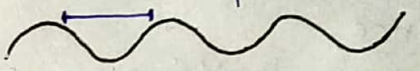
* LASER *

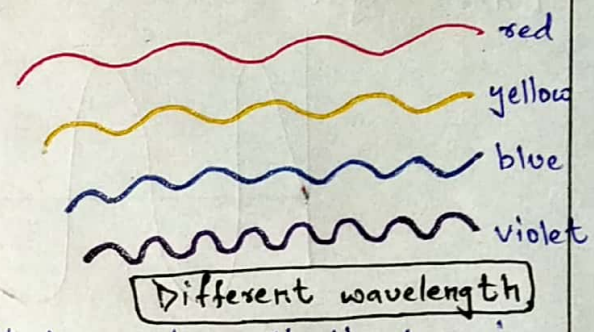
- Acronym → LIGHT AMPLIFICATION by STIMULATED EMISSION of RADIATION
- A laser is used as a source or generator of radiation.
- It is different from light bulb or flash light.
- Laser produces a beam of narrow light.

How does LASER work ?

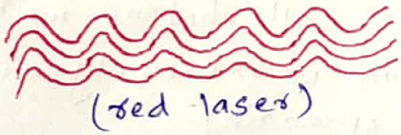
- Light travel in waves and the distance b/w two peaks of wave is called wavelength.



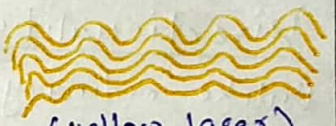
- Each colour has different wavelength.
- LASER is different. It is created artificially.



- Laser produce a narrow beam of light in which all the light waves have similar wavelength.
- Laser light waves travel together with their peaks all lined up in same phase → very narrow → very bright → focussed very tiny spot → → can travel very long distance.


(red laser)


(blue laser)


(yellow laser)

Difference b/w low power laser therapy & high power laser therapy

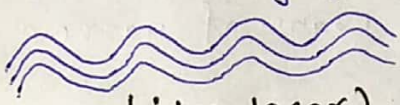
LPLT [Cold Laser]	HPLT
① has output power of less than 0.5W	① has output power of more than 0.5W
② don't create heating sensation during treatment.	② create heat on surface of skin.
③ medical laser	③ surgical laser
④ sub thermal	④ thermal
⑤ for pain relief, wound healing, tissue repair and anti inflammation	⑤ for purpose of opthalmology, dermatology, oncology etc

Characteristic of LASER EMISSION

① **Monochromatic** → [Greek root:- mono (single/one) khroma (colour)]

- In laser, all emitted photon have same energy, frequency and wavelength. While ordinary light (white light) is a combination of many different wavelength.

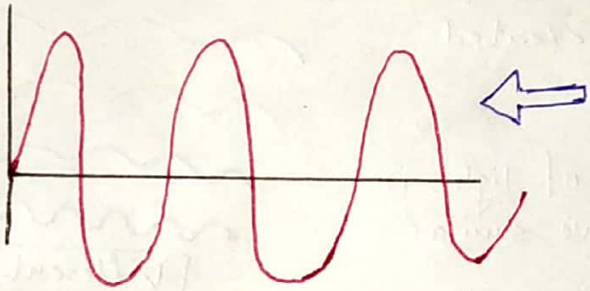
(red laser)



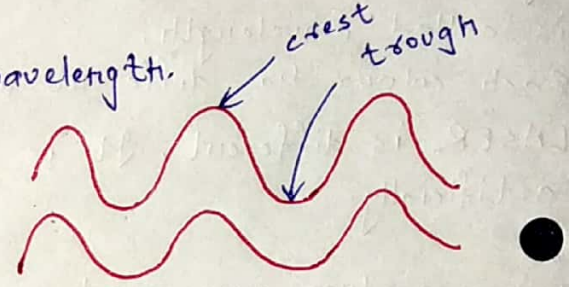
(blue laser)

② **Coherence**

Laser light emit in same phase and wavelength.



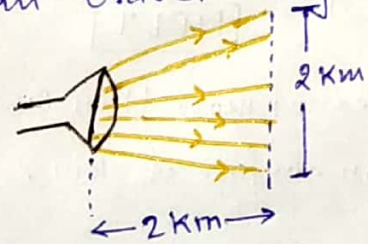
[adding up both phase
coherent]



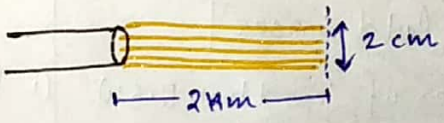
[waves combine in same phase]

③ **Directionality**

- Unlike ordinary light source, in laser, all photons will travel in same direction, width of laser beam is extremely narrow and can travel long distance without spreading.



ordinary light



laser light

④ **Collimation**

- Process of aligning all the beam of laser parallely so that radiation do not diverge the energy even if propagated over long distance. This property make its invaluable for measurement & aiming purpose.

⑤ Polarized (in one plane – easy to pass through media)

⑥ High energy (Intensity measured by Watt – J/sec)

How does LASER THERAPY Work at cellular level ?

For therapeutic use, Low Power Laser Therapy [LPLT] is used :-

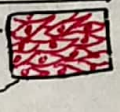
LPLT

↓

absorbed by melanin, Hb, oxyhaemoglobin and water

↓

energy from laser causes soothing warmth to tissue



↓

primary target of photobiomodulation is Cytochrome C complex [found in inner membrane of mitochondria]

↓

As light absorbed, cytochrome C stimulated resulting in production of ATP

↓

In addition, free nitric oxide (NO) and reactive oxygen species (ROS) is produced.

