OFC (EC0305) Question Bank Unit 1-4 & 6

1. Define the Following:
    a. Refractive Index
    b. Reflection
    c. Refraction
    d. Angle of Incidence
    e. Total Internal reflection (TIR)
    f. Critical angle
    g. Small wavelength Limit
    h. Ray Congruence
    i. Meridional Rays
    j. Skew Rays
    k. Numerical Aperture
    l. Tunnel effect
    m. Leaky modes
    n. V- Number
    o. Mode Field Diameter (MFD)
    p. Fiber Birefringence (B_f)
    q. Fiber Beat Length (L_p)
    r. Fiber Loss
    s. Dispersion
    t. Modal delay
    u. Group Velocity Dispersion (GVD)
    v. Bit Rate Distance Product (BL)
2. Explain the concept of Reflection and Refraction using ray diagram. Also illustrate the TIR condition at a glass-air interface and demonstrate the significance of phase change δ occurs in reflected wave.
3. Explain fiber types with neat sketches of index profile and fiber cross section and ray paths. Also mention its dimensions
4. Discuss the rays and modes in an fiber configurations.
5. Explain ray optics representation. Derive an expression for numerical aperture using ray theory.
6. Demonstrate how light wave propagate along a dielectric slab fiber waveguide
7. Illustrate overview of circular waveguides w.r.t optical domain.
8. Explain mode field diameter (MFD), fiber birefringence and fiber beat length in single mode fibers with necessary diagrams and equations.
9. Describe How graded index fiber structure is different from step index fiber with necessary equations
10. Classify the fiber materials. Mention the features of each category.
11. Explain different types of absorption losses in an optical fiber.
12. Describe fiber losses w.r.t:
    a. Scattering
    b. Bending

    c. Core and Cladding
13. Derive an expression for rms pulse broadening due to intermodal dispersion in a step index fiber
14. Derive an expression for pulse spreading due to material dispersion which is a function of wavelength and time delay.
15. Derive an expression for pulse spreading due to waveguide dispersion
16. Explain Intramodal dispersion and Intermodal dispersion.
17. Describe broadening and attenuation of two adjacent pulses as they travel along a fiber.
18. Solve problems based on the following topics:
    a. Calculation of critical angle, NA, V-number, No. of modes (M), % of power available in core & cladding.
    b. Calculation of Modal birefringence
    c. Problems on fiber loss and signal distortion (attenuation, scattering, bending, core-cladding losses, group delay, bit rate -distance product, pulse spreading, and dispersion)
19. Demonstrate the GaAlAs double heterostructure LED. Also highlight the importance of energy band diagram and refractive index profile in each region.
20. Explain the surface emitting LED with neat schematic.
21. Explain how edge emitting LED is different from surface emitting LED.
22. Derive an expression for internal optical power generated by the LED.
23. Describe LED material.
24. Explain Quantum efficiency and LED power with mathematical notations.
25. Solve the problems based on: Quantum efficiency and LED power.
26. State electrical bandwidth, optical bandwidth, electrical 3dB point and optical 3dB point.
27. Solve the problems based on Modulation of an LED.
28. Illustrate the three key transition processes involved in laser action.
29. Explain Fabry perot resonator cavity for a laser diode.
30. Discuss the structure of distributed -feedback (DFB) laser diode.
31. Explain how laser is going to achieve lasing condition and its threshold condition.
32. Demonstrate the architecture of single mode lasers (VCSEL)
33. Illustrate the three types of laser configurations using a built-in frequency selective.
34. Describe the working principles of pin photodiode with circuitry and energy band diagram.
35. Derive an expression for responsivity in terms of quantum efficiency.
36. Problems based on photocurrent, quantum efficiency and responsivity.
37. Explain RAPD.
38. Solve the problems based on APD multiplication factor.
39. Explain how digital signal transmission over an optical data link.
40. Describe the basic sections of optical receiver operation.
41. Explain noise sources and disturbances in optical pulse detection mechanism.
42. Explain generic structure of a transimpedance amplifier in receiver configuration.
43. List the requirements and characteristics of point to point optical links.
44. Explain the system considerations in optical digital link.
45. Demonstrate the link power budget model.

46. Solve the Problems based on Link power budget analysis.
47. Derive an expression for rise time budget analysis.
48. Solve the problems based on rise time budget analysis.
49. Describe SONET/SDH transmission formats and speeds.
50. Explain optical interfaces in optical networks; construct a table of transmission distance and their SONET and SDH designations.
51. Illustrate the working principle of UPSR and BLSR architecture.
52. Explain the generic configuration of a large SONET/SDH network.
53. Discuss the concept of ADM for SONET/SDH applications.
54. Explain how DWDM deployed in SONET/SDH architectures.
55. Distinguish single hop and multi-hop optical networks.
56. Explain shuffle net topology with an example.
57. Problems based on shuffle net topology.
58. Summarize the nonlinearity effects in optical networks.
59. Explain how effective area and length of the fiber will involve in Nonlinearity.
60. Describe how SRS is changing the input signal power over a distance travelled in fiber.
61. State and explain SBS in optical networks.
62. Explain the reason behind SPM, XPM and FWM are involved in optical networks.
63. Solve the problems based on SRS, SBS, SPM, XPM and FWM.

- **For unit 5 please refer Assignment 3 in Google classroom**
- **Refer prescribed book:**
  - **Gerd Keiser (third edition) Optical Fiber Communications.**
  - **SLE component not included in the question bank.**