SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIAC TECHNOLOGY

COURSE NAME : Basic Electrocardiography

UNIT : Introduction to ECG & Cardiac Electrical Activity

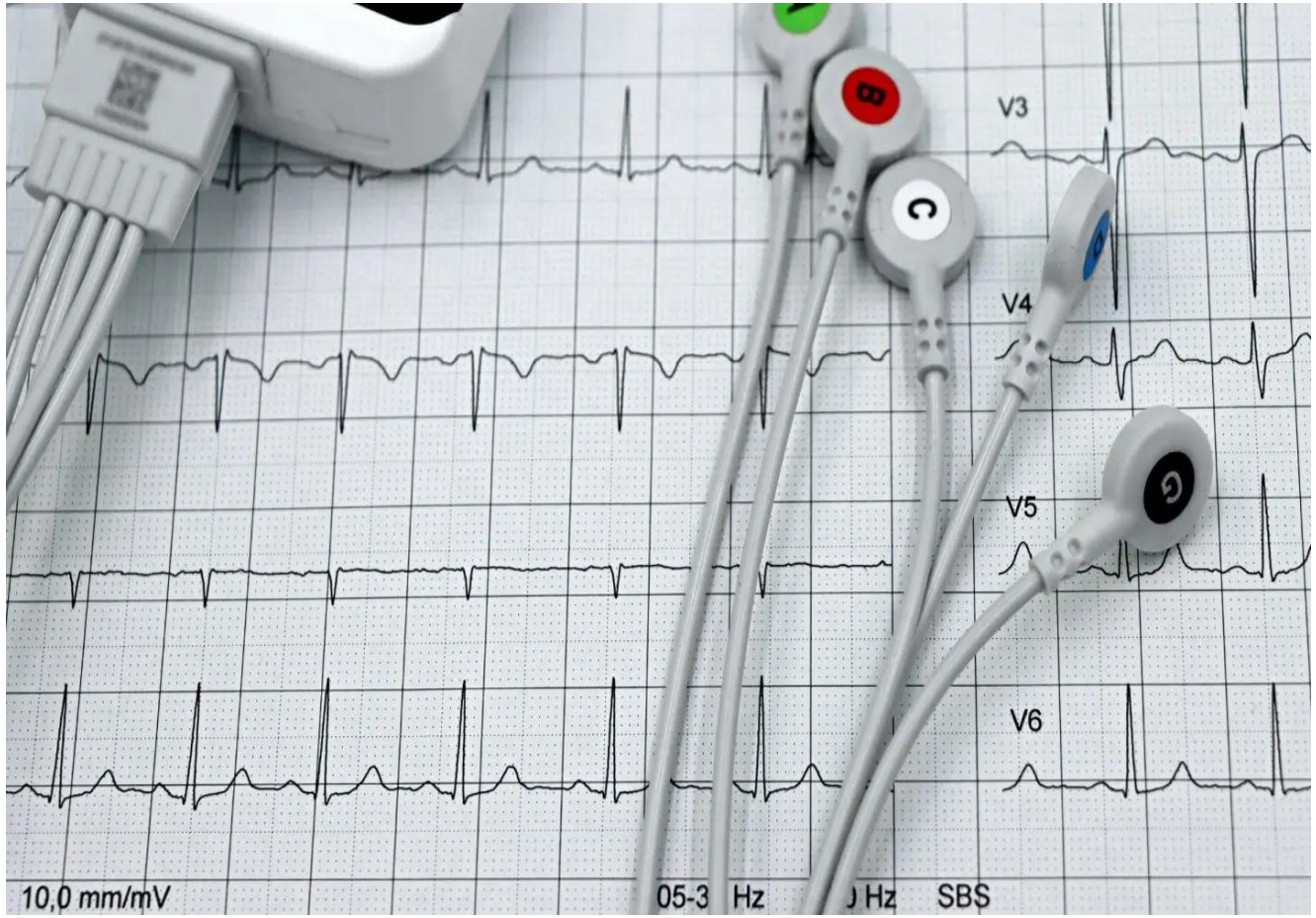
TOPIC : The Normal ECG

FACULTY NAME: Kavipriya S

EMPATHIZE – Understanding the Clinical and Learning Need

Objective:

- ECG (Electrocardiogram) is a **non-invasive diagnostic tool** that records the **electrical activity of the heart** over time.
- Helps clinicians, technologists, and students detect **arrhythmias, myocardial infarction, conduction blocks**, and **electrolyte disturbances**.



