

Basic Mechanical Engineering Unit–2 Notes Measurement and Production Engineering

UNIT–2 TOPICS

Measurement:

- Concept of Measurements
- Errors in Measurement
- Temperature Measurement
- Pressure Measurement
- Velocity Measurement
- Flow Measurement
- Strain Measurement
- Force and Torque Measurement
- Vernier Caliper
- Micrometer
- Dial Gauge
- Slip Gauge
- Sine Bar
- Combination Set

Production Engineering:

- Casting
- Carpentry
- Welding
- Lathe Machine
- Drilling Machine

1. CONCEPT OF MEASUREMENTS

Measurement is the process of comparing an unknown quantity with a standard quantity.

Importance of Measurement:

- Ensures product quality
- Improves accuracy
- Essential in manufacturing
- Reduces production errors

Types of Measurements:

1. Direct Measurement
2. Indirect Measurement

2. ERRORS IN MEASUREMENT

Error is the difference between true value and measured value.

Types of Errors:

1. Systematic Errors
2. Random Errors
3. Gross Errors

Methods to Reduce Errors:

- Proper calibration
- Careful observation
- Use of accurate instruments

3. TEMPERATURE MEASUREMENT

Temperature is measured using thermometers and sensors.

Instruments Used:

- Mercury thermometer
- Thermocouple
- Pyrometer

Applications:

- Boilers
- Furnaces
- Refrigeration systems

4. PRESSURE MEASUREMENT

Pressure is measured using pressure gauges.

Instruments Used:

- Bourdon tube gauge
- Manometer
- Pressure transducer

Applications:

- Hydraulic systems
- Boilers
- Compressors

5. VELOCITY MEASUREMENT

Velocity measurement determines speed of moving fluid or object.

Instruments Used:

- Tachometer
- Anemometer

6. FLOW MEASUREMENT

Flow measurement determines quantity of fluid flowing per unit time.

Instruments Used:

- Venturimeter
- Rotameter
- Orifice meter

7. STRAIN MEASUREMENT

Strain is deformation per unit length.

Expression:

Strain = Change in length / Original length

Instrument Used:

- Strain gauge

8. FORCE AND TORQUE MEASUREMENT

Force Measurement:

Measured using spring balance and load cells.

Torque Measurement:

Measured using dynamometers and torque meters.

9. VERNIER CALIPER

Vernier caliper is used to measure external, internal dimensions and depth accurately.

Main Parts:

- Main scale
- Vernier scale
- Jaws
- Depth rod

Least Count:

LC = 0.02 mm

Applications:

- Measurement of diameter
- Measurement of depth

10. MICROMETER

Micrometer is precision instrument used for accurate measurement of small dimensions.

Main Parts:

- Frame
- Spindle
- Thimble
- Sleeve

Least Count:

LC = 0.01 mm

Applications:

- Measurement of wire diameter
- Small thickness measurement

11. DIAL GAUGE

Dial gauge is used to measure small linear displacement.

Applications:

- Alignment checking
- Runout measurement

12. SLIP GAUGE

Slip gauges are precision measuring blocks used for calibration.

Applications:

- Calibration of instruments
- Precision measurement

13. SINE BAR

Sine bar is used for accurate angle measurement.

Formula:

$$\sin \theta = h / L$$

Where:

h = height of slip gauges

L = distance between rollers

14. COMBINATION SET

Combination set is multipurpose measuring instrument used for angle measurement, marking and leveling.

15. PRODUCTION ENGINEERING

Production engineering deals with manufacturing processes and machine tools.

16. CASTING

Casting is manufacturing process in which molten metal is poured into mould cavity and allowed to solidify.

Advantages:

- Complex shapes can be produced.
- Economical for large production.

Applications:

- Engine blocks
- Pipes
- Machine parts

17. CARPENTRY

Carpentry is process of cutting and shaping wood.

Common Carpentry Tools:

- Saw
- Chisel
- Hammer

Applications:

- Furniture making
- Wooden structures

18. WELDING

Welding is process of joining two metals by heating and pressure.

Types of Welding:

- Arc welding
- Gas welding

Applications:

- Automobile industry
- Construction industry

19. LATHE MACHINE

Lathe machine is machine tool used for machining cylindrical components.

Main Operations:

- Turning
- Facing
- Drilling
- Thread cutting

Applications:

- Shafts
- Bolts
- Cylindrical parts

20. DRILLING MACHINE

Drilling machine is used to produce holes in materials.

Main Operations:

- Drilling
- Reaming
- Tapping

Applications:

- Hole making in components

MOST IMPORTANT 14 MARK QUESTIONS

1. Explain concept of measurements and errors in measurement.
2. Explain temperature and pressure measurement methods.
3. Explain Vernier caliper with neat diagram.
4. Explain micrometer with neat sketch.
5. Explain dial gauge and slip gauge.
6. Explain sine bar and angle measurement.
7. Explain casting process with advantages and applications.
8. Explain welding process and types of welding.
9. Explain lathe machine and its operations.
10. Explain drilling machine and operations.

IMPORTANT 7 MARK QUESTIONS

1. Define measurement and errors.
2. Explain strain gauge.
3. Explain torque measurement.
4. Explain Vernier least count.
5. Explain micrometer least count.
6. Explain carpentry tools.
7. Explain turning operation.

IMPORTANT NUMERICALS

1. Vernier caliper numerical.
2. Micrometer reading problems.
3. Sine bar numerical.
4. Strain calculation problems.

EXAM TIPS

- Draw neat diagrams of instruments.
- Practice Vernier and micrometer numericals.
- Learn machine operations carefully.
- Revise welding and casting processes.
- Focus on repeated theory questions.