REVIEW OF CONTRIBUTION OF LASER TECHNOLOGY IN MODERN SOCIETY

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Abstract : Since the discovery of first laser in 1960 laser has been put into various fields for the development of society. The laser technology based both on wave or particle characteristics of light and light matter interaction. The facility for laser technology at institutions provides enormous opportunity to the scientists and research scholars involved in various research activities. For the development of optical integrated circuit and future optical communication system it is essential to make indigenously produced lasers. In this article, an attempt has been made to highlight the contribution of laser technology in various sections of modern society.

Index Terms **- Laser technology, optical integrated circuits, industrial field**

I. INTRODUCTION:

The laser is an optical device which produces monochromatic, highly directional, intense beam of light. Due to these unique characteristics of laser light it has many wonderful applications in modern society. The production of laser is based on fundamental principle of stimulated emission. The thorough laser action takes place in resonant cavity which consists of active medium enclosed between two end mirrors. The entire system is equipped with pump which is used for excitation purposes. Laser has enormous applications in the field of medical, defense, consumer electronics, information technology, communication etc. The use of laser technology opens the gate for more research oriented fields and upgrade existing facilities. Today more and more new lasers are constructed which fulfill current and future demands of modern society.

II. LASER TECHNOLOGY:

In the last decade laser technology has spread its wings from one corner to another corner in each technological field .The sole emphasis is to create more and more powerful lasers with compact size. The researchers at IIT Kharagpur are working has fibre optics lab, high power semiconductor lasers, integrated optics lab, etc. International School of Photonics (ISP), Cochin has facility like ultra-fast Ti-sapphire laser. Indian Institute of Technology, Guwahati (IITG) has Q switched high power Nd:YAG laser, laser ablation set-up, multiple beam interferometry set-ups, fiber optics communication set-up etc.

III. CONTRIBUTION OF LASER TECHNOLOGY:

3.1 LASER IN SCIENTIFIC RESEARCH:

Tremendous activities are going in following areas of laser interaction, plasma diagnostics, optical interferometry, opto electronics. In Raman Research Institute, Bangalore the interests have widened to include laser cooling and trapping of atoms, study of ultrafast processes and intense laser-matter interactions. Raja Ramanna Centre for Advanced Technology, Indore (RRCAT) engaged in R & D in non-nuclear front line research areas including various types of lasers, laser related components and laser-based instruments

3.2 MEDICAL APPLICATIONS:

The most revolutionary application of laser is in the field of Medical sciences, Whether the case of neuro surgery, hair & skin treatment, oral surgery, oncological surgery modern laser technology is extensively used. CAT has been developing CO_2 lasers for surgery and nitrogen laser for treatment of tuberculosis. CAT has taken up development of analytical instruments laser fluorimeter for detection of low concentration of uranium in water samples. This instrument uses a nitrogen laser to excite fluorescence in uranium source. The intensity of this fluorescence is a direct indication of the concentration of uranium in water. Electro phoretic light scattering technique is being used to differentiate electro kinetically diseased blood cells. In IITM work has been initiated on monitoring chest movements by holographic and speckle interferometry with a view to get diagnostic information and cardiac displacements or mal functions.

3.3 OPTICAL COMMUNICATION:

The property of laser beam to focus on to very small spots and to switch them on and off billions of times per second makes lasers important tools in telecommunications and information processing. In laser supermarket scanners, a rotating mirror scans a red beam while clerks move packages across the beam. Optical sensors detect light reflected from striped bar codes on packages, decode the symbol, and relay the information to a computer so that it can add the price to the bill. Audio compact discs, using infrared lasers, were introduced around 1980; CD-ROMs (compact disc read-only memory) for computer data soon followed. Newer optical drives use more powerful lasers to record data on light-sensitive discs called CD-R (recordable) or CD-RW (read/write), which can be played in ordinary CD-ROM drives. DVDs (digital video, or versatile, discs) work similarly, but they use a shorter-wavelength red laser to read smaller spots, so the discs can hold enough information to play a digitized motion picture.

3.4 MILITARY APPLICATIONS:

Scientists have shown that lasers can concentrate extremely high powers in either pulses or continuous beams. Major applications for these high- power levels are fusion research, nuclear weapons testing, and missile defense. Extremely high temperatures and pressures are needed to force atomic nuclei to fuse together, releasing energy. Intense laser pulses could theoretically produce these conditions by heating and compressing tiny pellets containing mixtures of hydrogen isotopes, which suggests using these “micro-implosions” both to generate energy for civilian use as well as to simulate the implosion of a hydrogen bomb, which involves similar processes. Since then, a series of lasers have been built to test and refine these theories. In 1970, military laser range finders were developed to measure the distance to battlefield targets accurately. Military researchers have tested high energy lasers for use as weapons on land, at sea, in the air, and in space, although no high-energy lasers have

been placed in orbit. Experiments have shown that massive lasers can generate high powers; however, tests have also shown that the atmosphere distorts such powerful beams, causing them to spread out and miss their targets. These problems have slowed research on laser weapons, though interest continues in laser developments to defend against smaller-scale missile attacks.

3.5 MATERIAL PROCESSING APPLICATIONS:

Laser welding is suitable for welding dissimilar metals. Using the 4 KW high power CO_2 laser, CAT scientists have successfully cladded an even harder material on the blades. Similarly, a technique was developed to improve ceramic coating to turbine blades by laser glazing. In the area of surface modification of materials by high power laser, research and development work is being carried out at defense metallurgical Research Laboratory (DMRL). Using a 5kW CO_2 laser, a variety of processes such as hardening, alloying and melting of steels, Ti alloys, Al alloys and ceramics are being developed to prevent from erosion and corrosion. In IITM grinding wheels of SiC/Al_2O_3 have been dressed using Nd: YAG laser radiation. In BARC a variety of special problems of nuclear reactor technology are being handled by laser materials processing. Work on surface hardness enhancement of aluminum alloys and on erosion of polymers has been initiated in IITK.

IV CONCLUSION:

The growth of laser technology with time has brought tremendous change in every front of modern society. The cutting edge technology of the laser shows tremendous development in medical field , military defense, industrial from, telecommunication etc. with the passage of time more and more vibrating changes are required to happen which one definitely change the course of development in modern society

REFERENCES:

[1] Shrivastava S K.2016. Status of Laser Technology In India. International Journal of Innovative Research and Advanced Studies (IJIRAS); 3(10): 181-185.
[2] http://web.iitd.ac.in/
[3] http://www.photonics.cusat.edu/
[4] http://www.iitkgp.ac.in/
[5] http://www.prl.ernet.in/
[6] http://www.phy.iitb.ac.in/
[7] htttp://www.worldoflasers.com/
[8] **http**://www.iitg.ernet.in/
[9] http://www.phy.iitb.ac.in/
[10] http://www.rri.res.in/
[11] **http**://www.sgsits.ac.in/
[12] **http**://physics.unipune.ernet.in/
[13] http://www.physics.dauniv.ac.in/
[14] http://www.ipr.res.in/