



# **19BMT202**

# **Biomedical Sensors and Measurement**

Unit – 4 Measurement of Non-Electrical Parameters



## UNIT IV

# Measurement of Non-Electrical Parameters

### Background on Pulse and Blood Pressure

#### **The Circulatory System**

The heart is located in the center of the chest, protected by the rib cage. The heart is really a double pump. One pump, the "right heart," receives blood which has just come from the body.

The "right heart," during contraction, pumps the blood to the lungs via the pulmonary artery. The blood then returns to the "left heart" via the pulmonary vein. This second pump, the "left heart," receives the blood from the lungs during contraction, pumps it out through the great artery called the aorta. The aorta branches out to supply the entire body with blood through a series of arteries.

Veins are the series of vessels which carry blood from various parts of the body back to the heart. One-way valves in the veins aid the blood on its return trip to the heart. This valve system prevents backward circulation.

#### **Definition of Pulse**

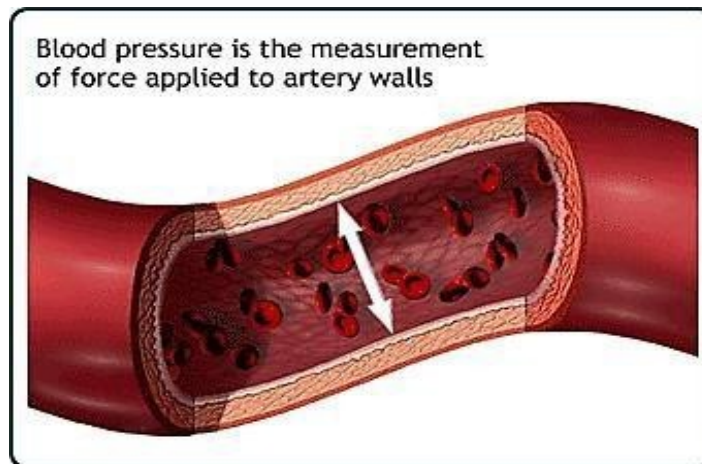
Pulse is the rhythmic expansion and contraction of an artery caused by the impact of blood pumped by the heart. The pulse can be felt with the fingers at different pulse pressure points throughout the body and heard through a listening device called a stethoscope.

We use Radial pulse (at the wrist) and the brachial pulse (inside of arm at the elbow) to obtain the pulse and blood pressure measurements.



## Definition of Blood Pressure

Arterial blood pressure is the force exerted by the blood on the wall of a blood vessel as the heart pumps (contracts) and relaxes. Systolic blood pressure is the degree of force when the heart is pumping (contracting). The diastolic blood pressure is the degree of force when the hearts relaxed.



## What is Blood Pressure?

A blood pressure reading is the measurement of the force of blood against the walls of the arteries as the heart pumps blood through the body. It is reported in millimeters of mercury (mmHg).

Blood pressure is typically expressed as the reflection of two numbers, **systolic pressure** and **diastolic pressure**. The **systolic blood pressure** is the maximum pressure on the arteries during systole, the phase of the heartbeat when the ventricles contract. This is the top number of a blood pressure reading. causes the ejection of blood out of the ventricles and into the aorta and pulmonary arteries.