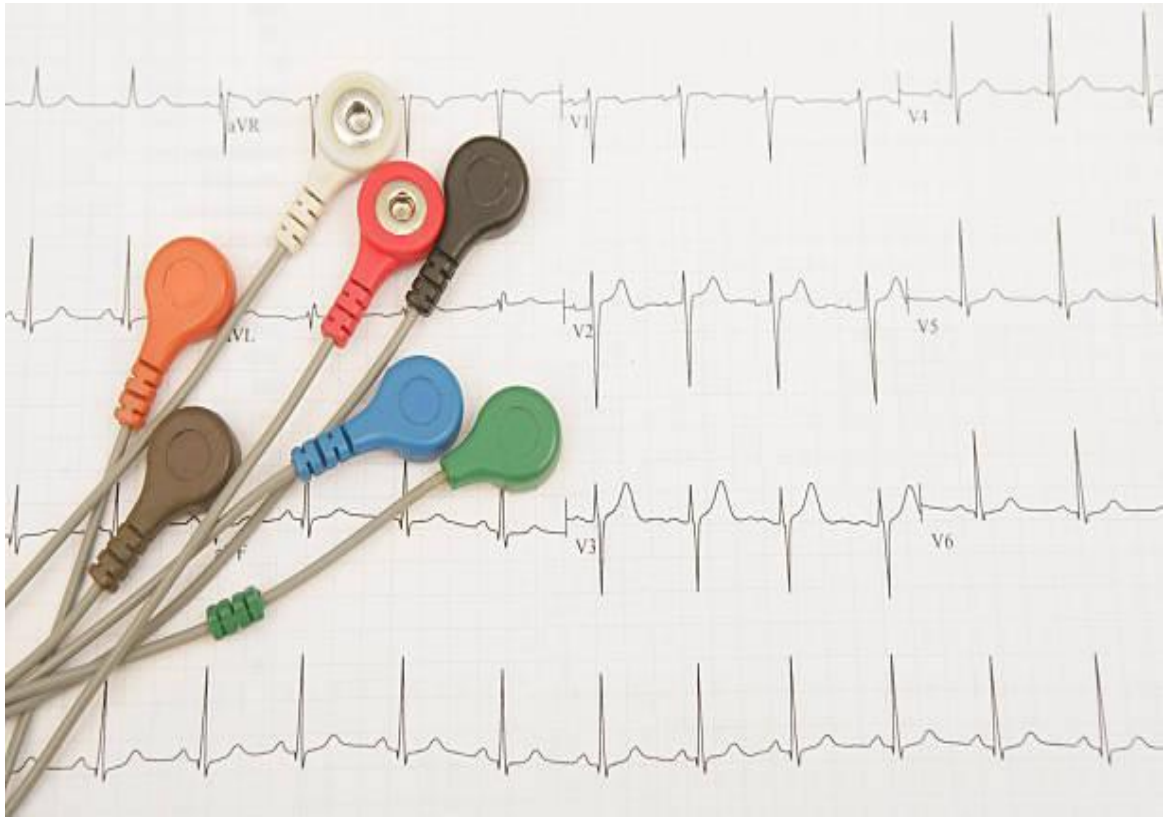
💡 2. DEFINE – Framing the Core Concept

Problem Statement:

👉 "How can we understand and interpret the normal ECG as a representation of the heart's electrical activity?"

