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WT—161—2024

FACULTY OF SCIENCE

M.Sc. (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2024

PHYSICS

PH-17

(Basics of Lasers and Devices)

(Saturday, 14-12-2024) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—75

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Symbols used in the questions have their usual meaning.

(*iii*) *All* questions carry equal marks.

1. Explain absorption, spontaneous emission and stimulated emission processes in detail. 15

Or

(*a*) Derive Einstein's relation

$$B_{12} = B_{21} = \frac{C^3}{8\pi h v^3 \mu^3} A_{21}$$ 8

(*b*) What is population of a level ? Show that under thermal equilibrium population of higher level cannot exceed population of lower level. 7

P.T.O.

2. Derive rate equation for two level system. 15

Or

(*a*) Explain optical resonator in detail. 8

(*b*) Explain natural and collision broadening mechanism. 7

3. Describe structure and working of carbon dioxide laser. 15

Or

(*a*) Explain Nd : YAG laser 8

(*b*) Explain population inversion in semiconductor lasers. 7

4. Explain applications of lasers in nuclear energy for isotope separation, nuclear fission and nuclear fusion. 15

Or

(*a*) Write applications of lasers in medicine. 8

(*b*) Which are applications of lasers in electronic industry. 7

5. Write short notes on the following (any *three*) : 15

(*i*) Planck quantum theory

(*ii*) Properties of laser modes

(*iii*) Diode laser operation

(*iv*) Application of lasers in industry.