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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST - 2 EXAMINATION, APRIL 2019
B.Tech VIII Semester

Course Code: 11B1WEC834 MAX. MARKS: 25
Course Name: Optical Communication Systems
Course Credits: 03 MAX. TIME: 1.5 Hrs.

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

Q1. A planar waveguide is formed from a 10-μm-thick core film of dielectric material of refractive index 1.5 sandwiched between the cladding slabs of a similar material for which the relative refractive index difference with respect to core is 0.02. Calculate (i) the V-parameter and the number of TE modes of propagation that the guide supports at a wavelength of 1.55μm. (ii) Estimate the propagation parameters u_m and w_m for different values of m and hence estimate b_m and β_m for each. (Refer Fig.1at the back) **[5 Marks]**

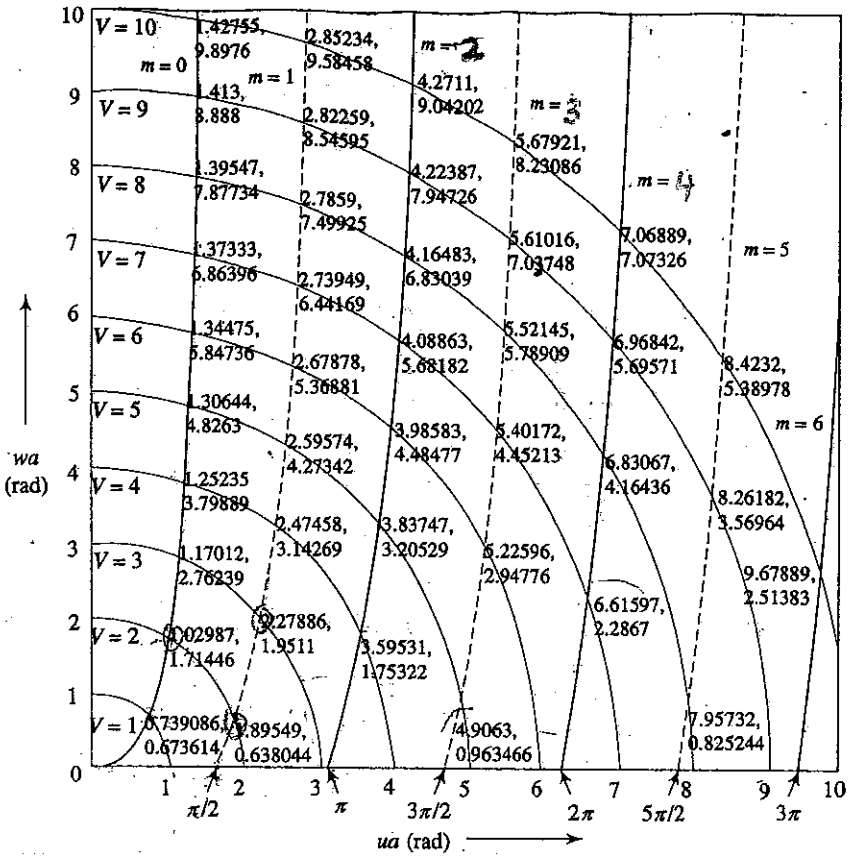
Q2. A step-index single mode fiber exhibits material dispersion of 6 ps/nm/km at an operating wavelength of 1.55 μm. Assume that n_1=1.45 and Δ=0.5%. Calculate the diameter of the core needed to make the total dispersion of the fiber zero at this wavelength. **[5 Marks]**

Q3. Define modal birefringence and beat length of a single mode fiber. Explain the effect of modal birefringence on pulse propagation in single mode fibers. **[5 Marks]**

Q4. Derive an expression for confinement factor G for a wave propagating in a planar waveguide. **[5 Marks]**

Q5. Calculate the injection efficiency of a GaAs diode in which $N_a=10^{23}/m^3$ and $N_d=10^{21}/m^3$. Assume that at RT=300K, $\mu_e=0.85 m^2/V/s$ and $\mu_h=0.04 m^2/V/s$ and $L_e=L_h$. **[3 Marks]**

Q6. Calculate the total pulse broadening due to material dispersion for a graded-index fiber of total length 80km when a LED emitting at wavelength 1300nm is coupled to the fiber. Assume $\Delta\lambda$=30nm. The material dispersion parameter of the fiber is -2.8ps/nm/km. **[2 Marks]**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V = 9
V = 8
V = 7
V = 6
V = 5
V = 4
V = 3
V = 2
V = 1
m = 0
m = 1
m = 2
m = 3
m = 4
m = 5
m = 6
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1.413, 8.888
1.39547, 7.87734
1.37333, 6.86396
1.34475, 5.84736
1.30644, 4.8263
1.25235
3.79889
1.17012, 2.76239
1.02987, 1.71446
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wa (rad)
ua (rad)
π/2
π
3π/2
2π
5π/2
3π

Fig. 1