Definition:

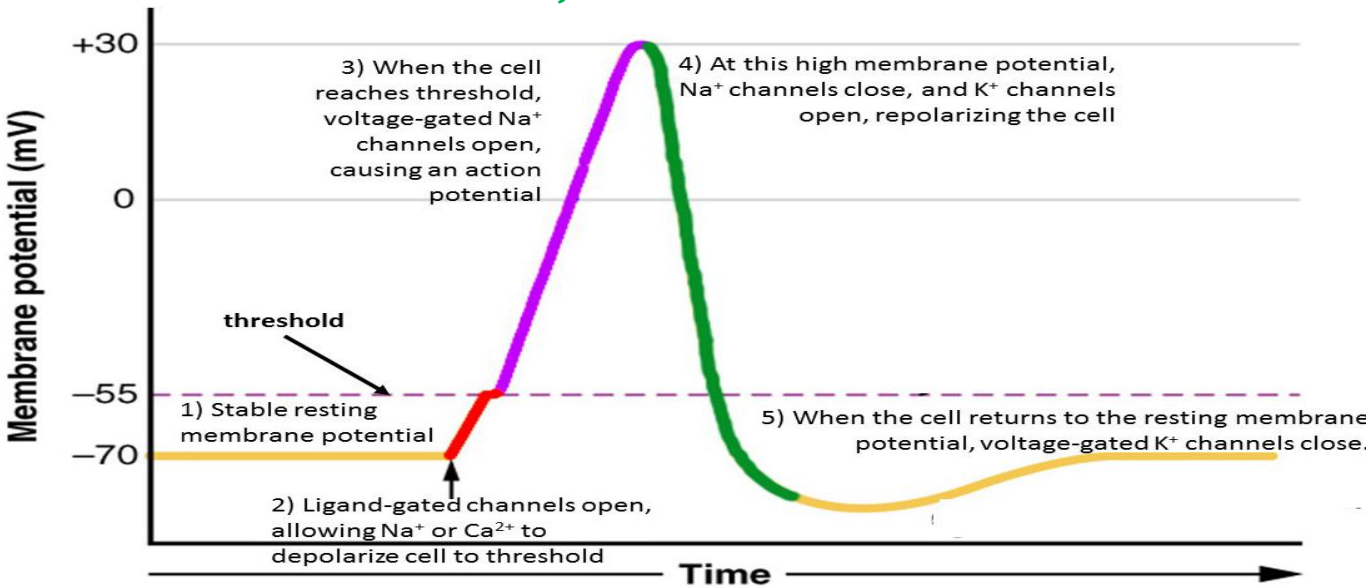
- An **ECG** is the **graphical recording** of the electrical potentials generated by the heart during its activity, recorded from the **body surface**.
- It represents the **sum of all cardiac electrical events** as detected by electrodes

