

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

B.Tech-I Semester (BT/BI)

COURSE CODE (CREDITS): 18B11PH112 (04)

MAX. MARKS: 35

COURSE NAME: Basic Engineering Physics-I

COURSE INSTRUCTORS: Dr. Ragini Raj Singh

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.1.(a) Differentiate between spontaneous and stimulated emission. [CO: 1, Marks: 2]

(b) Discuss construction and working of Ruby laser. [CO: 2, Marks: 2]

Q.2.(a) What are the main types of optical fibers on the basis of [CO:2, Marks:4]

(i) Material;

(ii) Number of modes; and

(iii) Refractive index profile

Q.3.(a) What are the basic attenuation mechanisms in optical fibers. Discuss any one type in detail.

[CO: 3, Marks: 3]

(b) What do you understand by dispersion in optical fibers? What are its types? Discuss Intermodal delay with the help of diagram.

[CO: 3, Marks: 3]

Q.4. (a) Why do we need different materials in biomedical field. What are the main types of materials used as biomaterials, also discuss the characteristics of each type. [CO: 4, Marks: 3]

(b) Discuss in short [CO: 4, Marks: 3 x 1= 3]

(a) Toxicology and Biocompatibility

(b) Dependence on anatomical sites of implantation

(c) Industrial involvement and Ethics

Q. 5. Solve the following: [CO: 5, Total Marks: 15]

(a) Calculate the divergence of light beam issuing out by He-Ne laser which produces spot diameters of 4 mm and 6 mm at 1 m and 2 m distances respectively. [Marks: 1.5]

(b) Calculate the relative population of the energy levels N_1 and N_2 at 300 , $\lambda = 600$ nm. [Marks: 1.5]

(c) A laser beam has a power of 50 mW. It has an aperture of 5×10^{-3} and wavelength 7000 Å. The beam is focused with a lens of focal length of 0.2 m. Calculate the areal spread and intensity of image. [Marks: 1.5]

(d) An optical fibre has the core refractive index $n_1 = 1.36$ and the relative difference in index $\Delta = 0.025$. Find the (i) Refractive index of cladding; (ii) Numerical aperture (iii) Acceptance angle [Marks: 1.5]

(e) Calculate the number of modes at 830 nm in a GI fibre having a parabolic index profile and core radius of 25 μm with core and cladding indices 1.50 and 1.48, respectively. How does this compare to an SI fibre. [Marks: 3]

(f) An SI fibre has core and cladding refractive indices as 1.466 and 1.460, respectively. Calculate the maximum radius allowed for the fibre, if it is supporting only one mode at a wavelength of 1200 nm. Also, calculate the numerical aperture, the critical angle. [Marks: 3]

(g) An optical fibre of length 150 m has input power of 10 μW . Calculate the loss in dB/m. [Marks: 2]

(h) How much will a light pulse spread after travelling along 6 km of an SI fibre, whose numerical aperture is 0.280 and $n_1 = 1.48$? [Marks: 1]

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