



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH (BME)/SEM-7/BME-704A/2009-10  
2009**

**LASERS AND FIBRE OPTICS IN MEDICINE**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) The basic principle of fibre optics is
  - a) Reflection
  - b) Refraction
  - c) Total internal reflection
  - d) none of these.
- ii) Thermal effect of Laser on tissue is normally a
  - a) 4-step process
  - b) 3-step process
  - c) 1-step process
  - d) 2-step process.
- iii) Dispersion problem of optical fibre can be overcome by using
  - a) Cylindrical fibre
  - b) Graded index fibre
  - c) None of these
  - d) All of these.



- iv) The term 'single frequency operation' of Laser is related to the property of Laser
- a) Monochromaticity      b) Coherency  
c) Directionality      d) None of these.
- v) Laser light travels in a fibre optic at  $3.2 \times 10^8$  m/s. What is the refractive index of the fibre ?
- a) 1.55      b) 1.67  
c) 2.89      d) None of these.
- vi) In population inversion
- a) no atoms are excited  
b) more atoms are excited  
c) less atoms are excited  
d) all atoms are excited.
- vii) Electromagnetic field and optical fibre do not show any interference because of their
- a) transparency      b) non-conductivity  
c) conductivity      d) none of these.
- viii) Nd-YAG Laser finds application in
- a) Neuro-surgery      b) Dermatology  
c) Gynaecology      d) all of these.
- ix) Which one of the following is most appropriate ?
- a) Core refractive index ( $\mu$ ) of fibre optic is more than cladding  $\mu$   
b) Core  $\mu$  is less than cladding  $\mu$   
c) Core  $\mu$  & cladding  $\mu$  are equal to each other  
d) None of these.
- x) He-Ne Laser shows
- a) Two-step emission      b) Three-step emission  
c) Four-step emission      d) none of these.



**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* from the following.  $3 \times 5 = 15$

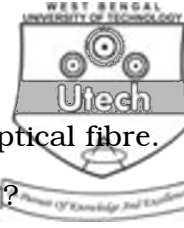
2. Write the basic working principle of Gas Laser action with proper diagram.
3. How Laser is used in dermatology ?
4. Write the basic working principle of 'Optical fibre' with diagram. What are the advantages of optical fibre ?  $3 + 2$
5. How are continuous wave ( CW ) and pulsed wave laser formed ? Why Ruby Source is not used for CW laser production ?
6. What are the safety precautions to be taken during laser operation as well as laser surgery ? Why wavelength selection is so important in laser surgery ?  $3 + 2$
7. What do you mean by 'Population Inversion' in Laser production ? Explain with different energy state diagrams.

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

8. a) What are the optical properties of living tissues ? Briefly explain the Laser-tissue interaction by considering the terms 'Thermal effect' and 'photo-thermal ablation'.  $8$
- b) Write the names of at least five different Lasers with specification (  $\lambda$  ) and their applications in medical field.  $7$



9. a) Write down the construction details of optical fibre. 3
- b) How is the signal transmitted through it? 4
- c) A silica optical fibre with a core diameter large enough to be considered by ray theory to analysis which has core refractive index of 1.67 and cladding refractive index of 1.52. Determine,
- i) the critical angle ( $\theta_c$ ) at core cladding interface
  - ii) numerical aperture of the fibre
  - iii) the acceptance angle of the fibre. 8
10. a) Briefly discuss about the coherency, directionality and monochromaticity of Laser. 4
- b) Find out the ratio between spontaneous and stimulated emission discovered by Albert Einstein. 8
- c) What do you mean by polarization of Laser emission? 3
11. a) Write the operation details of Nd-YAG Laser production. 5
- b) What is the full form of PDT? Write down the basic principle of it. 1 + 4
- c) What is selective photothermolysis? How it is performed? 1 + 4
12. a) Briefly discuss the Q-switching technique in Laser application. 5
- b) Write basic principle of Laser by showing different energy level diagram. 10
13. a) Explain photoablative and photodynamic effects of Laser. 5
- b) With a suitable schematic diagram, discuss the working principle of CO<sub>2</sub> laser. 5
- c) Discuss briefly about Laser flow cytometry. 5