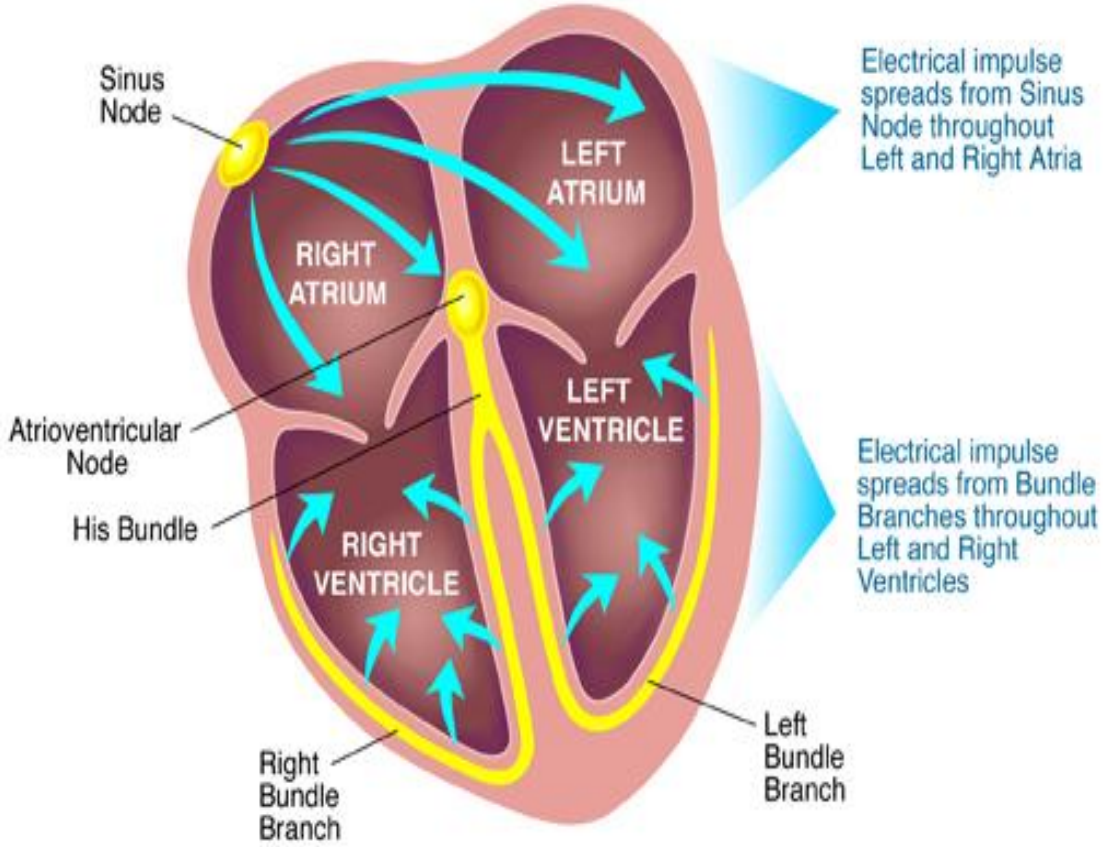


🧠 3. IDEATE – Conceptual Understanding

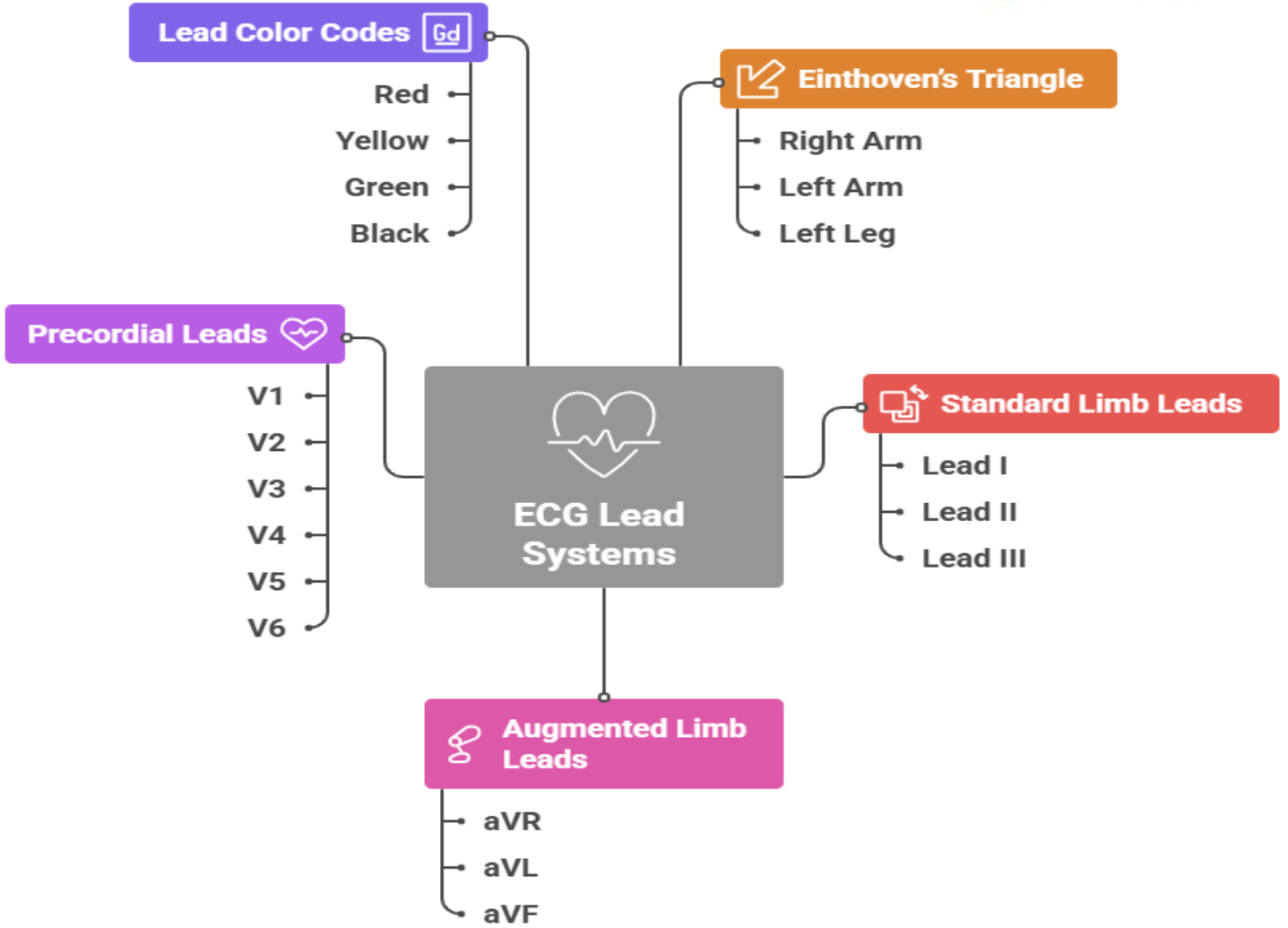
A. Electrical Basis

- **Depolarization:** Activation of myocardium → generates positive potential.
- **Repolarization:** Recovery phase → returns to resting potential.
- Electrical signals spread from **SA node → atria → AV node → Bundle of His → Purkinje fibers → ventricles.**





IDEATE – Lead System Overview



PROTOTYPE – Applying the Concept

Wave/Interval	Description	Normal Duration / Value	Significance
P wave	Atrial depolarization	0.08–0.10 sec	Atrial contraction
PR interval	SA → AV conduction time	0.12–0.20 sec	AV node delay
QRS complex	Ventricular depolarization	0.06–0.10 sec	Ventricular contraction
ST segment	End of depolarization, start of repolarization	Isoelectric	Plateau phase
T wave	Ventricular repolarization	Variable	Ventricular recovery
QT interval	Electrical systole (depolarization + repolarization)	0.36–0.44 sec	Reflects ventricular action potential duration

