



M 6153

Reg. No. :

Name :

VI Semester B.Sc. Degree (CCSS – Reg./Supple./Improv.)

Examination, May 2014

CORE COURSE IN PHYSICS

6B12 PHY : Photonics

Time: 3 Hours

Total Weightage : 30

SECTION – A

Choose the correct answer, **each** bunch carries a weightage of **one**.

1. i) A laser is a coherent source because it contains
 - a) Many wavelengths
 - b) Uncoordinated wave of particular wavelength
 - c) Coordinated waves of many wavelength
 - d) Coordinated wave of a particular wavelength
 - ii) The population inversion in Ruby laser is achieved by
 - a) Electrical discharge
 - b) Optical pumping
 - c) Inelastic atomic collision
 - d) Direct conversion
 - iii) In an optical fiber the core material is of refractive index 1.6 and that of cladding is 1.3. The acceptance angle is
 - a) 45
 - b) 60.5
 - c) 121
 - d) 135
 - iv) Holography is a _____ step method of optical imagery.
 - a) One
 - b) Two
 - c) Three
 - d) Multi
2. i) Propagation of light wave in an optical fiber is based on
 - a) Dispersion
 - b) Refraction
 - c) Total internal reflection
 - d) Interference

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- ii) Optical fibre sensors are used to measure
- a) Pressure
 - b) Temperature
 - c) Current
 - d) All of the above
- iii) Natural broadening of the spectrum is a consequence of
- a) Uncertainty principle
 - b) Compton scattering
 - c) Exclusion principle
 - d) None
- iv) The electric field of a light wave is given by $E = E_0 e^{-j\omega t}$. Here $e^{-j\omega t}$ represents
- a) Phase
 - b) Amplitude
 - c) Frequency
 - d) None of the above
- (2×1=2)

SECTION – B

Answer **any 6** questions; **each** question carries a weightage of **1**.

3. What is meant by pumping? Name any two pumping methods.
4. What do you mean by collision broadening?
5. Compare a photograph and hologram.
6. What is numerical aperture?
7. What are fibre optic sensors?
8. What is material dispersion?
9. What are the different types of photodetectors?
10. What do you mean by the depth of focus of a confocal microscope? (6×1=6)

SECTION – C

Answer **any 9** questions; **each** question carries a weightage of **2**.

11. Explain the term population inversion. How is it achieved?
12. Explain a Nd:YAG laser.



13. Give 4 applications of holography.
14. How will you reconstruct the image from a hologram ?
15. The refractive indices of core and cladding of an optical fiber are 1.54 and 1.50 respectively. Calculate the numerical aperture and acceptance angle of the fibre.
16. Explain pulse dispersion in a step index fiber. Derive an expression for the time delay between the lowest order and the highest order modes in a step index fiber.
17. Explain how the DVD differs from a CD.
18. Explain the double crucible method of fibre manufacture.
19. The length of a laser tube is 150 mm and the gain factor of the laser material is 0.0005/cm. If one of the cavity mirrors reflects 100 percent of light that is incident on it, what is the required reflectance of the other cavity mirror.
20. At what temperature are the rates of spontaneous and stimulated emission equal. Assume $\lambda = 5000\text{\AA}$.
21. Write a note on the working of any one type of optical sensor.
22. Briefly explain the working principle of a semiconductor laser. (9×2=18)

SECTION – D

Answer **any one** of the following, **each** carries a weightage of 4.

23. Explain with a schematic diagram the working of a He-Ne laser.
 24. Discuss the advantages and disadvantages of optical fibers over the conventional communication transmission media. (1×4=4)
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