# *Subject: - Mobile Wireless Communication (22533)*

**Maratha Vidya Prasarak Samaj's**

**Rajarshi Shahu Maharaj Polytechnic, Nashik**

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.

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# SYLLABUS

| Chapter No. | Name of chapter | Marks With Option |
|:---:|---|:---:|
| 1 | **Wireless Communication System** | **25** |
| 2 | **Fundamentals of Cellular System** | **21** |
| 3 | **Digital Cellular Mobile Standards** | **24** |
| 4 | **Advance Wireless Standards** | **14** |
| 5 | **Wireless Network Technology** | **14** |
| | **Total Marks :-** | **98** |

# BOARD THEORY PAPER PATTERN
# FOR ALL BRANCHES

| Q.1 | | **Attempt any FIVE**           **5*2=10** |
|-----|------|-------------------------------------------------------------|
| | a) | List out features of SS7 |
| | b) | Write any 4 GSM air interface specifications |
| | c) | State any 2 features & adv. of EDGE |
| | d) | List different multiple access techniques |
| | e) | Define Handoff mechanism & list its types |
| | f) | State need of 4G |
| | g) | State features of MANET |
| Q.2 | | **Attempt any THREE**        **3*4=12** |
| | a) | Explain Wi-max architecture |
| | b) | List any 4 features of IEEE 802.15.1 |
| | c) | Differentiate between cordless telephone, radio paging system |
| | d) | Explain authentication process in GSM system with A3 algorithm |
| Q.3 | | **Attempt any THREE**        **3*4=12** |
| | a) | Draw & explain forward & reverse channel structure of IS-95 system. |
| | b) | Explain logic unit in mobile (cellular) unit with neat diagram. |
| | c) | State any 4 features of UMTS |
| | d) | Sate different techniques used in cellular system to improve coverage & capacity of cellular system |
| Q.4 | | **Attempt any FOUR**        **3*4=12** |
| | a) | Draw frequency reuse pattern for cluster size 7 & 12 & explain how they use for range extension |
| | b) | Draw & explain architecture of IS-95 system |
| | c) | State any 4 features of WPAN |

| | d) | Explain co channel interference. State cause & role of COI |
|---|---|---|
| | e) | Define the terms :-<br>1. Base Station<br>2. Mobile switching Center<br>3. Forward channel<br>4. Control Channel |
| Q.5 | | **Attempt any TWO**        **2*6=12** |
| | a) | **i)** Illustrate with the help of neat timing diagram call making procedure from mobile to landline (PSTN) |
| | | **ii)** Explain WLL with neat diagram & State its importance. |
| | b) | **i)** Compare 3G & 4G system |
| | | **ii)** Write Services offered by SS7 |
| | c) | **i)** Compare GSM with CDMA-2000 (any 3 points) |
| | | **ii)** Draw & explain forward CDMA channel modulation of IS-95 system |
| Q.6 | | **Attempt any TWO**        **2*6=12** |
| | a) | Compare IS-95B with GPRS w.r.t.<br>1. Backward compatibility<br>2. Channel Bandwidth<br>3. Data Rate<br>4. No of voice channels<br>5. Type of modulation<br>6. Year of introduction & generation |
| | b) | Compare GSM & IS-95 w.r.t.<br>1.Handoff<br>2. Multiple Access techniques<br>3. Frequency range<br>4. Channel bandwidth<br>5. Data rate<br>6. No. of voice channels |
| | c) | i) Explain Mobile transmitter unit<br>ii) Draw basic of cellular system & state its advantages |

# CLASS TEST - I
# PAPER PATTERN

## Syllabus:-

| Unit No. | Name of the Unit | Course Outcome (CO) |
|---|---|---|
| 1 | **Wireless Communication System** | **533.1** |
| 2 | **Fundamentals of Cellular System** | **533.2** |
| 3 | **Digital Cellular Mobile Standards** | **533.3** |

| | | Course Outcome (CO) |
|---|---|---|
| **Q.1** | **Attempt any FOUR**        **4*2=8Marks** | |
| **a)** | Compare IS-95 standard and GSM standard w.r.t <br>      1. Frequency band <br>      2. Modulation technique <br>      3. Multiple access <br>      4. Channel bandwidth    [CO-1] | **533.3** |
| **b)** | Define the term cell and cluster with diagram | **533.2** |
| **c)** | Compare NAMPS and GSM w.r.t. generation and data rate | **533.1** |
| **d)** | Define frequency reuse & frequency reuse ratio | **533.2** |
| **e)** | State features of HSCSD & GPRS | **533.1** |
| **f)** | List any 4 features of GSM | **533.3** |
| **Q.2** | **Attempt any THREE**        **3*4=12 Marks** | |
| **a)** | Draw the architecture of GSM and state function of HLR and VLR | **533.3** |
| **b)** | What is hand-off? List different types of hand off. Explain any one in detail | **533.2** |
| **c)** | Draw and explain mobile unit in detail | **533.1** |
| **d)** | Explain control and traffic channels of GSM | **533.3** |
| **e)** | Explain radio paging system with neat diagram | **533.1** |

# CLASS TEST - II
# PAPER PATTERN

## Syllabus:-

| Unit No. | Name of the Unit | Course Outcome (CO) |
|---|---|---|
| 3 | **Digital Cellular Mobile Standards** | **533.3** |
| 4 | **Advance Wireless Standards** | **533.4** |
| 5 | **Wireless Network Technology** | **533.5** |

| Q.1 | Attempt any FOUR       4*2=8Marks | Course Outcome (CO) |
|---|---|---|
| a) | State any 4 features of IS-95 | **533.3** |
| b) | State IMT 2000 visions (Any 4 points) | **533.4** |
| c) | Compare IEEE 802.11 & IEEE 802.16 (Any 4 points) | **533.5** |
| d) | Compare WCDMA with CDMA 2000 (Any 4 points) | **533.4** |
| e) | State any 2 adv. & applications of MANET | **533.5** |
| Q.2 | **Attempt any THREE       3*4=12 Marks** | |
| a) | Explain concept of RFID with neat diagram. | **533.5** |
| b) | Draw architecture of SS7 & explain function of NSP | **533.3** |
| c) | Draw and explain UMTS architecture | **533.4** |
| d) | Explain Bluetooth protocol | **533.5** |

