

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY BACHELOR OF ENGINEERING (HONS) DEGREE

Final examination May 2011 TEE
5221

Communications Systems

Duration of Examination 3 Hours

Instructions to Candidates:

1. Answer any **five** questions only.
2. All questions carry equal marks.
3. Show all your steps clearly in any calculation.
4. Start the answers for each question on a fresh page.

Question 1

- (a) Describe a method to transmit eight Television channels using one antenna mast. (8 marks)
- b) Describe the signals and functions of the signals that constitute a complete composite signal of a television. (12 marks)

Question 2

- a) Give at least SIX advantages of fiber optic cables over ordinary metallic cables. (6 marks)
- b) Describe three types of optical cables in use, in terms of dispersion, index profile, and propagation modes. (9 marks)
- c) Give reasons of material dispersion in optical fibre systems. (5 marks)

Question 3

- a) Give FOUR factors that contribute to the losses in detectors and sources in optical systems. Explain the effect of each factor. (8 marks)
- b) A fibre has a core refractive index of 1.50 and cladding refractive index of 1.4.
- i) Calculate the critical angle of incidence.
 - ii) The numerical aperture

iii) The maximum angle of the acceptance angle of the cone. (6 marks)

- c) Explain the term wavelength division multiplexing as used in optical communication systems. Give example of the application. (6 marks)

Question 4

- a) Explain the arrangement of T coupler and star coupler used in the fibre coupling, State the advantage and disadvantage of each type of coupler. (6 marks)
- b) Give TWO advantages and TWO disadvantages of an Avalanche Photo diode used in the receiver end of an optical communication system. (4 marks)
- c) Explain with the help of diagrams the Burrus type and Edge Emitter type interface. Give the advantage of each type. (8 marks)
- d) Give TWO factors that are considered when choosing the source and detector in the optical system. (2 marks)

Question 5

- a) Describe a low orbit satellite system. State the advantages and the disadvantages of the system. (10 marks)
- b) Give the block diagram of a complete satellite link. Give typical frequency arrangements. (10 marks)

Question 6

Describe the principle of the M-ary encoding technique using the 16 quadrature amplitude modulation as a typical example. Give the block diagram of the transmitter, the phase diagram of the system and the constellation diagram. (20 marks)

Question 7

- a) Give Five advantages of using digital signal processing in Communication systems. (5 marks)
- b) A channel has a bandwidth of 4 kHz and a signal to noise ratio of 3162. Calculate the information capacity in bits per second when the channel uses a four level code. (6 marks)
- c) Give the expression that determine the complete optical link budget equation. Explain the equation. (9 marks)

Question 8

- a) Describe the operation of a Costas loop carrier recovery circuit. (8 marks)
- a) Draw a simplified block diagram of a data communication network. (8 marks)
- b) Give FIVE types of topologies in networks that can be used in data communication networks.
(5 marks)