JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

B.Tech-V Semester (All Branches)

COURSE CODE (CREDITS): 25B1WPH532 MAX. MARKS: 15

COURSE NAME: OPTOELECTRONIC MATERIALS AND DEVICES

COURSE INSTRUCTOR: SKK MAX. TIME: 1 Hour

Note: *(a) All questions are compulsory.*

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

(c) Use of calculator is allowed

Q.No	Question	CO	Marks
Q1	(a) What is the importance of reverse bias for photodetection in PiN and Photo Diodes? (b) Calculate excess noise current in a Si Avalanche diode (k=0.03) having internal gain of 30 with bandwidth of 90 MHz having primary photo current of 100 nm and dark current of 20 nm.	1	1+2
Q2	(a) Core of a step index fibre is made of high density material than cladding, Why. Using ray diagram show how does it help in propagation. (b) Consider a fiber with a 100μm core diameter and a 140μm cladding diameter. If $n_1 = 1.48$ and $\Delta = 1\%$, calculate the V-parameter if the operating wavelength is 900 nm?	2	2+2
Q3	(a) Consider an 8/125 single mode fiber operating at 1300 nm with a loss of 0.8 dB/km. The linewidth of the source is 0.013 nm. Calculate the threshold power level for Raman & Brillouin scattering in the fiber. (b) Calculate Lateral efficiency of 8/100 Step index fibre, if Lateral misalignment is 0.5 micrometres	2	2+1
Q4	Write Short notes on (a) Photomultiplier (b) Numeric Aperture (c) Pulse Dispersion	1 & 2	3
Q5	What is macro bending loss in optical fibers. How is cladding related to bending loss of fiber.	2	2

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Some important equation

$$NA = \sqrt{n_1^2 - n_2^2} \qquad \Delta = \frac{n_1^2 - n_2^2}{2 n_1^2}$$

$$V = \frac{2\pi a}{\lambda}(NA)$$

$$P_R = (23.6 \times 10^{-2})\, a'^2 \lambda' \alpha \qquad \gamma_c = \frac{3 n_2 \lambda}{4\pi (NA)^3}$$

$$P_B = (17.6 \times 10^{-3})\, a'^2 \lambda'^2 \alpha \Delta\nu \qquad \alpha_b = c_1 e^{-c_2 \gamma_c}$$

$$\eta_T = \eta_{NA}\, \eta_\gamma\, \eta_g$$

$$L_T = L_{NA} + L_\gamma + L_g$$

$$\eta_{SI} = \frac{2}{\pi}\cos^{-1}(d/a) - \frac{d}{\pi a}\sqrt{1 - \left(\frac{d}{2a}\right)^2}$$

$$\eta_{gI} = 1 - \left(\frac{2d}{\pi a}\right)\left(\frac{g+2}{g+1}\right)$$

$$\eta_{SI} = \left(\frac{1}{1 + (S/a)\tan\theta_c}\right)^2 \approx 1 - \frac{S\sqrt{2\Delta}}{2a}$$

$$\eta = \frac{\sin\phi}{\sqrt{2\pi\Delta}} \cdot \frac{\Gamma(2/g + 2)}{\Gamma(2/g + 3/2)} \qquad S_{mat} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}$$

$$i_n^2 = 2q(I_q + I_d) M^2 F B$$

$$M = \frac{1}{1 - \left(\frac{V_b}{V}\right)^n} \qquad F = kM + (1-k)\left(2 - \frac{1}{M}\right)$$

$$\eta = N_{pe} / N_{photon} \qquad P_s = \frac{e\lambda}{h_c}\eta$$