



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR**

**FOURTH YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

FOR THE DEGREE OF BACHELOR OF SCIENCE IN PHYSICS

COURSE CODE: SPH 460E

COURSE TITLE: INTRODUCTION TO LASERS

DURATION: 2 HOURS

DATE: 27/7/ 2018 TIME: 9 – 11AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 4 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

QUESTION ONE (30 MARKS)

- (a) Define the following terms
- (i) Stimulated absorption (2 marks)
 - (ii) Spontaneous emission (2 marks)
- (b) Differentiate between the following
- (i) Stable and Unstable resonator (2 marks)
 - (ii) Concentric and confocal resonator (2 marks)
 - (iii) Acoustic and saturable absorber Q-Switching. (2 marks)
- (c) Define the term laser (2 marks)
- (d) Write short notes on longitudinal modes of a resonator (5 marks)
- (e) From the basic principles of beam parameters, determine both Rayleigh range and confocal parameter (5 marks)
- (f) Determine the peak intensity at an axial distance z from the beam, Differentiate between peak and average intensities (5 marks)
- (g) State any three applications of Q-switched lasers (3 marks)

QUESTION TWO (20 MARKS)

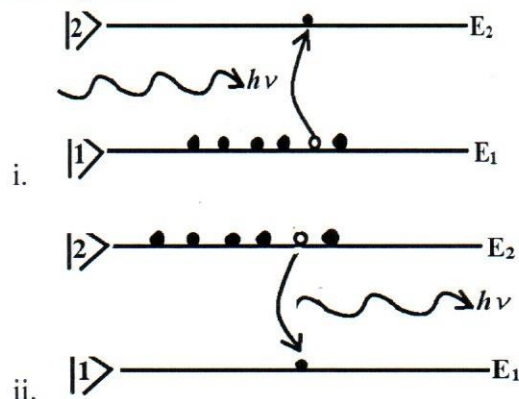
Describe the different ways in which a laser can be mode locked (20 marks).

QUESTION THREE 20 MARKS.

- a) State and explain the properties of Light emitted by lasers (16 marks)
- b) Explain the two categories of Q-Switching (4 marks)

QUESTION FOUR (20 MARKS)

- (a) Explain what is happening in the following figures naming each type of the radiative process (6 marks)



- (b) State the four factors that rate of decay in a stimulated emission is proportional to: (4 marks)
- (c) Using appropriate diagram, explain the four functional elements of a laser (10 marks)

QUESTION FIVE (20 MARKS)

- (a) Briefly describe the classical theory of light interaction with matter (15 marks)
- (b) State and explain the two types of coherence (5 marks)