

SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution) Coimbatore-35



DEPARTMENT OF BIOMEDICAL ENGINEERING

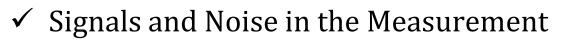
23BMT203 - BIOMEDICAL TRANSDUCERS AND SENSORS

UNIT I - Fundamental of Measurement II Year/ IV Sem

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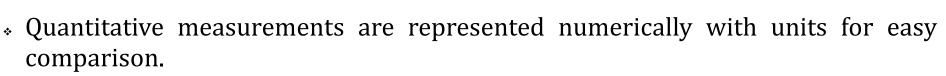


BIOMEDICAL TRANSDUCERS AND SENSORS



- ✓ Characteristics of the Measurement System (Static & Dynamic),
- ✓ Determination of Absolute Quantity
- ✓ Standards, Calibration,
- ✓ Accuracy and Error
- ✓ Units of Measurement Quantities.
- ✓ Physiological parameter and its measurement constraints.





- Using different units for the same quantity can create inconvenience, even if conversion is possible.
- Independently defined units for related quantities may introduce numerical factors in equations, such as when converting mechanical work to heat.
- To avoid such issues, a coherent system of units defines units systematically, eliminating conversion factors.
- While systems like CGS and MKS existed, the International System of Units (SI) is now the recommended standard.





The International System of Units

- Base Units and Derived Units
- Dimension of a Quantity
- Recommendations for the Use of SI Units and Symbols

Non-SI Units





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Units of Measurement Quantities



The International System of Units

- The International System of Units (SI) was established by the International Organization for Standardization (ISO) as a coherent system of units for physical quantities.
- SI standards define quantities, units, symbols, and writing rules, as documented in ISO 1000 (1992) and ISO 31 (Parts 0–13, 1992).



SI Base Unit



Units of Measurement Quantities

Base Units and Derived Units

SI Base Units

The SI system is built on seven base quantities with their corresponding base units: meter (length), kilogram (mass), second (time), ampere (electric current), kelvin (temperature), mole (amount of substance), and candela (luminous intensity).

Base Quantity	Name	Symbo	
length	meter	m	
mass	kilogram	kg	
time	second	S	
electric current	ampere	Α	
thermodynamic temperature	kelvin	К	
amount of substance	mole	mol	
luminous intensity	candela	cd	

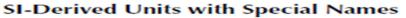


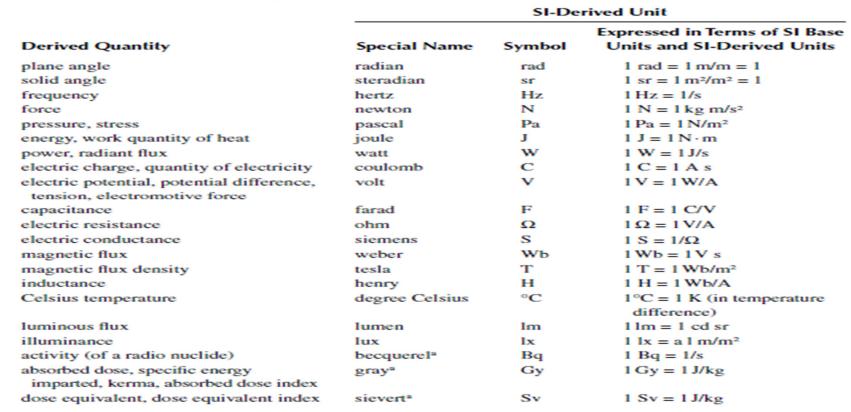


Derived Units

- Derived quantities are expressed in terms of base quantities (e.g., velocity as length divided by time), and their units, derived units, are combinations of base units (e.g., meter per second for velocity).
- Some derived quantities have special names and symbols in SI, such as radian and steradian, which are dimensionless supplementary units. For example, moment of force is typically expressed as N \cdot m instead of kg m²/s².

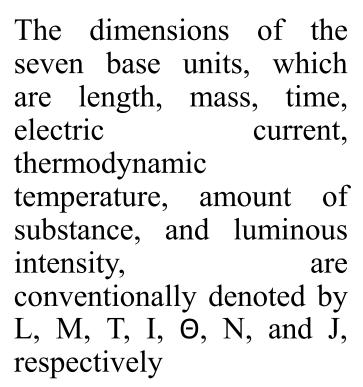












Some Examples of Quantities, Units, and Their Dimension				
Quantity	Unit	Dimension		
velocity	m/s	LT-1		
force	kg m/s ² or N	LMT ⁻²		
energy	kg m ² /s ² or J	L ² MT ⁻²		
electric potential	kg m²/(s² A) or V	$L^2MT^{-3}I^{-1}$		
heat capacity	kg m²/(s² K) or J/K	$L^2MT^{-2}\Theta^{-1}$		
molar concentration	mol/m ³	L-3N		
illuminance	cd sr/m ² or lx	L-2J		

SI Prefixes

	Prefix		
Factor	Name	Symbo	
1024	yotta	Y	
1021	zetta	Z	
1018	exa	E	
1015	peta	Р	
1012	tera	Т	
109	giga	G	
106	mega	Μ	
10 ³	kilo	k	
10 ²	hecto	h	
10	deca	da	
10-1	deci	d	
10-2	centi	с	
10-3	milli	m	
10-6	micro	μ	
10-9	nano	n	
10-12	pico	р	
10-15	femto	f	
10-18	atto	a	
10-21	zepto	z	
10-24	yocto	У	





Non-SI U nits

- **Recognized Non-SI Units:** The International Committee for Weights and Measures (ISO) recognizes certain non-SI units for continued use due to their practical importance.
- These include units for time (minute, hour, day), plane angle (degree, minute, second), volume (liter), mass (tonne, unified atomic mass unit), and energy (electron volt).
- **Traditional Units and Dual Reporting:** Many fields, like medicine, still use traditional non-SI units (e.g., mmHg, cal).
- While SI conversions are important, it's often more practical to provide values in both SI and the traditional unit (e.g., 16 kPa (120 mmHg)) or simply the SI unit with the traditional equivalent in parentheses as an approximation.