COMPLETE CONTENT (UNIT-WISE / WEEK-WISE)

Plant Maintenance & Material Handling

1st Week

1. Necessity and Advantages of Testing, Repair and Maintenance

- Ensures reliable and safe operation of machines
- Reduces breakdown time and production loss
- Improves machine efficiency and accuracy
- Increases machine life and reduces long-term cost
- Helps detect faults before failure

Common Instruments Required for Testing

- Vernier caliper
- Micrometer
- Dial gauge
- Straight edge
- Spirit level
- Feeler gauge
- Mandrel
- Surface plate

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2. Significance of B-T Curve in Life Span of Machine Tool

- B-T (Bath-Tub) curve shows **failure rate vs time**
- Three zones:
    1. **Infant Mortality Zone** – early failures
    2. **Useful Life Zone** – stable and low failure rate
    3. **Wear-out Zone** – failures increase due to wear
- Helps plan maintenance schedules and replacements

Acceptance Test for Machine Tools

- Performed before machine installation/usage
- Includes:
    - Geometrical accuracy test

    - Alignment test
    - Performance test
    - Noise and vibration test
    - Load test

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3. Revision

2nd Week

1. Economic Aspects, Manpower Planning and Material Management

- **Economic Aspects**: cost of maintenance, downtime cost, ROI, machine utilization
- **Manpower Planning**: required technicians, skill levels, training
- **Materials Management**: spare parts, purchasing, storage control

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2. Fits and Tolerances

- Ensures correct functioning and assembly of machine parts
- Common types:
    - Clearance fit
    - Interference fit
    - Transition fit
- Used in shafts, bearings, gears, pulleys, etc.

3rd Week

1. Plant Layout – Location and Layout of Machines

- Aim: smooth workflow, minimum material handling, safety
- Principles:
    - Minimum movement
    - Efficient utilization of space
    - Flexibility
    - Safety and comfort

2. Types of Plant Layout

- Product layout
- Process layout
- Fixed layout
- Group or cellular layout

Positioning and Grouping of Machines

- Based on process similarity
- Based on product flow
- Minimizes travel distance and improves productivity

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3. Machine Foundations

- **Types**:
  - Block type
  - Box type
  - Wall type
- **Considerations**:
  - Soil conditions
  - Vibration
  - Load carrying capacity
  - Machine size
- **Foundation Bolts**: rag bolt, L-type bolt, J-type bolt
- **Foundation Plan**: drawing showing size, reinforcement, bolt positions

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4th Week

1. Erection, Leveling and Grouting

- **Erection**: positioning, aligning and securing the machine
- **Leveling**: using spirit level, dial gauge
- **Grouting**: filling cement mixture around base to fix machine
- **Vibration & Damping**:
  - Natural frequency, forced vibration
  - Isolation methods: rubber pads, springs, inertia blocks
  - Anti-vibration mounts

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2. Testing Equipment

- Dial gauge
- Mandrel

- Spirit level
- Straight edge
- Auto collimator

Re-calibration of Measuring Instruments

- Vernier caliper
- Micrometer
- Gauge blocks
- Ensures measurement accuracy

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3. Testing Methods

- **Geometrical / Alignment Test**
- **Performance Test**
- **Load Test**
- **Run Test**
- **Vibration and Noise Test**

5th Week

1. Maintenance Organisation

Definition

Structure responsible for maintenance planning and execution

Advantages

- Efficient repair
- Better scheduling
- Less downtime

Limitations

- Costly
- Requires skilled staff

Types of Maintenance

- Emergency
- Preventive
- Breakdown / Corrective

- Predictive

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2. Computerized Maintenance Records

- Facility register
- Maintenance request forms
- CMMS software

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3. ISO Standards for Maintenance Documentation

- Standard procedures
- Data recording
- Work order system

Machine History Card

- Shows complete service history
- Helps predict failures and plan maintenance

6th Week

1. Scheduled Yearly Plan for Preventive Maintenance

- Daily, weekly, monthly, yearly tasks
- Work content difference:
    - **Servicing** – cleaning, lubrication
    - **Repairs** – parts replacement
    - **Overhauling** – complete dismantling

MTBF & MTTR

- **MTBF** – mean time between failures
- **MTTR** – mean time to repair
- **Maintainability** – ease of performing maintenance

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2. Spare Parts Management

- Frequently needed spare parts inventory
- Provision for unavailable or imported parts

3. Common Failure-Prone Parts

- Belts, screws, bearings, seals
- **Reasons of failure**:
  - Overload
  - Wear and tear
  - Misalignment
  - Poor lubrication

7th Week

1. Repair Schedule

Parts commonly needing repair:

- Belts
- Couplings
- Nuts and bolts

2 & 3. Repair of Engines, Compressors and Boilers

- Checking wear, lubrication, pressure levels
- Replacing damaged parts
- Cleaning filters
- Alignment of shafts

8th Week

Continuation: Repair of Engines, Compressors and Boilers

3. Lubrication

- Methods:
  - Grease lubrication
  - Oil bath
  - Forced lubrication
- Periodical lubrication chart:
  - Daily

- Weekly
- Monthly

9th Week

1. Handling and Storage of Lubricants

- Store in clean, dry containers
- Keep away from moisture
- Avoid contamination

2. Lubricant Conditioning and Disposal

- Filtering
- Testing viscosity
- Proper disposal to avoid pollution

3. Lubricants and Grades for Gears & Bearings

- Gear oils (EP grades)
- Bearing grease (NLGI grades)

10th Week

1. Lubricants and Grades for Chains

- Chain oils
- Adhesive lubricants

2 & 3. Purpose and Procedure of Changing Oil (e.g., Gearbox Oil)

- Removes contaminated oil
- Maintains efficiency
- Procedure:
  - Drain old oil
  - Clean system
  - Check leaks
  - Refill new oil

11th Week

1. Basic Principles of Material Handling

- Reduce handling cost
- Use gravity where possible
- Minimize distance
- Ensure safety

2. Types of Material Handling Equipment

- Hoists
- Cranes
- Conveyors
- Forklifts

12th Week

1. Forklift Trucks – Uses & Limitations

- Uses: lifting pallets, transporting heavy loads
- Limitations: requires trained driver, limited height

2. Selection of Material Handling Equipment

- Load capacity
- Distance
- Type of material
- Safety and cost

3. Unit Load: Pallet Sizing & Loading

- Standard pallet sizes
- Proper stacking
- Load balancing

13th Week

1. Conveyor Models

- Belt conveyors
- Roller conveyors
- Chain conveyors
- Screw conveyors

3. AGV Systems (Automatic Guided Vehicles)

- Uses:
  - Automated transport
  - Warehouse operations
- Types:
  - Laser guided
  - Magnetic tape guided

14th Week

1. Automated Storage Systems

- Computer-controlled storage
- Efficient space utilization

2. Retrieval System (ASRS)

- Automated retrieval of stored items
- Increases speed and accuracy

3. Carousels

- Vertical/horizontal
- Used for high-density storage