# COURSE OUTCOME (CO)

**COURSE:- Mobile Wireless Communication (22533)**          **PROGRAMME: - EJ**

| CO.NO | Course Outcome |
|---|---|
| **CO-533.1** | Troubleshoot Mobile Handsets |
| **CO-533.2** | Assess Cellular system Capacity |
| **CO-533.3** | Assess performance of standards of different cellular mobile system |
| **CO-533.4** | Select relevant wireless technology suitable for various applications |
| **CO-533.5** | Test performance of various wireless protocols |

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# 1. Wireless Communication System

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**Position in Question Paper**                                        **Total Marks-12**

  Q.1.a) **2-Marks.**
  Q.2.b) **4-Marks.**
  Q.3.a) **4-Marks.**
  Q.4.c) **4-Marks.**
  Q.5 b) **6-Marks.**

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# Descriptive Question

1. Compare system used around the world i.e. AMPS, IS-95, GSM, NAMPS. With the following points:
   a. Year of introduction.
   b. Frequency range of data rate.
   c. Modulation used whether it is analog or digital.
   d. Chanel bandwidth.
   e. Generation.
2. Compare GSM, IS-136 and IS-95 with respect to frequency band, channel bandwidth, data rate and modulation technique.
3. State various 2.5 generation cellular standards based on TDMA and CDMA also list out their specifications like backward compatibility, channel B.W, data rate and duplexing method.
4. Compare 3G & 4G wireless system.
5. Explain cordless telephone system.
6. Explain working principal of paging system with neat block diagram.
7. Differentiate between cordless telephone, paging system and cellular phone.
8. Explain WLL with neat diagram. State it's any 2 advantages and disadvantages.
9. Explain mobile unit in detail with neat diagram
10. Explain frequency synthesizer in mobile unit with neat diagram
11. Explain mobile transmitter in mobile unit with neat diagram
12. Explain control unit in mobile unit with neat diagram
13. Explain logic unit in mobile unit with neat diagram
14. Compare IS-95B with GPRS w.r.t.
    a. Backward compatibility

   b. Channel Bandwidth
   c. Data Rate
   d. No of voice channels
   e. Type of modulation
   f. Year of introduction & generation

15. State features of HSCSD & GPRS

# MCQ Question

## (Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. Which of the following is not a standard used for paging system?
   a) POCSAG              **c) IS-95**
   b) ERMES               d) FLEX
2. Paging system uses which mode of transmission?
   a) Full duplex         **c) Half duplex**
   b) Simplex             d) none
3. The information sent by paging system is known as a _____
   a) Note                c) Message
   b) Line                **d) Page**
4. Which type of message cannot be sent with the help of paging system?
   a) Alphanumeric message    **c) Voice message**
   b) Video message           d) Numeric message
5. What is a paging access number?
   a) An e mail id        **c) A toll free telephone number**
   b) A username          d) A registration number
6. Which type of transmission technique is employed by paging system?
   **a) Simulcasting**    c) Unicasting
   b) Multicasting        d) Hybrid
7. Which of the following is not the property of paging system?
   a) Asymmetric communication    **c) High cost**
   b) Light weight               d) Wide area coverage
8. Which of the following properties describes the transmitters and receivers in paging system?
   a) High complexity and high power transmitter, high complexity and high power receivers

b) Low complexity and low power transmitter, low complexity and low power receivers

c) Low complexity and low power transmitter, high complexity and high power receivers

**d) High complexity and high power transmitter, low complexity and low power receivers**

9. What is a pager in the paging system?
   a) A transmitter
   **b) A receiver**
   c) A transceiver
   d) An equalizer

10. Who introduced the paging system for the first time?
    **a) Al Gross**
    b) Teri Pall
    c) Alexander Graham Bell
    d) Martin Cooper

11. Which of the following is a protocol used for cordless telephone system?
    **a) PACS**
    b) ERMES
    c) IS-95
    d) FLEX

12. In which frequency range do the cordless phones mostly work?
    **a) 43-50 MHz**
    b) 88-108 MHz
    c) 540-1600 KHz
    d) 200-540 KHz

13. Which of the following is the drawback for cordless telephones?
    a) Wireless technology
    **b) Limited coverage area**
    c) Mobile
    d) Security

14. Which of the following is a fully digital cordless system?
    a) CT0
    b) CT1
    c) CT1+
    **d) DECT**

15. Which of the following is an example of local wireless system?
    a) GSM
    **b) Cordless telephone system**
    c) UMTS
    d) EDGE

16. Which of the following is not a standard for cordless telephony?
    a) CT-2
    b) DECT
    **c) UMTS**
    d) PHS

17. What is the range of cell diameter of DECT?
    a) **300 m**
    b) 2 km
    c) 10 km
    d) 70 km

18. Which of the following standard of cordless telephone system is also approved as a 3G standard?
    a) PHS
    b) PACS
    **c) DECT**
    d) CT2

19. Cordless telephone system will not work under which of the following criteria?

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a) Within a home     c) Within campus

b) Within a building     **d) Within a city**

20. Which of the following is not an application of DECT?

    **a) Multimedia processing**

    b) Cordless private branch exchange

    c) Wireless local loop

    d) Home cordless phone

21. What is the name of the web browsing format language supported by 2.5G technology?

    a) Wireless Application Protocol     c) Extensible Markup Language

    **b) Hypertext Markup Language**     d) Hypertext Transfer Protocol

22. What is the name of the internet microbrowser technology used by NTT DoCoMo in Japan?

    a) Wireless Application Protocol     a) c).W-mode

    **b) I-mode**     c) Hypertext Markup Language

23. 2.5G upgrade path for a particular wireless carrier does not match the original 2G technology choice made earlier by the same carrier.