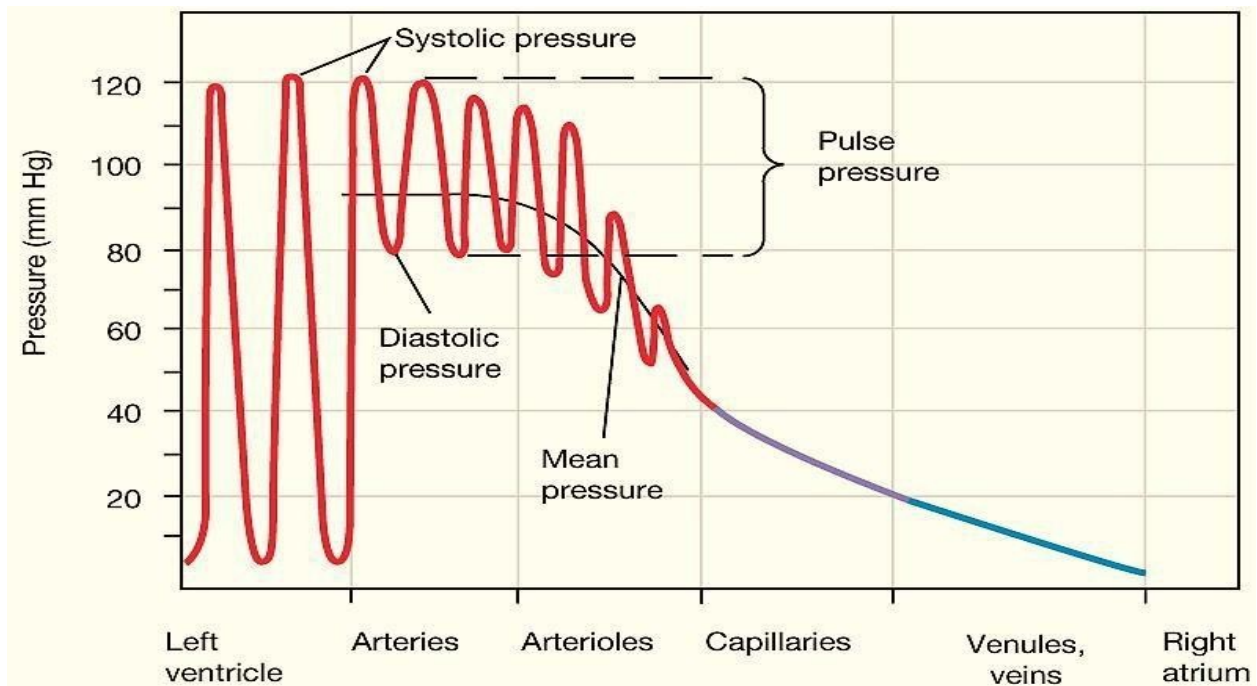
**Systole** causes the ejection of blood out of the ventricles and into the aorta and pulmonary arteries.

The **diastolic blood pressure** is the resting pressure on the arteries during **diastole**, the phase between each contraction of the heart when the ventricles are filling with blood. This is the bottom number of the blood pressure reading

Therefore, **120/80** indicates the systolic blood pressure is 120 mm Hg and the diastolic blood pressure is 80 mm Hg.



## Pressure changes throughout the systemic circulation



Adult BP range 110 - 130 / 70 - 85 mmHg

BP Category	Systolic (mmHg)		Diastolic (mmHg)	Follow-up
Optimal	<120	&	<80	Recheck 2 years
Normal	<130	&	<85	Recheck 2 years
High Normal (Pre-hypertension)	130-<140	or	85-<90	Recheck 1 year



## Systolic BP:

The peak (highest) blood pressure, it is measured during **ventricular systole**, it is **120 mmHg** in a young person at rest.

## Diastolic BP:

The minimum blood pressure, it is measured at the end of **ventricular Diastole**, it is **80 mmHg** in a young person at rest.

## Pulse pressure:

It is the difference between **systolic BP** and **diastolic BP**.

Pulse pressure = systolic BP - diastolic BP

(e.g.:  $120 - 80 = 40 \text{ mmHg}$ )

## Mean BP:

Calculated by adding one-third of the pulse pressure to the diastolic BP

Mean BP = diastolic pressure +  $\frac{1}{3}$  (systolic pressure – diastolic pressure)

eg.:f BP= 120/90 mmHg → diastolic BP= 90 ,pulse pressure = 30

Mean BP:(diastolic BP) + (one-third of pulse pressure) = (90) + (30/3) = 90+10 = 100 mmHg