i.e., it allows both receiving and dispatching of goods to be done on one side. d) S-flow-If the production line is so long that zig-zagging on the plant floor is necessary, than S-Flow is adopted. e) O-flow-This type is used where processes or operations are performed on a rotary table or a rotary handling system. **B. vertical flow lines** a) **Processing downward and upward-**In downward processing, the materials are fed from the top floor and in upward processing the materials are fed from the bottom floor while the finished product is received at the top floor. b) **Centralized elevation** - In a centralized elevation all the material handling devices are installed at one central place of the building. **Decentralized elevation** - A decentralized elevation method is more costly in installation, maintenance and space, but by this method handling on each floor can be greatly reduced and more flexibility in design of the flow lines is possible. c) **Unidirectional or Retractional flow-** In retractional type of flow, material has to come back on the floor which had already passed previously. This is done purposely to achieve better utilization of available space and machines. **d) Vertical or inclined flow** **e) Single or multi flow-** In a single flow, there is only one flow line of materials while in multi-flow, there will be several flow lines and all these feed one assembly line.	Any seven movements (7x1)	7	7
IV.	**1. Planning:** Establish a clear plan for the material handling system. Identify the materials to be transported and stored. **2. Standardization:** Standardize your process and equipment to achieve predictable results while considering flexibility. For example, if you have boxes	Any seven movements (7x1)	7	7

	of the same size, your team should anticipate future changes regarding box sizes, so you can choose equipment that can efficiently transport smaller or larger boxes in the future. **3. Work:** Reduce unnecessary work by using equipment that will minimize or eliminate repetitive tasks. **4. Ergonomics:** Acknowledge the employees' restrictions and capabilities by investing in ergonomic equipment to ensure safety in the workplace. **5. Unit load:** Utilize unit loads such as containers and pellets to reduce effort and walking time in the warehouse. **6. Space Utilization:** Organize the warehouse to maximize the available warehouse space. Ensure that the warehouse is organized by clearing warehouse aisles from clutter, stacking inventory to utilize vertical height and grouping products in the same category. **7. System:** Integrate tracking tools so as to quickly identify materials and products at every stage of the system. **8. Environment:** Use equipment that will reduce energy consumption and prevent greenhouse gas emissions. For example, using an electric forklift is more sustainable than using a liquid-propane powered truck. **9. Automation:** Implement automation in warehouse processes such as picking and retrieval to lower costs and boost employee productivity. **10. Life Cycle Cost:** Utilize a comprehensive analysis of life cycle costs on material handling equipment to ensure durability and sustainability. Consider different criteria, including programming, installation, setup, operation, repair and maintenance, reuse value and disposal.			

V.	**Major components of welded load chain are :** **Welded Joints:** Instead of traditional riveted or mechanical joints, welded hoist chains have welded connections between the links. These welds are critical for maintaining the integrity and load-bearing capacity of the chain. **End Fittings or Attachments:** Some welded hoist chains may have specific end fittings or attachments. These can include hooks, links, or other fittings that facilitate connection to lifting equipment or loads. **Surface Treatment:** The surface of the chain is often treated to enhance durability and corrosion resistance. Common treatments include galvanizing or coating with zinc or other protective materials. **Markings and Certifications:** Welded hoist chains are usually marked with important information such as the manufacturer's name or logo, chain grade (indicating strength), and certifications (e.g., ANSI, ISO) to ensure compliance with safety standards	7	7	7
VI.	Electromagnetic shoe brakes are a type of braking system commonly used in various industrial applications where precise and reliable braking is required. Construction & use : Shoe Mechanism: The braking action is achieved using a pair of friction shoes or pads that are pressed against a rotating drum or disk attached to the driven machinery (such as a motor shaft). Electromagnetic Activation: When the brake is engaged, an electromagnetic field is generated to pull the shoes against the drum or disk, creating friction and thus stopping or holding the rotating component. Release Mechanism: Disengaging the brake involves reducing or cutting off the electromagnetic field, allowing springs or other mechanisms to pull the shoes away from the drum or disk, thus releasing the brake.	7	7	7
VII.	A conveyor belt works by using two motorized pulleys that loop over a long stretch of thick, durable material. When motors in the pulleys operate at the same speed and spin in the same direction, the belt moves between the two. If objects are particularly heavy or bulky or if	7	7	7

	the conveyor belt is carrying them for a long distance or duration, rollers may be placed on the sides of the conveyor belt for support. Components of a Belt Conveyor: Belt: A continuous loop of material, typically rubber or fabric that carries the load. Pulley: A cylindrical component that drives the belt. Motor: Provides power to the drive pulley. Frame: The structural support that holds all the conveyor components together. Rollers: Positioned along the length of the conveyor to support the belt and reduce friction. Guarding and Safety Features: Includes covers and safety stops to protect operators and maintain safe operation.			
VII I.	A screw conveyor is a device used to move bulk materials from one place to another. It consists of a helical screw blade enclosed in a tube or trough. The working principle of a screw conveyor is based on the following key concepts: Rotation of the Screw: The core of a screw conveyor is a helical screw blade that rotates within a tube or trough. When the screw rotates, it creates a moving force that pushes the material along the conveyor. Material Conveyance: As the screw turns, it picks up material from the inlet or feed end of the conveyor and transports it along the length of the conveyor. The material is conveyed by the pushing action of the rotating screw blade. Discharge: At the discharge end of the conveyor, the material is expelled out of the conveyor. Depending on the design, the discharge can be controlled to direct the material to a specific location or in a specific manner. Enclosure: The screw is enclosed within a tube or trough that helps to contain the material and guide it along the conveyor. This enclosure can be open or closed, depending on the application and the need to prevent spillage or contamination. Type of Screw: The design of the screw can vary based	7	7	7