    a) True     **b) False**

24. Which of the following is not a TDMA standard of 2.5G network?

    a) HSCSD     c) EDGE

    b) GPRS     **d) GSM**

25. Which of the following is a 2.5G CDMA standard?

    a) IS-95     c) IS-95B

    **b) Cdma2000**     d) CdmaOne

26. HSCSD supports which 2G standard?

    **a) GSM**     c) GSM and IS-136

    b) IS-136     d) PDC

27. How does HSCSD differs from the GSM to obtain higher speed data rate?

    a) By allowing single user to use one specific time slot

    **b) By allowing single user to use consecutive user time slots**

    c) By using 8-PSK modulation technique

    d) By allowing multiple users to use individual time slot

28. GPRS and EDGE supports which 2G standard?

    a) GSM only     **c) GSM and IS-136 both**

    b) IS-136 only     d) PDC

29. How is HSCSD different from GPRS?

    a) Infrastructure     c) Modulation technique

    b) Multiple Access Scheme     **d) Switching Technique**

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30. What changes GPRS need to acquire while upgrading itself from GSM?
    a) A whole new base station
    b) New transceiver at base station
    c) New channel cards
    **d) New packet overlay including routers and gateways**

31. Which new modulation technique is used by EDGE?
    a) BPSK                         **c) DQPSK**
    b) 8- PSK                        d) AFSK

32. Various air interface formats used by EDGE are also known as _____
    **a) Modulation and coding schemes**
    b) Coding schemes
    c) Modulating air interface
    d) Air interface coding schemes

33. EDGE is sometimes also referred as _____
    a) HSCSD                        **c) EGPRS**
    b) 3GPP                         d) EGSCSD

34. What is one disadvantage of EDGE in comparison to HSCSD and GPRS?
    a) Low data rates               c) Low speed
    **b) Small coverage range**      d) No advancement

35. 1G or First Generation Mobile Network is _____?
    **a) Analog**                    c) Sequential
    b) Digital                       d) Fuzzy

36. In a 1G network, the type of communication between Tower ot BTS and Switching Center is _____?
    a) Analog                        c) Discrete
    **b) Digital**                    d) Diminished

37. Who launched the first commercial 1G network in the world?
    **a) NTT, Japan**                c) TACS, UK
    b) NMT, Netherlands              d) AMPS, America

38. Which country is still using the 1G network in limited or demo use?
    a) USA                           c) UK
    b) CHINA                         **d) Russia**

39. Choose a 1G or First Generation Network from the options below.
    a) NMT, AMPS                     c) TMA, TZ801
    b) TACS, C-450                   **d) All the above**

40. Choose correct abbreviations from the list below.
    a) NMT - Nordic Mobile Telephone
    b) AMPS - Advanced Mobile Phone System

   c) TACS - Total Access Communication System
   **d) All the above**

41. What are main problems in 1G technology?
   a) Noise
   b) Security
   c) Poor Battery backup
   **d) All the above**

42. What is the Cell Size or Coverage Area in 1G technology?
   a) 1-5Km
   b) 20-60Km
   c) 5-50Km
   **d) 2-30Km**

43. Modulation technique employed by NMT type 1G network is _____?
   a) TDM (Time Domain Multiplexing)
   b) QPSK (Quadrature Phase Shift Keying)
   **c) FFSK (Fast Frequency Shift Keying)**
   d) BPSK (Binary Phase Shift Keying)

44. Modulation technique employed by AMPS 1G network is _____?
   a) TDMA
   **b) FDMA**
   c) CDMA
   d) PDMA

45. The process of intercepting analog signals from the phone to tower/BTS, copying ESN number of talking phone to the programmable phone and making calls freely is called _____ problem in a 1G network.
   a) Skimming
   b) Eve's Dropping
   **c) Cloning**
   d) Banning

46. DAMPS or Digital-AMPS network is treated as a ___ network.
   a) 1G
   **b) 2G**
   c) 1.5G
   d) None of the above

47. Choose a 1G network from the list below.
   a) HiCap
   b) Mobitex
   c) ETACS
   **d) All the above**

48. The terminology "Cellular" was first used by _____ network.
   a) TACS
   **b) AMPS**
   c) NMT
   d) C-450

49. Which mobile network type introduced international roaming on 1G network?
   a) AMPS
   b) NTT
   **c) NMT**
   d) TACS

50. RSSI stands for _____
   **a) Received Signal Strength Indicator**
   b) Restricted Signal Strength Indicator
   c) Radio Signal Strength Indication
   d) Restricted System Software Indicator

# 2. Fundamentals of Cellular System

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**Position in Question Paper**                                        **Total Marks-12**

 Q.1. b) 2-Marks.
 Q.2. c) 4-Marks.
 Q.3. c) 4-Marks.
 Q.4. d) 4-Marks.

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# Descriptive Question

1   Define the term cell with help of diagram.
2   Define frequency reuse and write its advantages.
3   Define cluster with help of diagram.
4   State the significance of frequency reuse in cellular system. Write the procedure to select cell for frequency reuse.
5   Explain co-channel interference.
6   State the role of hand off mechanism in cellular system also define dwell time.
7   List different types of handoff and explain any two.
8   Compare hand and soft hand off.
9   Explain the concept of cell splitting and cell sectoring.
10  Define repeater and explain microcell zone with suitable diagram.
11  Draw basic of cellular system & state its advantages
12  Define the terms :-
    a. Base Station
    b. Mobile switching Center
    c.  Forward channel
    d. Control Channel
13  Draw frequency reuse pattern for cluster size 7 & 12 & explain how they use for range extension
14  State cause & role of COI

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## MCQ Question

## (Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. Which of the following is not a characteristic of cellular telephone system?
   a) Accommodate a large number of users
   b) Large geographic area
   c) Limited frequency spectrum
   **d) Large frequency spectrum**

2. What is the responsibility of MSC in cellular telephone system?
   a) Connection of mobile to base stations
   **b) Connection of mobile to PSTN**
   c) Connection of base station to PSTN
   d) Connection of base station to MSC

3. Who has the responsibility of billing and system maintenance function in cellular system?
   a) Base Station                         **c) MSC**
   b) PSTN                                  d) Mobile system

4. What is the function of FVC (Forward Voice Channel)?
   **a) Voice transmission from base station to mobiles**
   b) Voice transmission from mobile to base station
   c) Initiating mobile calls
   d) Broadcast all traffic request for all mobile

5. Which two channels are responsible for initiating mobile calls?
   a) FVC and FCC                          **c) FCC and RCC**
   b) FVC and RVC                          d) FCC and RVC

6. Of the total channels present in the cellular system, what is the percentage of voice and control channels?
   **a) 95% voice channels, 5% control channels**
   b) 5% voice channels, 95% control channels
   c) 50% voice channels, 50% control channels
   d) 25% voice channels, 75% control channels