Sequence of Events

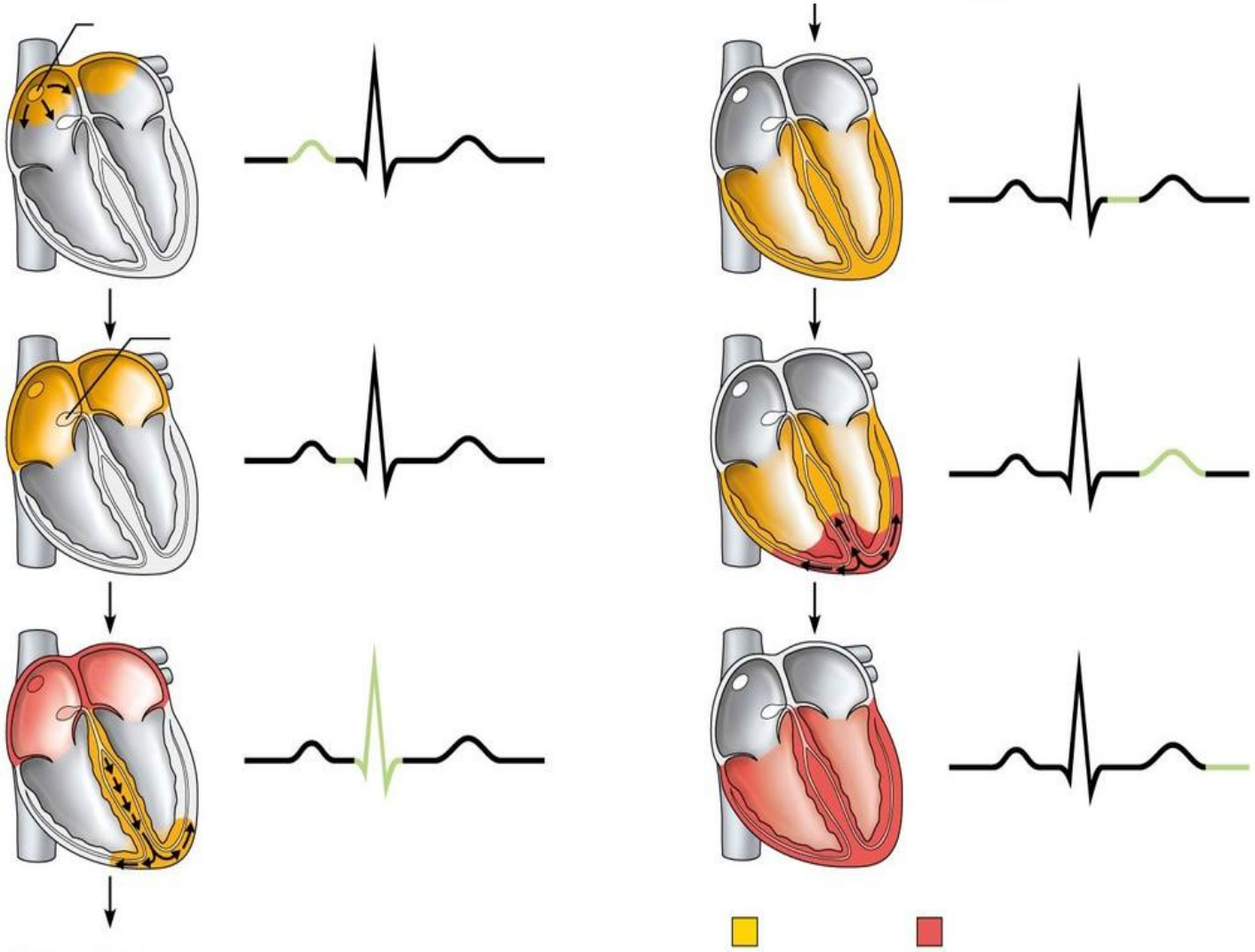
1.P wave: SA node fires → atrial depolarization.

2.PR segment: Impulse delayed at AV node for ventricular filling.

3.QRS complex: Rapid ventricular depolarization and contraction.

4.ST segment: Ventricles fully depolarized.

5.T wave: Ventricular repolarization (relaxation).