	on the type of material being conveyed. For example, the pitch (distance between the screw threads) and the diameter of the screw can be adjusted to handle different materials and flow rates. Feed Mechanism: The material is fed into the screw conveyor through an inlet, which is usually at one end of the conveyor. The screw's rotation ensures that the material is evenly distributed and moves toward the discharge end.			
IX.	A bucket conveyor is a type of conveyor system designed to transport bulk materials vertically or at an incline using buckets attached to a chain or belt. It's commonly used in industries such as agriculture, mining, and manufacturing. Working The working principle of the bucket elevator is relatively simple. When the equipment is working, the material is evenly fed through the feeding port. Rising until it reaches the top of the driving drum, the bucket starts to turn over, and then under the action of centrifugal force or gravity, the material is unloaded from the discharge port and sent to the next process. The bucket elevator is suitable for lifting from a low place to a high place, and the lifting height can reach 40 meters; the bucket elevator is generally equipped with an casing to prevent dust from flying.	7	7	7
X.	A gravity conveyor moves the load without utilizing motor power sources, usually down an incline or through a person pushing the load along a flat conveyor. WORKING PRINCIPLE 1. Incline: Gravity conveyors typically operate on an inclined plane. The incline allows gravity to naturally move the materials from the higher end of the conveyor to the lower end. 2. Rollers or Skate Wheels: The most common types of gravity conveyors use either rollers or skate wheels to support and move the products. a. Roller Conveyors: These have a series of cylindrical rollers mounted in a frame. The product moves across these rollers due to gravity. b. Skate Wheel Conveyors: These have a series of small wheels mounted on a frame, which facilitate the movement of lighter products. 3. Adjustable Angle: Many gravity conveyors are adjustable, allowing the angle of the incline to be modified. This adjustability can help optimize the flow of materials depending on the load and the space available.	7	7	7

XI.	Differential hoists, also known as differential gear hoists, utilize a unique mechanical arrangement to lift heavy loads efficiently. They combine the principles of leverage and gear systems to provide a high lifting capacity with minimal input effort. **Major components** **Frame:** The sturdy structure that supports the entire hoist and houses the internal mechanisms. **Pulley System:** A set of pulleys arranged in a differential configuration to allow for efficient load lifting. **Load Chain or Wire Rope:** Connects the load to the hoist and moves through the pulleys. **Differential Gear Mechanism**: A system of gears that allows for the multiplication of force applied by the operator. **Crank Handle or Lever:** The operator uses this to engage the gear mechanism and lift the load. **Load Hook:** A secure attachment point for the load, often equipped with a safety latch. **Brake System:** Engages automatically to hold the load securely in place once lifted.	7	7	7
XII	**Rotary cranes**, also known as rotating cranes or swivel cranes, are designed to lift and move heavy loads with a rotating mechanism. They are widely used in construction, shipping, and manufacturing. The operator uses the control system to maneuver the crane. The rotary mechanism allows the boom to swivel, enabling the crane to reach various positions without moving the entire base. The winch system raises or lowers the load as needed, while counterweights ensure stability throughout the operation. **Components** • **Base:** • **Mast (Tower)** • **Boom (Arm)** • **Rotary Mechanism** • **Drive Motor** • **Load Hook:** • **Winch System:** • **Drum:** • **Motor:** • **Control System:** • **Counterweights:**	7	7	7
XII I.	**Positioning the Stacker**: The operator positions the stacker near the load (e.g., a pallet) that needs to be lifted. **Engaging the Load**: The operator uses the forks to slide under the pallet.	7	7	7

	This can be done manually or with electric controls, depending on the type of stacker. **Lifting the Load**: The lift mechanism is activated. In electric stackers, the operator presses a button or joystick; in manual stackers, a hand crank is used. The hydraulic cylinders or mechanical system raises the mast, lifting the load off the ground. **Transporting the Load:** With the load elevated, the operator maneuvers the stacker to the desired location. The stacker can move in tight spaces, making it ideal for warehouses. **Stacking the Load**: Upon reaching the designated spot, the operator raises the load to the desired height using the lift mechanism. Once in position, the operator lowers the load carefully onto the stacking area (e.g., another pallet or shelf). **Releasing the Load**: The operator disengages the load by lowering the forks, allowing the pallet to rest securely in its new position. **Returning to Position**: After unloading, the stacker can be repositioned to pick up another load or move to a different area.			
XI V.	**Regular Inspections:** **Visual Checks:** Inspect for signs of wear, corrosion, or damage to the frame, chain, and hooks. **Functional Testing:** Operate the hoist to ensure smooth lifting and lowering. **Lubrication:** Chain and Gears: Use appropriate lubricant to minimize friction and wear. Avoid over-lubrication which can attract dirt. Pivot Points: Apply grease to the lever arm pivot and any other moving parts. Cleaning: **Debris Removal:** Regularly clean the hoist to remove dirt, dust, and grime that can interfere with operation. **Corrosion Prevention:** Treat any areas showing signs of rust or corrosion promptly. **Load Testing:** Conduct load tests periodically to ensure the hoist can handle its rated capacity safely. Follow manufacturer guidelines for testing procedures. **Storage:** Store hoists in a dry, clean environment when not in use to prevent corrosion and damage. Avoid placing heavy objects on or near the hoist during storage. **User Training:** Ensure that all operators are trained on proper usage and safety protocols to prevent accidents and prolong	7	7	7

	the lifespan of the hoist.			