7. What is MIN?
   **a) Subscriber's telephone number**
   b) Paging message
   c) Traffic request number
   d) Mobile Internet

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8. What is the shape of the cell present in the cellular system?
   a) Circular
   b) Square
   **c) Hexagonal**
   d) Triangular

9. Why the size of the cell is kept small in cellular network?
   **a) Increase capacity**
   b) Decrease capacity
   c) Increased size of base station electronics
   d) Slow process of handoffs

10. What is handoff?
    a) Forward channel
    b) Switching technique
    **c) Roamer**
    d) Guard channel

11. Which one is not an advantage of using frequency reuse?
    a) Increased capacity
    b) Limited spectrum is required
    c) Same spectrum may be allocated to other network
    **d) Number of base stations is reduced**

12. The process of transferring a mobile station from one base station to another is
    a) MSC
    b) Roamer
    **c) Handoff**
    d) Forward channel

13. The interference between the neighbouring base stations is avoided by___
    **a) Assigning different group of channels**
    b) Using transmitters with different power level
    c) Using different antennas
    d) Using different base stations

14. What is the condition for handoff?
    **a) A mobile moves into a different cell while in conversation**
    b) A mobile remains in the same cell while in conversation
    c) A mobile moves to different cell when idle
    d) A mobile remains in the same cell and is idle

15. Handoff does not require voice and control channel to be allocated to channels associated with the new base station.
    a) True
    **b) False**

16. The time over which a call can be maintained within a cell without handoff is called _____
    a) Run time
    b) Peak time
    **c) Dwell time**
    d) Cell time

17. Dwell time does not depend on which of the following factor?
    a) Propagation

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b) Interference

c) Distance between subscriber and base station

**d) Mobile station**

18. Which of the following is associated with the handoff in first generation analog cellular systems?

   **a) Locator receiver**         c) Cell dragging

   b) MAHO                  d) Breathing cell

19. MAHO stands for _____

   a) MSC assisted handoff       c) Machine assisted handoff

   **b) Mobile assisted handoff**    d) Man assisted handoff

20. A handoff is initiated when the power received from the base station of a neighboring cell falls behind the power received from the current base station by certain level.

   a) True                         **b) False**

21. What is the condition for intersystem interference?

   a) Mobile moves from one cell to another cell

   b) Mobile remains in the same cell

   **c) Mobile moves from one cellular system to another cellular system**

   d) Mobile remains in the same cluster

22. What is the disadvantage of guard channel?

   a) Efficient utilization of spectrum    c) Near far effect

   b) Cross talk               **d) Reduce total carried traffic**

23. Which of the following priority handoff method decrease the probability of forced termination of a call due to lack of available channels?

   **a) Queuing**               c) Cell dragging

   b) Guard channel          d) Near far effect

24. Umbrella cell approach is possible by using _____

   a) Antenna of same heights    c) Different voice channels

   **b) Antenna of different heights**  d) Different control channels

25. Cell dragging is a problem occur due to _____

   **a) Pedestrian users**

   b) Stationary users

   c) High speed mobile systems

   d) Base stations having same frequency

26. What was the typical handoff time in first generation analog cellular systems?

   a) 1 second                c) 1 minute

   **b) 10 seconds**           d) 10 milliseconds

27. How much time it takes for handoff in digital cellular systems like GSM?

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a) **1 second**
b) 10 seconds
c) 1 minute
d) 10 milliseconds

28. Soft handoff is also known as _____
    a) MAHO
    b) Hand over
    c) Break before make
    d) **Make before break**

29. Which of the following is not a source of interference?
    a) **Base station in a different cluster**
    b) Another mobile in same cell
    c) A call in progress in neighbouring cell
    d) Any BS operating on same frequency

30. Interference on voice channels causes _____
    a) Blocked calls
    b) Cross talk
    c) **Queuing**
    d) Missed calls

31. Interference in control channel leads to _____
    a) Cross talk
    b) Queuing
    c) **Blocked calls**
    d) Voice traffic

32. Interference is more severe in rural areas.
    a) **True**
    b) False

33. What are co-channel cells?
    a) Cells having different base stations
    b) Cells using different frequency
    c) Cells using adjacent frequency
    d) **Cells using same frequency**

34. Co-channel **interference is a function of** _____
    a) **Radius** of cell
    b) Transmitted power
    c) Received power
    d) Frequency of mobile user

35. Co-channel reuse ratio is define by _____
    a) Q=D*R
    b) **Q=D/R**
    c) Q=D^R
    d) Q=1/R

36. What is the cluster size for CDMA?
    a) N=10
    b) N=100
    c) **N=1**
    d) N=50

37. What is breathing cell effect?
    a) Fixed coverage region
    b) **Dynamic and time varying coverage region**
    c) Large coverage region
    d) Very small coverage region

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38. Adjacent channel interference occurs due to _____
    a) Power transmitted by Base station
    b) MSCs
    c) Same frequency of mobile users
    **d) Imperfect receiver filters**

39. Which of the following problem occur due to adjacent channel interference?
    a) Blocked calls
    **b) Cross talk**
    c) Near-far effect
    d) Missed calls

40. In near-far effect, a nearby transmitter captures the _____
    **a) Receiver of the subscriber**
    b) Transmitter of the subscriber
    c) Nearby MSC
    d) Neighboring base station

41. Adjacent channel interference can be minimized through _____
    a) Changing frequency of base stations
    **b) Careful filtering and channel assignments**
    c) Increasing number of base stations
    d) Increasing number of control channels

42. In dynamic channel assignment, any channel which is being used in one cell can be reassigned simultaneously to another cell in the system at a reasonable distance.
    **a) True**
    b) False

43. Which of the following techniques do not help in expanding the capacity of cellular system?
    a) Sectoring
    **b) Scattering**
    c) Splitting
    d) Microcell zone concept

44. _____ uses directional antennas to control interference.
    **a) Sectoring**
    b) Cell splitting
    c) Repeaters
    d) Micro cell zone concept

45. _____ allows an orderly growth of cellular system.
    a) Sectoring
    **b) Scattering**
    c) Cell splitting
    d) Micro cell zone technique

46. Which of the following technology distributes the coverage of the cell and extends the cell boundary to hard-to-reach places?
    a) Cell splitting
    b) Scattering
    c) Sectoring
    **d) Micro cell zone concept**

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47. Which of the following increases the number of base stations in order to increase capacity?

