

UNIVERSITY EXAMINATIONS

FIRST SEMESTER 2025/2026 ACADEMIC YEAR

**FOURTH YEAR EXAMINATION FOR THE DEGREES OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE**

COMP 415/BICT 315: WIRELESS AND MOBILE COMPUTING

STREAM: R

TIME: 2 HRS

DAY: TUESDAY [8.30 – 10.30 A.M]

DATE: 03/02/2026

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.

INSTRUCTIONS: Answer Question ONE and ANY other TWO Questions in Section B

SECTION A

QUESTION ONE [30 MARKS] – COMPULSORY

- (a) Write short notes on the following concepts
- (i) Cell splitting [2 Marks]
 - (ii) Co-channel interference [2 Marks]
 - (iii) Cluster size [2 Marks]
- (b) Describe the concept of handoff in cellular communication systems and briefly explain why it is necessary for maintaining call quality and continuity as a mobile device moves between cells. [3 Marks]
- (c) Discuss **FOUR** problems with traditional TCP in wireless environments. [8 Marks]
- (d) With the aid of a well-labelled diagram, explain the concept of the *Hidden Node/Terminal Problem* as it applies to wireless networks. [5 Marks]
- (e) Describe what a Wireless Sensor Network (WSN) is and discuss its importance in commercial and industrial applications. [4 Marks]
- (f) If 20 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25 kHz RF bandwidth, find:
- (i) the number of duplex channels. [2 Marks]
 - (ii) the total number of channels per cell site, if $N = 4$ cell reuse is used [2 Marks]

QUESTION TWO [20 MARKS]

- (a) Sketch a diagram showing the GSM system architecture and explain its components [6 Marks]
- (b) Explain why a Mobile traveler may continue calling from one location to another without call drop. [6 Marks]
- (c) Discuss the WAP architecture [8 Marks]

QUESTION THREE [20 MARKS]

- (a) Explain the following terms
- (i) Mobile station [2 Marks]
 - (ii) Base station [2 Marks]

- (iii) Network Backbone [2 Marks]
- (b) Explain the FOUR characteristics that a communication device can exhibit. [4 Marks]
- (c) Discuss FIVE various forms of research challenges exhibited by the handheld terminal devices. [5 Marks]
- (d) Explain how mobile TCP improves the TCP performance in wireless and mobile environment. [5 Marks]

QUESTION FOUR [20 MARKS]

- (a) Discuss the IEEE 802.11 protocol and explain its significance in the wireless networking landscape? [2 Marks]
- (b) What is a Mobile IP? [2 Marks]
- (c) Discuss any three channel allocation techniques that are used in cellular systems [3 Marks]
- (d) Explain any two reasons why the hexagon cell shape is highly recommended for the design of cellular networks [4 Marks]
- (e) If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses.
 - (i) 4-cell reuse [3 Marks]
 - (ii) 7-cell reuse [3 Marks]
 - (iii) 12-cell reuse. [3 Marks]

QUESTION FIVE [20 MARKS]

- (a) Given a cellular system which has a total of 1001 radio channels available for handling traffic and given the area of a cell is 6 km² and the area of the entire system is 2100 km².
 - (i) Calculate the system capacity if the cluster size is 7 [5 Marks]
 - (ii) Calculate the number of times that the cluster of size 4 have to be replicated in order to approximately cover the entire cellular area. [5 Marks]
 - (iii) Calculate the system capacity if the size of the cluster is 4. [4 Marks]
- (b) Safaricom, a leading telecommunications company, has observed a significant increase in the number of subscribers around Egerton University and its surrounding areas. As a network engineer employed by Safaricom, outline three strategic approaches you would propose to effectively address this surge in demand in the mentioned area. [6 Marks]