PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST - 1

Even Semester: 2018-19   **Date**: 06 March 2019

Course Code: ECE 303   **Time**: 1 Hour

Course Name: Optical Communication   **Max Marks**: 40

Programme & Sem: B.Tech (DE) & VI Sem   **Weightage**: 20%

Instructions:
(i)   Read the question properly and answer accordingly.
(ii)   Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer **both** the Questions. **Each** question carries **four** marks.   (2Qx4M=8)

1. Distinguish between Micro bending & Macro bending with proper diagram & expressions if any.
2. Describe about types of Fiber Material.

Part B

Answer **both** the Questions. **Each** question carries **eight** marks.   (2Qx8M=16)

3. Based on index profile differentiate between step index & Graded index Optical fibers.
4. A step index fiber has Numerical Aperture of 0.35 & relative index difference of 0.01. If the core diameter is 10 μm & the wavelength is 1550 nm, then calculate: i) Core & Cladding Refractive Index, ii) Critical Angle, iii) V-Number iv) No. of guided modes.

Part C

Answer the Question. Question carries **sixteen** marks.   (1Qx16M=16)

5. Define the following terms with correct mathematical expressions & diagram wherever necessary:
   i)   V-Number.
   ii) Cut-off Wavelength.
   iii) Mode Field Diameter.
   iv) Fiber Birefringence & Fiber Beat Length.

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST - 2

Even Semester: 2018-19

Course Code: ECE 303

Course Name: Optical Communication

Programme & Sem: B.Tech & 6th Sem

Date: 16 April 2019

Time: 1 Hour

Max Marks: 40

Weightage: 20%

Instructions:
(i)   *Read the question properly and answer accordingly.*
(ii)   *Question paper consists of 3 parts.*
(iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer **all** the Questions. **Each** question carries **4** marks.   (2Qx4M=8)

1. Differentiate between LED & LASER.
2. Calculate the critical radius of curvature at which large bending loss occurs in a single mode & multimode fiber with core diameter of 80μm with core refractive index of 1.5, relative index difference of 0.4% & an operating wavelength of 1550 nm.

Part B

Answer **all** the Questions. **Each** question carries **8** marks.   (2Qx8M=16)

3. Along with the band diagram describe the working of LED with the significance of hetero junction structure LED. Calculate the attenuation in dB/Km if a fiber is of length 8 Km, optical power launched is 250 μW & output power is 20 μW.

4. .A double hetero junction InGaAsP LED emitting at a peak wavelength of 1550 nm has radiative & non-radiative recombination times of 30ns & 90ns respectively. The drive current is 40 mA. Find: a) Internal quantum efficiency & Internal Power Level, b) If the refractive index is 4, find power emitted from the device.

Part C

Answer **all** the Questions. **Each** question carries **16** marks.   (1Qx16M=16)

5. Derive Rate Equation for LASER with necessary band diagrams & show how population inversion is necessary for the lasing to start. Describe Lasing action in 3-Level system.

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Even Semester: 2018-19   **Date**: 23 May 2019

Course Code: ECE 303   **Time**: 3 Hours

Course Name: Optical Communication   **Max Marks**: 80

Program & Sem: B.Tech & 6th Sem.   **Weightage**: 40%

Instructions:
(i)   *Read the question properly and answer accordingly.*
(ii)   *Question paper consists of 3 parts.*
(iii)   Scientific and Non-programmable calculators are permitted.

Part A

Answer **all** the Questions. **Each** bit carries 2 marks.   (1Qx20M=20M)

1.
   a. Plastic fibers are less widely used than glass fibers. State whether the statement is true or false. Justify your answer.
   b. In the structure of fiber, the light is guided through the core due to _____ Comment on your answer.
   c. When the input and output power in an optical fiber is 120μW & 3μW respectively and the length of the fiber is 8 km. What is the signal attenuation per km for the fiber?
   d. A single mode fiber has refractive indices n1=1.50, n2= 2.23, core diameter of 8μm, wavelength=1.5μm, cutoff wavelength= 1.214μm. Find the radius of curvature?
   e. Sharp bends or micro bends causes significant losses in fiber. State true or false. Justify your answer.
   f. If a step index fiber operates at 1400 nm with the diameter of about 10 μm, n_1 = 1.30, Δ = 0.80% , V = 3.5, then how many modes will it have?
   g. Rayleigh scattering can be reduced by operating at smallest possible wavelengths. State whether the following statement is true or false. Justify your answer.
   h. The lower energy level contains more atoms than upper level under the conditions of _____. Show the diagram.
   i. For a photo-diode with responsivity of 0.50 A/W & optical power of about 12μW, what would be the value of generated photocurrent?
   j. The overall power conversion efficiency of electrical lens coupled LED is 0.8% and power applied 0.0375 w. Determine optical power coupled into the fiber.

Part B

Answer **all** the Questions. **Each** question carries **8** marks.   (3Qx8M=24M)

2. Explain the working of PN Photo detector with the help of Energy-Band diagram. In what way PIN Photo detector is better than this? An APD has a quantum efficiency of 45% at 1300 nm. Calculate the multiplication factor of the diode if it produces an output photocurrent of 6 µA after Avalanche multiplication for the incident power of 0.3 µW.

3. Write a short note on Optical Coupler with proper diagram & all the loss parameters. A 2×2 Biconical tapered fiber coupler has an input optical power level of 300 µW. The coupler output powers are $P_1 = 150\,\mu W, P_2 = 65\,\mu W, P_3 = 8.3\,nW$. Find: a) Splitting Ratio, b) Crosstalk. C) Excess Loss.

4. Derive an expression for the responsivity of an intrinsic photodiode in terms of the quantum efficiency of the device & the wavelength of the incident radiation. Also find the wavelength at which quantum efficiency & the responsivity are equal. Determine the cutoff wavelength for InP photo detector having band gap energy of 1.35 eV.

Part C

Answer **all** the Questions. **Each** question carries **Y** marks.   (3Qx12M=36M)

5. With proper sketch, Write Short notes on:
    a) Optical Circulator.
    b) Fiber Bragg Grating.

6. Give the definition of bandwidth of a photodiode. What are the factors that restrict the response time of a PN photo diode? Calculate transit time, junction capacitance & time constant of a Silicon PIN Photodiode having depletion region width of 15 µm, cross-sectional area of 0.5 mm², Load Resistance of 10 MΩ, Permittivity of Silicon is $11.8\varepsilon_o$ & saturation velocity of 10^5 m/s.

7. Briefly explain about Erbium Doped Fiber Amplifier with basic principle of operation. Draw the appropriate diagram & mention the advantages & disadvantages.