   **a) Cell splitting**
   c) Repeaters
   b) Sectoring
   d) Micro cell zone concept

48. Which of the following trunking inefficiencies?

   a) Cell splitting
   **c) Sectoring**
   b) Micro cell zone technique
   d) Repeaters

49. The process of subdividing a congested cell into smaller cells is called _____

   **a) Cell splitting**
   c) Micro cell technique
   b) Sectoring
   d) Repeaters

50. Cell splitting increases the capacity of a cellular system since it increases the number of times _____ are reused.

   a) Cells
   **c) Transmitters**
   b) Channels
   d) Mobile stations

# 3. Digital Cellular Mobile Standards

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**Position in Question Paper**                                              **Total Marks-16**

  Q.1. d) 2-Marks.
  Q.2. a) 4-Marks.
  Q.3. d) 4-Marks.
  Q.4. c) 4-Marks.
  Q.5 a) 6-Marks.
  Q.6 b) 6-Marks

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# Descriptive Question

1 Compare GSM with CDMA with respect to:
   a. Channel bandwidth.
   b. Type of modulation.
   c. Number of voice channels/ number of users.
   d. SMS length with type of handoff.
   e. Frequency range.
   f. Multiple interference.
2 Illustrate with the help of neat timing diagram, call initialization from landline telephone to cellular phone.
3 Illustrate with the help of neat timing diagram, call making procedure from mobile handset to landline phone.
4 Draw the architecture of GSM and explain function of HLR, VLR, BSC, MSC, AUC, and OMC.
5 Write GSM air interface specifications for the following parameters.
   a. Reverse channel frequency.
   b. Forward channel frequency.
   c. ARFCL number.
   d. Modulation.
   e. Number of users per frame.
   f. Transmitter receiver frequency spacing.
6 List any 4 GSM features.
7 List any 8 features of IS95 and describe any 4 of them.
8 Explain authentication process in GSM system with neat diagram.
9 List features of SS7
10 Draw protocol architecture of SS7 and explain the function of NSP.

11 Explain GSM traffic and control channels with neat diagram.

12 State and explain any three services offered by GSM.

13 Draw and explain architecture of IS95 system.

14 Explain forward & reverse control channel structure in IS-95 system

15 Explain forward channel modulation process in CDMA

## MCQ Question

## (Total number of Question=Marks*3=16*3=48)

Note: Correct answer is marked with **bold**

1. Which of the following is the world's first cellular system to specify digital modulation and network level architecture?

    **a) GSM**                 c) CDMA

    b) AMPS                d) IS-54

2. Previously in 1980s, GSM stands for _____

    a) Global system for mobile     **c) Global special mobile**

    b) Group special mobile        d) Group system mobile

3. Who sets the standards of GSM?

    a) ITU                  **c) ETSI**

    b) AT & T              d) USDC

4. Which of the following does not come under the teleservices of GSM?

    a) Standard mobile telephony    c) Base originated traffic

    b) Mobile originated traffic     **d) Packet switched traffic**

5. Which of the following comes under supplementary ISDN services?

    a) Emergency calling        **c) Call diversion**

    b) Packet switched protocols   d) Standard mobile telephony

6. Which of the following memory device stores information such as subscriber's identification number in GSM?

    a) Register               **c) SIM**

    b) Flip flop              d) SMS

7. Which of the following feature makes impossible to eavesdrop on GSM radio transmission?

    a) SIM                  c) SMS

    **b) On the air privacy**      d) Packet switched traffic

8. Which of the following does not come under subsystem of GSM architecture?

    a) BSS                  c) OSS

    b) NSS                 **d) Channel**

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9. Which of the following subsystem provides radio transmission between mobile station and MSC?

  **a) BSS**         c) OSS
  b) NSS          d) BSC

10. _____ manages the switching function in GSM.

  a) BSS          c) OSS
  b) NSS          **d) MSC**

11. _____ carries digitally encoded user data.

  **a) Traffic channels**      c) Signalling channels
  b) Control channels      d) Forward channels

12. _____ carries signalling and synchronizing commands.

  a) Traffic channels      c) Signalling channels
  **b) Control channels**      d) Forward channels

13. Which of the following is not a control channel of GSM?

  a) BCH          c) DCCH
  b) CCCH         **d) TCH**

14. Which of the following is the forward control channel that is used to broadcast information?

  **a) BCCH**         c) DCCH
  b) CCCH         d) TCH

15. Which of the following channel does not come under CCCH?

  a) PCH          **c) DCCH**
  b) RACH         d) AGCH

16. Which of the following channel provides paging signals from base station to all mobiles in the cell?

  a) RACH         c) DCCH
  b) AGCH         **d) PCH**

17. _____ is a reverse link channel used by a subscriber unit to acknowledge.

  **a) RACH**         c) DCCH
  b) AGCH         d) PCH

18. Which of the following channel is used by base station to provide forward link communication to mobile?

  a) RACH         c) DCCH
  **b) AGCH**         d) PCH

19. Which of the following burst is used to broadcast the frequency and time synchronization control messages?

  **a) FCCH and SCH**       b) TCH and DCCH

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    c) RACH and TCH            d) FCCH and DCCH

20. Which of the following burst is used to access service from any base station?
    a) TCH                      c) SCH
    **b) RACH**               d) FCCH

21. Group of superframes in GSM is called multiframe.
    a) True                      **b) False**

22. US digital cellular system based on CDMA was standardized as _____
    a) IS-54                   **c) IS-95**
    b) IS-136                d) IS-76

23. IS-95 was not compatible with existing AMPS frequency band.
    a) True                      **b) False**

24. Which of the following is used by IS-95?
    **a) DSSS**               c) THSS
    b) FHSS                d) Hybrid

25. Each IS-95 channel occupies _____ of spectrum on each one way link.
    **a) 1.25 MHz**          c) 200 kHz
    b) 1.25 kHz           d) 125 kHz

26. IS-95 uses same modulation technique for forward and reverse channel.
    a) True                      **b) False**

27. IS-95 is specified for reverse link operation in _____ band.
    a) 869-894 MHz        c) 849-869 MHz
    b) 849-894 MHz        **d) 824-849 MHz**

