Ref. No **Ex/PG/LST/T/122A/2019**

M.TECH. LASER SCIENCE AND TECHNOLOGY FIRST YEAR SECOND SEMESTER - 2019

SUBJECT: LASER DAMAGE OF MATERIALS

Time: Three hours. Full Marks : 100

Answer any *five* questions

No. of questions		Marks
1.	Explain how the LIDT of coated optics is governed by the surface, material properties of the substrate and the properties of the optical coating. Derive the local heating in the surface of a ND glass caused by a single laser pulse, using the measured absorption coefficients. 15+5	
2.	How could you define Laser Induced Damage Threshold (**LIDT**) of an optical component. Show the variation of Damage Probability with laser fluence (J/cm^2) for nanosecond pulses and how we can get an idea of defining LIDT from the plot. Describe 1-on-1 test method for LIDT determination. What are the basic differences of 1-on-1 and R-on-1 techniques? 6+4+8+2	
3.	a) Explain with a graph how maximum power handling capacity of glass fiber power changes with fiber diameter and pulse length. b) Explain the factors on which the maximum power or energy transmitted down an optical fiber depends. c) What are the basic differences between optical and acoustic phonons? 8+8+4	

4. a) Compute the power density of a 50 mW Nd: Yag laser at 1064 nm with a 0.8 mm beam diameter. Why the damage threshold at the second harmonic (532 nm) of Nd:YAG laser will be half of that at 1064 nm?

b) How the damage mechanisms in optical materials occur when intensity of light beam starts from low to very high values.

c) Explain Self-focusing and Birefringes.

5+1+8+6

5. Explain in details the mechanisms involved in laser induced damage processes?

What are the similarities and differences between Thermal absorption and Dielectric breakdown processes.

15+5

6. How ablation and luminous plasma processes are involved in laser induced breakdown spectroscopy **(LIBS)** ?

What are the main advantages of LIBS over other analytical methods?

Draw a diagram for the experimental set up of obtaining LIB spectra of a solid sample.

Why pellets formations of soil sample is required to obtain LIB spectra of soil, a heterogeneous sample. What important information we can get from the LIB spectra of the soil?

7+3+ 3+7