↓

The production of these signalling molecule induce growth factor production to increase cell proliferation and mobility.

Cytochrome C complex → vital for electron transport chain that drive cellular metabolism.

Nitric Oxide → powerful vasodialator, imp. cellular signaling molecule and involved in many physiological processes. Also improve circulation in damaged tissue, delivering O_2, vital sugar and protein & salt, removing waste.

ROS → affect many imp. physiological signaling pathway including inflammatory responses.

MEDICAL ONESHOT

Increase in —

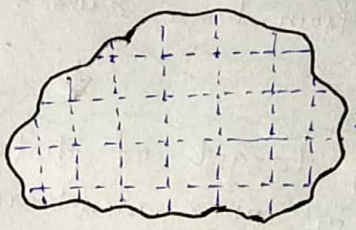
- Macrophage
- fibroblast
- Endothelicytes
- Keratinocytes
- Mast cell
- Serotonin

} Result in tissue repair

Decrease in —

Result in pain relief { Bradykinin Activity in C fibres

Technique of Application

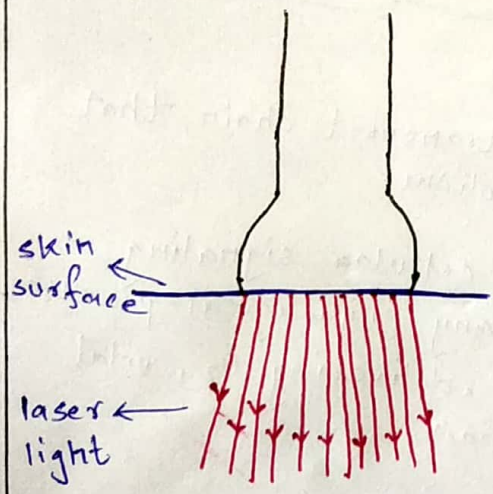


① GRID METHOD →

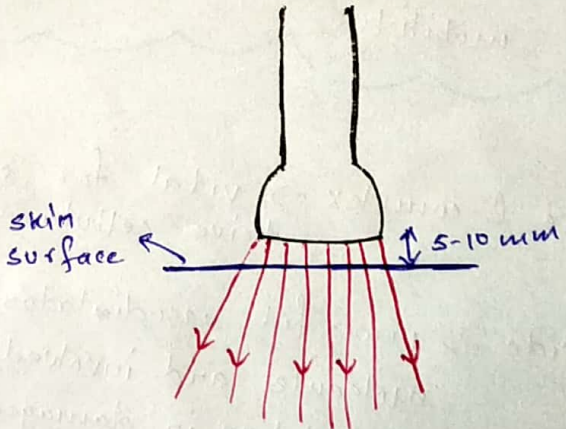
- The treatment area is divided into a grid each of 1 square cm.
- The hand held applicator should be in contact with skin and directly perpendicular to target tissue.
- Each sq cm is stimulated for a specific period of time.

② SCANNING METHOD →

- No contact blw tip of laser and patient skin.
- The tip of applicator is held at distance 5–10 mm.
- since divergence of beam occurs, there is decrease in the amount of energy applied as the distance increases.



GRID METHOD
(direct contact to skin)



SCANNING METHOD
(no contact to skin surface)

Dosage Parameters

① **Wavelength** → depend on lasing medium used.
eg -
- for superficial condition [wound, ulcer] → visible red laser used
- for deep condition of bones & muscles → infrared laser
- for larger areas of soft tissues → cluster probe laser having several diodes.

② **Power** → Power output measured in Watt.
Therapeutic laser beam is quite small, mW is used.

③ **Energy** → Energy delivered to treatment tissue is expressed in Joules.

Energy (J) = Power (W) × Time (sec)

④ **Power density** → Power density decreases as the area b/w tip of applicator and part to be treated increases.

Power density = Incident power / area in cm^2

⑤ **Energy density** →

$$\text{Energy density} = \frac{\text{Power (W)} \times \text{Time (sec)}}{\text{Area } (cm^2)}$$

Dosage of laser therapy is calculated in terms of energy density, expressed in J/cm^2.

MEDICALL ONESHOT

Indication

- Wound healing
- Necrosis
- Burnt
- Soft tissue injuries
- Traumatic injuries
- Bursitis
- Tendinopathies
- Gingivitis
- Muscle spasm
- Tensile strength of tissue
- Tennis elbow (Lateral epicondylitis)
- Golfer's elbow
- Supraspinatus tendinitis
- Ankle sprain
- Osteoarthritis
- Rheumatoid arthritis
- Ankylosing arthritis
- Pyogenic arthritis
- Plantar fascilitis
- Herpes Zoster or Post Herpetic neuralgia
- Reduction of oedema
- Acute pain
- Chronic pain
- Haematoma

Contraindication

- Do not radiate the eye directly.
- Do not use in pregnancy.
- Do not use on infected tissue.
- Do not use over hemorrhagic area
- Do not use with patients who are photosensitive.

Precautions

Poor results may ensure in those patients :—

- Extreme age
- Under heavy medication
- With scar tissue
- With extremely dry skin
- With active infection