28. User data in IS-95 is spread to a channel chip rate of _____
    **a) 1.2288 Mchip/s**     c) 12.288 Mchip/s
    b) 9.6 Mchip/s         d) 0.96 Mchip/s

29. Cell splitting do not maintain the minimum c-channel reuse ratio.
    a) True                      **b) False**

30. Which of the following technique is used to limit radio coverage of newly formed microcells?
    a) Sectoring           **c) Antenna down tilting**
    b) Splitting           d) Scattering

31. Sectoring increases SIR (Signal to Interference Ratio).
    **a) True**                 b) False

32. Which of the following has range extension capability?
    a) Sectoring           c) Scattering
    **b) Repeaters**         d) Micro cell zone concept

33. Which of the following is not an advantage of micro cell zone technique?
    a) Reduced co channel interference

b) Improved signal quality

c) Increase in capacity

**d) Increasing number of base stations**

34. In a micro cell zone concept, when a mobile travels from one zone to another within the cell, it retains the same _____

   a) Power level                **c) Channel**

   b) Base station            d) Receiver

35. If D is the distance between co-channel cells and R be the cell radius, co-channel reuse ratio is given by _____

   a) D*R                   **c) D/R**

   b) D2/R                d) D/R2

36. _____ is the interference at a base station receiver that comes from the subscriber units in the surrounding cells.

   a) Forward channel interference      c) Receiver interference

   b) Carrier interference             **d) Reverse channel interference**

37. _____ allows subscribers to monitor neighbouring base stations.

   a) TDMA                  c) FDMA

   **b) MAHO**                d) ACA

38. Frequency reuse factor for CDMA system is _____

   **a) One**                  c) Zero

   b) Two                   d) Ten

39. Cellular concept replaces many low power transmitters to a single high power transmitter.

   a) True                  **b) False**

40. Why neighbouring stations are assigned different group of channels in cellular system?

   **a) To minimize interference**

   b) To minimize area

   c) To maximize throughput

   d) To maximize capacity of each cell

41. What is a cell in cellular system?

   a) A group of cells

   b) A group of subscribers

   **c) A small geographical area**

   d) A large group of mobile systems

42. What is frequency reuse?

   **a) Process of selecting and allocating channels**

   b) Process of selection of mobile users

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c) Process of selecting frequency of mobile equipment

d) Process of selection of number of cells

# 4. Advance Wireless Standards

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Position in Question Paper                                    Total Marks-18

  Q.1. f) 2-Marks.
  Q.2. d) 4-Marks.
  Q.3. d) 4-Marks.
  Q.4. a) 4-Marks.
  Q.6. c)  6-Marks
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# Descriptive Question

1. State any four features of IMT 2000.
2. Explain IMT 2000 services.
3. State any four features of UMTS.
4. Draw and explain UMTS architecture.
5. Compare with CDMA 2000.
6. Compare 4G LTE with VOLTE.
7. Compare 4G &5G.

## MCQ Question

## (Total number of Question=Marks*3=18*3=54)

Note: Correct answer is marked with **bold**

1. Which of the following has no backward compatibility with 3G Cdma2000?
  a) IS-95                                      c) IS-95A
  **b) GPRS**                                d) IS-95B
2. 2G and 2.5G CDMA operators may selectively introduce 3G capabilities at each cell without changing entire base stations and reallocate spectrums.
  **a) True**                                  b) False
3. Which of the following the first 3G CDMA air interface?
  a) IS-95                                    **c) Cdma2000 1xRTT**
  b) IS-95B                               d) CdmaOne
4. Within ITU IMT-2000 body, Cdma2000 1xRTT is also known as _____
  a) Cdma2000 1xEV-DO                 c) IS-95B
  b) Cdma2000 1xEV-DV               **d) G3G-MC-CDMA-1X**

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5. How many users are supported by Cdma2000 1X in comparison to 2G CDMA standard?

