



(Knowledge for development)

**KIBABII UNIVERSITY
(KIBU)
UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

**END OF SEMESTER EXAMINATIONS
YEAR FOUR SEMESTER TWO EXAMINATIONS**

**FOR THE DEGREE OF
BACHELOR OF SCIENCE
(COMPUTER SCIENCE)**

COURSE CODE : CSC 454E

COURSE TITLE : WIRELESS SYSTEMS AN PROTOCOLS

DATE: 29/08/2022

TIME: 2.00 P.M – 4.00 P.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [30 MARKS]

- a) Define the following terms applicable in cellular networking
- (i) A Cell [2 marks]
 - (ii) Cell splitting [2 marks]
 - (iii) Dwell Time [2 marks]
- b) Cellular systems for mobile communications implement SDM. Each transmitter, typically called a base station, covers a certain area referred to as a cell.
- (i) Illustrate using a diagram a cellular system with three cell clusters [2 marks]
 - (ii) State and briefly explain four advantages of cellular systems with small cells [4 marks]
- c) (i) Briefly explain the concept of frequency reuse applicable in cellular communication [2 marks]
- (ii) In Advanced Mobile Phone Services (AMPS), N cells are using the same number of frequencies and K is the total number of frequencies used in systems. Assume the value of $N= 10$ and $K = 500$, calculate the average number of frequencies used per cell i.e. cell frequency. [2 marks]
- d) (i) GSM architecture is a layered model that is designed broadly to consist of the mobile station (MS) and three subsystems. List the three subsystems [3 marks]
- (ii) Illustrate using a diagram the simplified infrastructure of cellular system and explain each interconnecting layer of the cellular system [4 marks]
- e) (i) Mobile ad-hoc networks are deployed where users of a network cannot rely on an infrastructure and should be mobile and use wireless communications. State four needs that necessitate deployment of these networks [4 marks]
- (ii) Illustrate using a diagram the main requirements of ad-hoc networks to address the needs in (i) above [3 marks]

QUESTION TWO [20 MARKS]

- (a) (i) Wireless transmissions propagate in three modes. Briefly list the three modes of propagation [3 marks]
- (ii) State three methods of improving the coverage and capacity in cellular networks [3 marks]
- (b) (i) Assume that the total frequency band allocated for a cellular system is 800Hz, and that each half-duplex channel requires 20 Hz, compute the number of full-duplex channels S that the total band supports (one channel for transmission and one for reception) [3 marks]
- (ii) Consider the total number of full-duplex channels be divided equally among 4 cells (in an 4-Cell Frequency reuse system). Using the above result, calculate the total number of channels k assigned to each cell. [2 marks]
- (c) (i) State the condition for occurrence for intersystem handoff in cellular system [2 marks]
- (ii) Briefly discuss three basic concept of General Packet Radio System applicable in wireless systems [3 marks]
- (d) Optimization of Mobile IP protocols needs four additional messages. State the four messages. [4 marks]

QUESTION THREE [20 MARKS]

- (a) (i) Global System for Mobile (GSM) is a second-generation cellular system standard. State and briefly describe three major categories of services offered on GSM [3 marks]
- (ii) List two disadvantages of GSM systems in cellular wireless communication [2 marks]
- (b) (i) State four factors that determine the dwell time in cellular systems [4 marks]
- (ii) Briefly discuss the handoff threshold in cellular systems [3 marks]
- (c) (i) The IEEE 802.11 standard covers the physical layer PHY and medium access layer MAC. State the two sections of the physical layer [2 marks]
- (ii) State two reasons for choosing wireless networking over traditional wired networks [2 marks]
- (d) Briefly describe four basic multiplexing techniques that are employed in cellular technology [4 marks]

QUESTION FOUR [20 MARKS]

- (a) (i) State the three different modes that GPRS can operate [3 marks]
(ii) IEEE 802.11 is wireless LAN standard with a variety of standards, each with a letter suffix. State four the role of the following each of the following three standards; 802.11a, 802.11b and 802.11e [3 marks]
- (b) (i) List two technologies that that digital formats in second generation (2G) networks introduced in cellular networks [2 marks]
(ii) State four applications that 2.5G networks brought into the market [4 marks]
- (c) In WCDMA each user is allocated frames of 10 ms duration, during which the user-data rate is kept constant. State two factors that are achieved by fast radio capacity allocation controlled and coordinated by the radio resource management (RRM) functions in the network [4 marks]
- (d) Briefly discuss the following four wireless LAN technologies
- (i) Narrowband [1 mark]
 - (ii) Spread Spectrum [1 mark]
 - (iii) Frequency Hopping Spread Spectrum (FHSS) [1 mark]
 - (iv) Direct Sequence Spread Spectrum (DSSS) [1 mark]

QUESTION FIVE [20 MARKS]

- (a) Define the following terms Global System for Mobile Communication (GSM)
- i. Frequency Reuse [1 mark]
 - ii. Subscriber Identity Module [1 mark]
 - iii. Home Location Register (HLR) [1 mark]
 - iv. Visitor Location Register [1 mark]
- (b) (i) State two reasons why a cell uses a different set of frequencies from neighboring cells [2 marks]
(ii) Briefly state the major goal toward the 4G Wireless evolution in cellular networks [3 marks]
- (c) In reference to cellular networks, state three advantage of the zone cell [3 marks]
- (d) List four benefits that are drawn from frequency reuse in cellular networks; [4 marks]
- (e) (i) State the meaning of the term “handoff” applicable in GSM systems [2 marks]
(ii) Differentiate between Soft handoff and hard handoff in GSM system [2 marks]