Engineering Physics
06PHY12
Assignment 5

Answer the following questions

1. What is Superconductivity? Describe *type-I* and *type-II* superconductors. [8]
2. Explain in brief *type-I* and *type-II* superconductors. How does a superconductor differ from a normal conductor? [10]
3. Discuss *BCS theory* of super conductivity. [6]
4. Describe how Cooper pairs are formed and explain the salient features of super conductivity. [5]
5. Explain *Meissner effect*. Illustrate with an example. [5]
6. Give a brief account of high temperature superconductors. [4]
7. Explain any two applications of superconductivity. [5]
8. What are SQUIDS? Give a brief account of their applications. [5]
9. Write short note on *Maglev* vehicles. [4]
10. Using total internal reflection concept, obtain an expression for the *acceptance angle* in an optical fiber. [6]
11. With a neat diagram derive an expression for *numerical aperture* and condition for propagation in optical fiber. [8]
12. Explain the different types of optical fiber with the refractive index profile and mode propagation sketches. [7]
13. What is *attenuation* in an optical fiber? Explain the attenuation mechanisms. [5]
14. Explain fiber-optic communication. Describe point to point communication system using optical fibers with the help of a block diagram. [8]
15. Explain the advantages and disadvantages of optical fibers when used for communication. [4]

Solve the following problems

1. An optical fiber has a core material with refractive index 1.55 and its cladding material has a refractive index of 1.50. Calculate its numerical aperture, the acceptance angle and also the fractional index change. [5]
2. Calculate the numerical aperture, fractional index change and V-number for a fiber of core diameter $40\mu m$ and with refractive indices of 1.55 and 1.50 respectively for core and cladding. The wavelength of the propagating wave is $1400\,nm$. Assume that the fiber is in air. [5]
3. The attenuation of an optic fiber is $-3.6\,dB/km$. What is the fraction of light intensity that remain after (i) $1\,km$ and (ii) $3\,km$? [5]
4. A fiber with an input power of $9.0\,\mu W$ has a loss of $1.5\,dB/km$. If the fiber is $3000\,m$ long. what is the output power? [5]

5. Find the attenuation in an optical fiber of length $500\,m$, when the light signal power $100\,mw$ emerges out of the fiber with $90\,mw$. [5]

6. The attenuation of light in an optical-fiber is estimated as $2.2\,dB/km$. What fractional initial intensity remains after $2\,km$ and $6\,km$? [4]

7. Calculate the number of modes an optical fiber will transmit given the following data $n_{core} = 1.50$, $n_{clad} = 1.48$, core radius $= 50\,\mu m$, wave length of light $= 1\,\mu m$. [4]

8. A multi mode step-index fiber with a core diameter of $80\,\mu m$ and relative refractive index difference of 1.5% is operating at $0.85\,\mu m$. If the core refractive index is 1.48, calculate number of guided modes. [4]

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