a) Half

**b) Twice**

c) Six times

d) Ten times

6. Cdma2000 works in TDD mode only.

a) True

**b) False**

7. Which of the following is not a characteristic of Cdma2000?

a) Adaptable baseband signalling rates

b) Adaptable baseband chipping rates

c) Multicarrier technologies

**d) OFDMA**

8. Cdma2000 1xEV was developed by _____

**a) Motorola**

b) samsung

c) nokia

d) none

9. How is bandwidth increased in Cdma2000?

**a) Clubbing adjacent radio channels**

b) Changing the hardware of base stations

c) Change of spectrum

d) Change of RF equipment

10. What are the two options provided by Cdma2000 1xEV?

a) Cdma2000 1xRTT. Cdma2000 3xRTT

**b) Cdma2000 1xEV-DO, Cdma2000 1xEV-DV**

c) Cdma2000 1xEV-DT, Cdma2000 1xEV-DO

d) Cdma2000 1xRTT, Cdma2000 1xEV-DV

11. Which of the following is not backward compatible with Cdma2000?

a) Cdma2000 1xRTT

b) Cdma2000 3xRTT

**c) Cdma2000 1xEV-DO**

d) Cdma2000 1xEV-DT

12. Which UE category supports 64 QAM on the uplink?

**a) Only category 5**

b) Only category 4

c) Only category 3

d) Category 3,4 and 5

13. What type of handovers is supported by LTE?

**a) Hard handover only**

b) Soft handover only

c) Hard and soft handover

d) Hard, soft and softest handover

14. What is the minimum amount of RF spectrum needed for an FDD LTE radio channel?

a) 1.4 MHz

**b) 2.8 MHz**

c) 5 MHz

d) 20 MHz

15. Which organization is responsible for developing LTE standards?

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a) UMTS    c) 3GPP2

**b) 3GPP**    d) ISO

16. How often can resources be allocated to the UE?

    a) Every symbol    **c) Every subframe**

    b) Every slot    d) Every frame

17. What is the largest channel bandwidth a UE is required to support in LTE?

    a) 10 MHz    c) 1.4 MHz

    **b) 20 MHz**    d) 5 MHz

18. In LTE, what is the benefit of PAPR reduction in the uplink?

    a) Improved uplink coverage

    b) Lower UE power consumption

    c) Reduced equalizer complexity

    **d) Improved uplink coverage, lower UE power consumption and reduced equalizer**

19. What is the full form of UMTS?

    **a) Universal Mobile Telephone System**

    b) Ubiquitous Mobile Telephone System

    c) Ubiquitous Mobile Telemetry System

    d) Universal Machine Telemedicine System

20. UMTS use which multiple access technique?

    **a) CDMA**    c) FDMA

    b) TDMA    d) SDMA

21. UMTS does not has backward compatibility with _____

    a) GSM    **c) IS-95**

    b) IS-136    d) GPRS

22. UMTS is also known as _____

    a) IS-95    c) CdmaOne

    b) GPRS    **d) W-CDMA**

23. What is the chip rate of W-CDMA?

    a) 1.2288 Mcps    c) 270.833 Ksps

    **b) 3.84 Mcps**    d) 100 Mcps

24. W-CDMA works in FDD mode only.

    **a) True**    b) False

28. How much packet data rate per user is supported by W-CDMA if the user is stationary?

    a) 2.048 Kbps    **c) 2.048 Mbps**

    b) 100 Mbps    d) 1 Gbps

29. What is the minimum spectrum allocation required by W-CDMA?

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a) **5 MHz**                                          c) 1.25 MHz

b) 20MHz                                            d) 200 KHz

30. W-CDMA requires a complete change of RF equipment at each base station.

   a) **True**                                          b) False

31. How much increase in spectral efficiency is provided by W-CDMA in comparison to GSM?

   a) Two times                                      c) No increase

   b) Three times                                    **d) Six times**

32. Which of the following is not a characteristic of 3G network?

   a) Communication over VoIP

   **b) Unparalleled network capacity**

   c) Multi-megabit Internet access

   d) LTE based network

33. What is the term used by ITU for a set of global standards of 3G systems?

   **a) IMT 2000**                                    c) CDMA

   b) GSM                                            d) EDGE

34. Which of the following leads to evolution of 3G networks in CDMA systems?

   a) IS-95                                          c) CdmaOne

   b) IS-95B                                        **d) Cdma2000**

35. Which of the following is not a standard of 3G?

   a) UMTS                                          c) TD-SCDMA

   b) Cdma2000                                      **d) LTE**

36. Which of the following 3G standard is used in Japan?

   a) Cdma2000                                      **c) UMTS**

   b) TD-SCDMA                                      d) UTRA

37. What does the number 2000 in IMT-2000 signifies?

   **a) Year**                                        c) Number of cells

   b) Number of subscribers per cell                d) Area (Km)

38. Which of the following is not an application of third generation network?

   a) Global Positioning System (GPS)

   b) Video conferencing

   c) Mobile TV

   **d) Downloading rate upto 1 Gbps**

39. What does LTE stands for?

   a) Level Telecom Advanced                        **c) Long Term Evolution**

   b) Long Terminal Advanced                        d) Long Time Evolution

40. Though LTE is treated as a 4G (Fourth Generation) network, it is actually a ___ generation technology as it does not meet expectations.

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a) 2.5G  c) 3.5G
b) 3G  **d) 3.9G**

41. What is the Access technique used by an LTE or LTE-A network?
    a) WCDMA  c) PDMA
    b) FDMA  **d) OFDMA**

42. What does OFDMA stands for?
    a) Original Frequency Division Multiple Access
    **b) Orthogonal Frequency Division Multiple Access**
    c) Omitted Frequency Division Multiple Access
    d) None

43. What is the carrier Bandwidth in a typical 3G WCDMA based network?
    a) 1.4 Mhz  **c) 5 MHz**
    b) 3MHz  d) 10 MHz

44. The Air interface or Radio interface of a 4G LTE network is _____ as a 3G network.
    a) Same  **b) Not same**

45. ITU stands for ___.
    a) International Television Union
    b) Internal Telecommunication Union
    c) Inventions for Telecommunication Union
    **d) International Telecommunication Union**

46. Which of the following is not an objective for channel assignment strategies?
    a) Efficient utilization of spectrum
    b) Increase of capacity
    c) Minimize the interference
    **d) Maximize the interference**

47. In fixed channel assignment strategy, each cell is allocated a predetermined set of _____
    **a) Voice channels**  c) Frequency
    b) Control channels  d) base stations

48. What is a borrowing strategy in fixed channel assignments?
    **a) Borrowing channels from neighbouring cell**
    b) Borrowing channels from neighbouring cluster
    c) Borrowing channels from same cell
    d) Borrowing channels from other base station in same cell

49. Which of the following is a universally adopted shape of cell?
    a) Square  c) Triangle
    b) Circle  **d) Hexagon**

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50. Actual radio coverage of a cell is called _____
   a) Fingerprint                          c) Imprint
   **b) Footprint**                         d) Matrix

51. Why the shape of cell is not circle?
   a) Omni directionality
   b) Small area
   **c) Overlapping regions or gaps are left**
   d) Complex design

52. What is the main reason to adopt hexagon shape in comparison to square and triangle?
   **a) Largest area**                      c) Small area
   b) Simple design                        d) Single directional

53. For a cellular system, if there are N cells and each cell is allocated k channel. What is the total number of available radio channels, S?
   **a) S=k*N**                             c) S=N/k
   b) S=k/N                                 d) S=kN

54. What is a cluster in a cellular system?
   a) Group of frequencies                 c) Group of subscribers
   **b) Group of cells**                    d) Group of mobile systems

55. What is a frequency reuse factor for N number of cells in a system?
   a) N                                     c) 2*N
   b) N2                                    **d) 1/N**

56. Capacity of a cellular system is directly proportional to _____
   a) Number of cells
   **b) Number of times a cluster is replicated**
   c) Number of Base stations
   d) Number of users

# 5. Wireless Network Technology

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**Position in Question Paper**                                **Total Marks-12**

   Q.1. g) 2-Marks.
   Q.3.c) 4-Marks.
   Q.5. b) 3-Marks.
   Q.6. c) 3-Marks

# Descriptive Question

   1. Explain the concept RFID with neat diagram.
   2. Explain Bluetooth protocol.
   3. List out any 4 features of IEEE 801:15:1or Bluetooth
   4. Advantages and applications of WLAN.
   5. Compare active and passive tags.
   6. Explain WIMAX architecture.
   7. Compare IEEE 802:11 & 802:16.
   8. Write any 4 features of WPAN.
   9. What is MANET? Write any four features and applications of MANET

