



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIFTH YEAR SECOND SEMESTER EXAMINATIONS FOR BACHELOR OF ELECTRICAL AND ELECTRONICS ENGINEERING

EEE 529: OPTIC FIBER COMMUNICATION

DATE: 11/12/2017

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Discuss briefly the evolution of optic fiber (4 marks)
- b) A light ray is incident from medium-1 to medium-2. If the refractive indices of medium-1 and medium-2 are 1.5 and 1.36 respectively then determine the angle of refraction for an angle of incidence of 30° . (2 marks)
- c) Define the term attenuation hence Compute the length over which Power is decreases by 50 for a low loss fiber which has an average loss of 3 dB/km at 900 nm. (3 marks)
- d) Distinguish between micro bending and macro bending in reference to optical fiber (2 marks)
- e) Highlight the features of Edge Light Emitting Diode (ELED) (3 marks)
- f) Outline the advantages and disadvantages of Laser diode (4 marks)
- g) Explain the two types fiber splices used (4 marks)
- h) Enlist various benefit of trans impedance amplifier for optical receivers (2 marks)
- i) In an optical fiber communication link, list the different components and their characteristics to the considered for selecting it (3 marks)
- j) Briefly discuss DWDM with a simple sketch. (4 marks)

- k) Enumerates the similarities and differences between SONET and SDH (3 marks)

QUESTION TWO (20 MARKS)

- a) i. Discuss the advantages, disadvantages and application of optic fiber communication (8 marks)
- ii. A step index multimode fiber with a numerical aperture of a 0.20 supports approximately 1000 modes at an 850 nm wavelength. (6 marks)
- i) Determine the diameter of its core
- ii) How many modes does the fiber support at 1320 nm?
- iii) How many modes does the fiber support at 1550 nm?
- b) A continuous 12 km long optical fiber link has a loss of 1.5 dB/km. (6 marks)
- i) Determine the minimum optical power level that must be launched into the fiber to maintain as optical power level of 0.3 μ W at the receiving end?
- ii) Find the required input power if the fiber has a loss of 2.5 dB/km?

QUESTION THREE (20 MARKS)

- a) Discuss briefly the characteristic of light used for communication (4 marks)
- b) Using illustration, explain how Light Emitting Diode (LED) is used as a detector (6 marks)
- c) The radiative and no- radiative recombination life times of minority carriers in the active region of a double heterojunction LED are 60 nsec and 90 nsec respectively. Determine the total carrier recombination life time and optical power generated internally if the peak emission wavelength is 870 nm and the drive current is 40 mA. (6 marks)
- d) Compare the features of Laser diode and LED (4 marks)

QUESTION FOUR (20 MARKS)

- a) Explain various types of misalignment that occur in fiber cables (6 marks)
- b) Describe the role of preamplifier in optical receiver hence explain briefly different types of preamplifier available. (8 marks)
- c) A transmitter has an output power of 0.1 mW. It is used with a fiber having NA = 0.25, attenuation of 6 dB/km and length 0.5 km. The link contains two connectors of 2 dB

average loss. The receiver has a minimum acceptable power (sensitivity) of -35 dBm.

The designer has allowed a 4 dB margin. Calculate the link power budget. (6 marks)

QUESTION FIVE (20 MARKS)

- a) Discuss in detail about the problems suffered by Plesiochronous digital hierarchy (4 marks)
- b) Explain various element devised for SONET/SDH infrastructure (8 marks)
- c) Describe different types of synchronization techniques involved in broadcast optical network (8 marks)