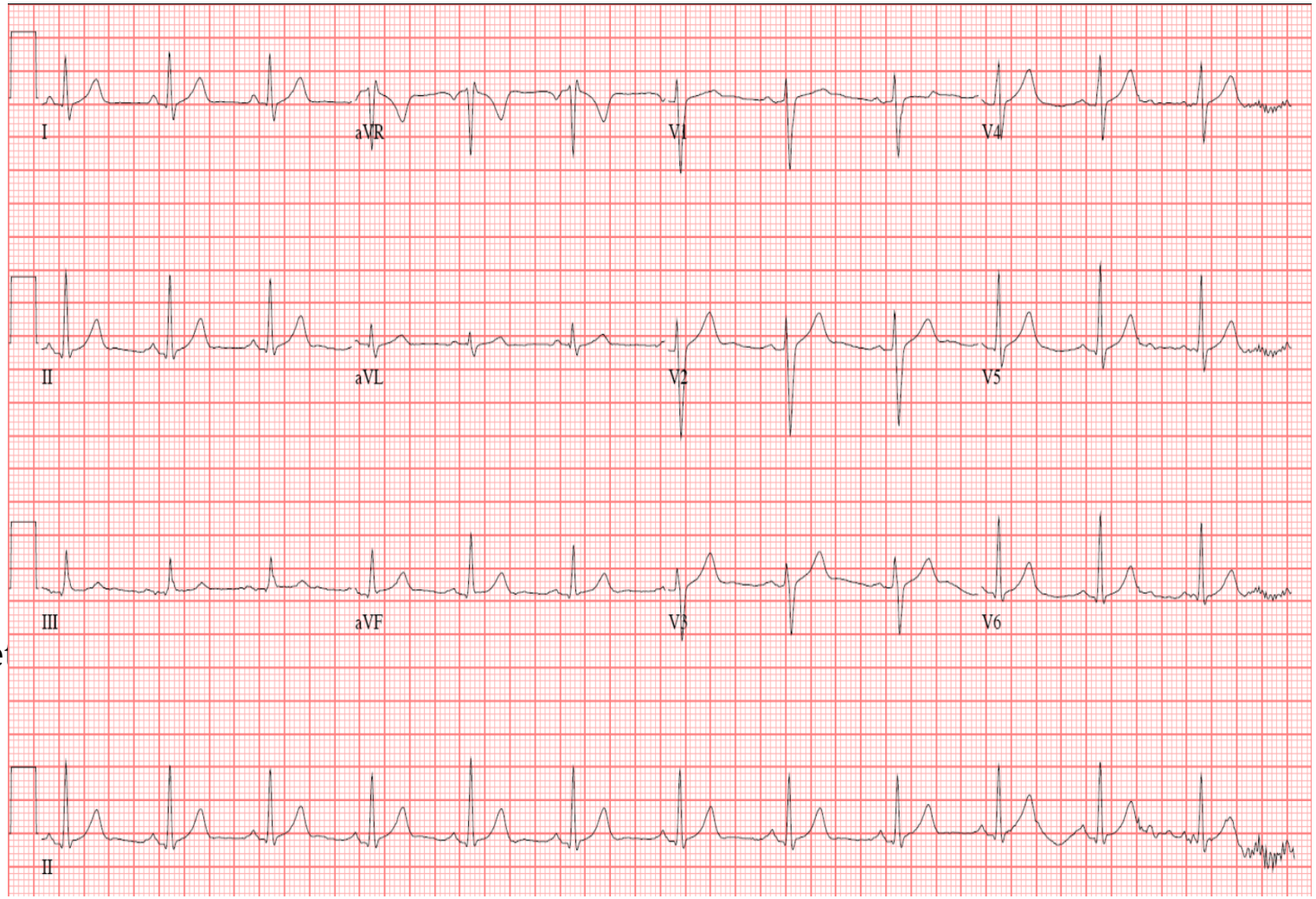


TEST – Application & Interpretation

Normal ECG Characteristics:

