



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:V
Class:TY	Program:B.Tech
Branch Code:ETC	Pattern:2022
Name of Course:Cellular Networks	Course Code:ETC223002
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Marks CO

Question No. 1

- 1a) Explain time, frequency, and spatial diversity and describe their advantages. (6) CO1

Question No. 2

- 2a) Write a short note on the MIMO wireless communication and explain why multiple antennas improve system performance (6) CO2

Question No. 3

- 3a) Explain the progression of cellular services from 1G to 5G, highlighting major improvements. (8) CO3

OR

- 3b) A cellular system allocates 120 channels per cell and uses a cluster size of $N = 4$. If the cluster is repeated 5 times in the service area: (8) CO3

- 1) Determine the total number of duplex channels available in the entire network.
- 2) Calculate the network capacity.

- 3c) Discuss the process and advantages of cell splitting in cellular networks. (8) CO3

OR

- 3d) Explain the concept of frequency reuse and derive the expression for reuse distance. (8) CO3

Question No. 4

- 4a) Explain Erlang as a traffic unit and give a simple example of how traffic is calculated. (8) CO4

OR

- 4b) A city of 1050 km² is served by a cellular system where each cell has $N = 40$ channels. (8) CO4
The blocking probability is 2%, and each subscriber offers $A_0 = 0.025$ Erlangs.
The cell radius is 1.5 km.
For $N = 40$ and 2% blocking, the supported traffic per cell is $A = 31.7$ Erlangs.

Determine the number of subscribers that can be supported.

- 4c) Explain transmit power, antenna gain, and receiver sensitivity in a link budget with simple examples. (8) CO4

OR

- 4d) Define tele-traffic theory and explain why traffic modeling is necessary in communication networks. (8) CO4

Question No. 5

- 5a) Explain key features of LTE-Advanced (LTE-A) such as relay nodes, CoMP, and enhanced MIMO. (8) CO5

OR

- 5b) Describe the 5G NR architecture and discuss the functions of gNodeB, AMF, SMF, and UPF with neat block diagram. (8) CO5

- 5c) Analyze how 5G improves latency, bandwidth, spectrum usage, and massive connectivity compared to 4G. (8) CO5

OR

- 5d) Explain what wireless communication is and list its main advantages and applications. (8) CO5

..... End of question paper.....