

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks Scored:

Level : B. E.

Year : IV

Course : ETEG 422

Semester: I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 08 MAR 2019

SECTION "A"

[20 Q. \times 0.5 = 10 marks]

Choose the most appropriate option.

- An optical fiber cable has specified refractive index values of 1.6 and 1.4 for the fiber core and the cladding respectively. The width of the cone of acceptance is _____
a. 50.8 degree b. 20.8 degree c. 40.16 degree d. 101.6 degree
- A single mode fiber cable has specified value equal to 0.15 for numerical aperture. What is the maximum core diameter it could have for use with infrared light with a wavelength of 850 nm?
a. 4.34 μ m b. 6.4 μ m c. 8.45 μ m d. 8.64 μ m
- For given V- number, the number of modes that can be carried by multimode step-index fiber is approximately given by _____
a. $V^2/2$ b. $V^2/4$ c. $V^2/3$ d. $V^2/5$
- The transmission bandwidth of a 300 meter optical fiber cable having specified bandwidth length product 600MHz.km is _____
a. 1 GHz b. 2 GHz c. 3 GHz d. 4 GHz
- A single mode fiber has chromatic dispersion specification as 950 ps. What is its maximum possible transmission bandwidth?
a. 123 MHz b. 328 MHz c. 526 MHz d. 759 MHz
- The bandgap of a semiconductor material used for fabrication of a laser diode is specified as 1.3eV. The emission wavelength is _____
a. 1520 nm b. 1310 nm c. 954 nm d. 631 nm
- On a photodiode operating at a wavelength of 1.3 μ m, 3×10^{11} photons are incident which results in the generation of 1.5×10^{11} electron-hole pairs. The quantum efficiency is _____
a. 0% b. 40% c. 50% d. 60%
- The number of doped region in APD detector is _____
a. 1 b. 2 c. 3 d. 4
- Dense wavelength division multiplexing (DWDM) is used for _____
a. Wavelength conversion b. Filtering
c. Amplification d. Capacity enhancement

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Time : 2 hrs. 30 mins.

08 MAR 2019
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F. M. : 40

SECTION "B"

[4 Q.× 10 = 40 marks]

Attempt *ANY FOUR* questions. Figure in the margin indicates the full mark. Symbols have their usual meaning. Students are required to answer in their own words as far as practicable.

1.
 - a) How do you differentiate between the point optical sensor and the distributed optical sensor? Describe with the help of suitable diagrams. [5]
 - b) Why quantum efficiency of an APD is higher than that of a PiN photo detector? Explain. [3]
 - c) In a given optical fiber, the relative refractive index difference between the core and cladding is 0.9% and acceptance angle in air is 0.15 radians. Determine the velocity of light in the fiber core, assuming that the fiber has a core diameter such that ray theory can be applied for the analysis. [2]
2.
 - a) Draw the complete block diagram of optical fiber communication system and explain the photo detection and signal restorer. [5]
 - b) Explain the modified chemical vapor deposition (MCVD) process implemented in optical fiber fabrication process. [5]
3.
 - a) How is semiconductor optical amplifier (SOA) different from fiber optical amplifier (FOA)? Describe with the help of relevant examples and applications. [5]
 - b) The core diameter of a step index fiber is specified as $8\mu\text{m}$. The value of core refractive index and relative refractive index difference are specified as 1.46 and 0.3% respectively. Calculate the mode field diameter (MFD) at operating wavelength of 1550nm. [2]
 - c) Distinguish between homojunction and heterojunction laser diodes. [3]
4.
 - a) How is heterodyne detection technique different from homodyne detection in optical fiber communication system? [5]
 - b) Mention some implications of optical fiber communication system. [2]
 - c) Elaborate about the photonic integrated circuits that can be used in optical fiber communication system. [3]
5.
 - a) Why does dispersion occur in multimode step index fiber and single mode fiber? How is it possible to reduce the effect of dispersion by using dispersion compensation fiber? Explain in detail. [6]
 - b) What are the advantages of external modulation in optical fiber communication? Describe the operating principle of MZI modulator and the acousto-optic modulator. [1+3]