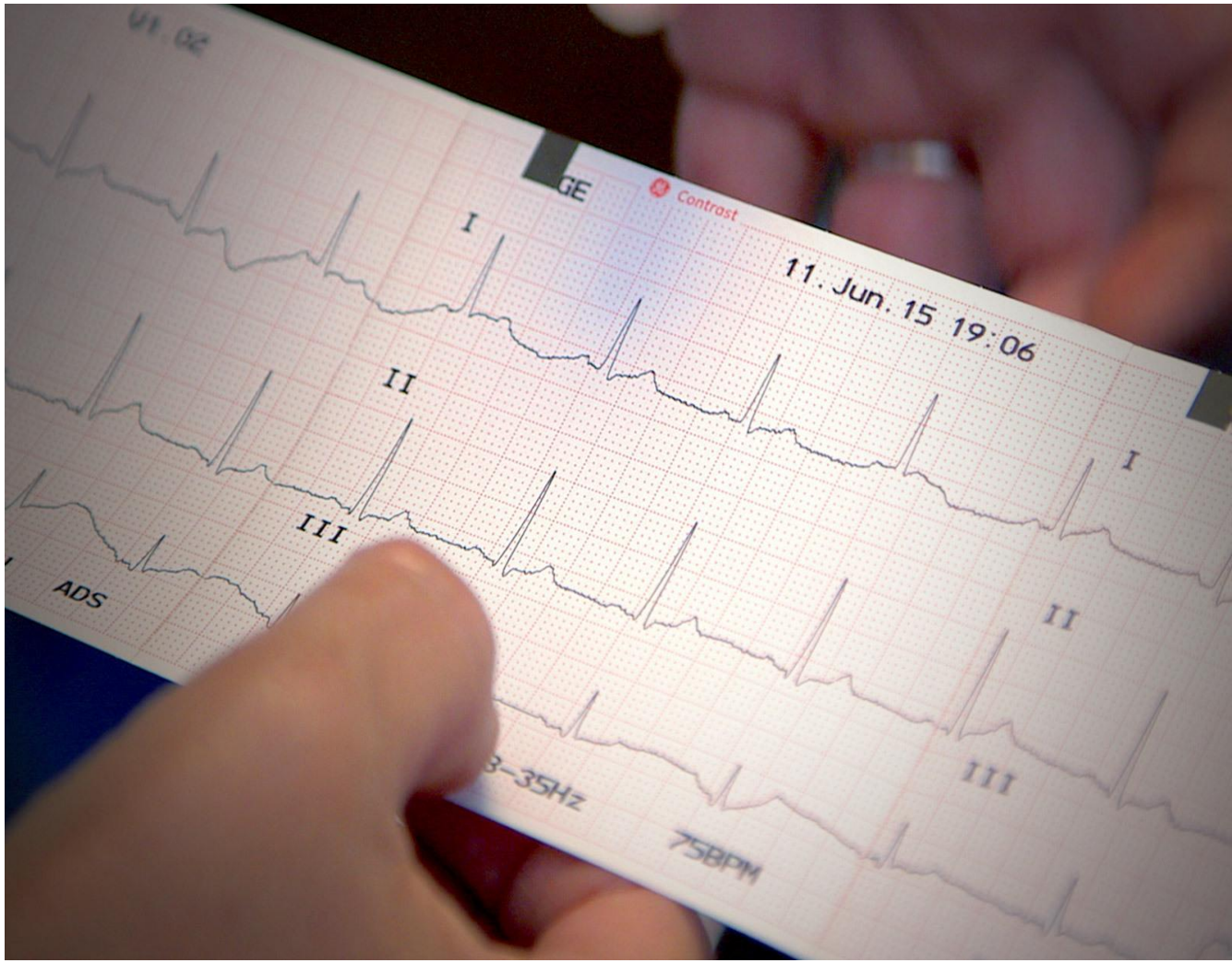
- **Heart rate:** 60–100 bpm
- **Rhythm:** Regular (R–R intervals equal)
- **P wave:** Upright in leads I, II, aVF
- **PR interval:** Constant (0.12–0.20 sec)
- **QRS:** Narrow and uniform (< 0.10 sec)
- **ST segment:** Flat (isoelectric)
- **T wave:** Upright in most leads except aVR and some

  V1
- **QT interval:** Adjusted for heart rate (QTc)



REFLECT – Learning & Correlation

- The **normal ECG** serves as a **baseline** for understanding all cardiac pathologies.
- Each wave corresponds to a **specific electrical and mechanical event** in the cardiac cycle.
- Integrating ECG with **anatomy (conduction system)** and **physiology (action potentials)** helps students **visualize heart function in real time**.
- Clinical technologists use ECGs daily for **monitoring cardiac performance**, **pre-procedure assessment**, and **emergency diagnosis**.



Summary Table

Parameter	Normal Value	Significance
Heart Rate	60–100 bpm	Normal sinus rhythm
PR Interval	0.12–0.20 s	Atrioventricular conduction
QRS Duration	< 0.10 s	Ventricular depolarization
QT Interval	0.36–0.44 s	Ventricular systole
P Wave	0.08–0.10 s	Atrial depolarization
ST Segment	Isoelectric	End of depolarization
T Wave	Upright	Repolarization phase

📚 Reference Books

- **Guyton & Hall**, *Textbook of Medical Physiology* (14th Edition)
- **Sembulingam & Sembulingam**, *Essentials of Medical Physiology*
- **John R. Hampton**, *The ECG Made Easy*
- **Chatterjee & Price**, *Clinical Electrocardiography*
- **Klabunde R.E.**, *Cardiovascular Physiology Concepts*