## MCQ Question

## (Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. What is the full form of WLAN?
   a) Wide Local Area Network              c) Wireless Land Access Network
   **b) Wireless Local Area Network**       d) Wireless Local Area Node
2. WLANs use high power levels and generally require a license for spectrum use.
   a) True                                 **b) False**
3. What is the name of 300 MHz of unlicensed spectrum allocated by FCC in ISM band?
   **a) UNII**                              c) Millimeter wave
   b) Unlicensed PCS                        d) Bluetooth
4. Which of the following specifies a set of media access control (MAC) and physical layer specifications for implementing WLANs?
   a) IEEE 802.16                           **c) IEEE 802.11**
   b) IEEE 802.3                            d) IEEE 802.15

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5. Which of the following is not a standard of WLAN?
   a) HIPER-LAN
   b) HIPERLAN/2
   c) IEEE 802.11b
   **d) AMPS**

6. Which of the following is the 802.11 High Rate Standard?
   a) IEEE 802.15
   b) IEEE 802.15.4
   c) IEEE 802.11g
   **d) IEEE 802.11b**

7. Which of the following spread spectrum techniques were used in the original IEEE 802.11 standard?
   **a) FHSS and DSSS**
   b) THSS and FHSS
   c) THSS and DSSS
   d) Hybrid technique

8. Which of the following WLAN standard has been named Wi-Fi?
   a) IEEE 802.6
   b) IEEE 802.15.4
   **c) DSSS IEEE 802.11b**
   d) IEEE 802.11g

9. Which of the following is developing CCK-OFDM?
   a) IEEE 802.11a
   b) IEEE 802.11b
   c) IEEE 802.15.4
   **d) IEEE 802.11g**

10. What is the data rate of HomeRF 2.0?
    **a) 10 Mbps**
    b) 54 Mbps
    c) 200 Mbps
    d) 1 Mbps

11. HIPER-LAN stands for _____
    a) High Precision Radio Local Area Network
    **b) High Performance Radio Local Area Network**
    c) High Precision Radio Land Area Network
    d) Huge Performance Radio Link Access Node

12. What is the range of asynchronous user data rates provided by HIPER-LAN?
    a) 1-100 Mbps
    b) 50-100 Mbps
    **c) 1-20 Mbps**
    d) 500 Mbps to 1 Gbps

13. What is the name of the European WLAN standard that provides user data rate upto 54 Mbps?
    a) UNII
    b) WISP
    c) MMAC
    **d) HIPERLAN/2**

14. What is WISP?
    a) Wideband Internet Service Protocol
    **b) Wireless Internet Service Provider**
    c) Wireless Instantaneous Source Provider
    d) Wideband Internet Source Protocol

15. The price of WLAN hardware is more than 3G telephones and fixed wireless equipment.

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a) True      b) **False**

16. Which of the following is not an open standard?
    a) Bluetooth      c) HTML
    b) WWW      **d) VPN**

17. What is the nominal range of Bluetooth?
    a) 1 Km      c) 1 m
    **b) 10 m**      d) 10 Km

18. Bluetooth standard is named after _____
    a) King Ronaldo Bluetooth      **c) King Herald Bluetooth**
    b) Pope Vincent Bluetooth      d) Pope Francis Bluetooth

19. Bluetooth operates in which band?
    a) Ka Band      c) Ku Band
    b) L Band      **d) 2.4 GHz ISM Band**

20. Which of the following scheme is used by Bluetooth?
    **a) Frequency hopping TDD scheme**
    b) Frequency hopping FDD scheme
    c) DSSS TDD scheme
    d) None

21. What is the range of time slot in Bluetooth?
    a) 120 milliseconds      c) 577 microseconds
    **b) 625 microseconds**      d) 5.7 seconds

22. Which modulation scheme is used by Bluetooth?
    a) DQPSK      **c) GFSK**
    b) MSK      d) BPSK

23. What is the channel symbol rate in Bluetooth for each user?
    a) 270.833 Kbps      c) 100 Mbps
    b) 1 Gbps      **d) 1 Mbps**

24. What is the raw channel bit error rate of Bluetooth?
    **a) 10-3**      c) 103
    b) 10-10      d) 10-1

25. Which of the following standard committee specifies Bluetooth and other Personal Area Networks (PAN)?
    a) IEEE 802.11b      c) IEEE 802.11g
    **b) IEEE 802.15**      d) IEEE 802.16

26. What is the use of the RFID Module?
    **a) Object Identification**      c) To measure temperature
    b) To provide 3G Connectivity      d) To measure Wi-Fi strength

27. What is the role of the MISO pin in the RFID Module?

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 **a) Master In Slave Out**
 b) Manage Internal Slave Output
 c) Master Internal Search Optimization
 d) Manage Input Slave Optimization

28. What will happen if we supply a voltage of 25V to the Vcc of the RFID Module?
 **a) Damage is caused**
 b) Module will shut down
 c) Module will not respond for the time the voltage is applied
 d) Module will function normally

29. Which frequency does the RFID Module operate in?
 a) 12.98 MHz     c) 19.56 MHz
 b) 14.67 MHz     **d) 13.56 MHz**

30. What is the maximum data rate of the RFID Module?
 a) 11 Mbps     **c) 10 Mbps**
 b) 1 Kbps     d) 11 Gbps

31. What is the maximum read range of the RFID Module?
 a) 2 cm     c) 10 cm
 b) 1 cm     **d) 5 cm**

32. Is there an interrupt pin on the RFID Module?
 a) No     **b) YES**

33. Military vehicles on a battlefield with no existing infrastructure will deploy ___network.
 **a) MANET**     c) LAN
 b) Cell Network     d) Wi-Fi

34. The network in which all the nodes are symmetric and there is no central control or hierarchy is _____
 a) MANET     c) Peer-to-Peer
 **b) Client -Server Technology**     d) None of these

35. What is the type of network in which the topology change from time to time?
 a) Wi-Fi     c) LAN
 b) Cell Network     **d) MANET**

36. The processes that keep track of all mobile hosts visiting the area is _____
 a) Home agent     **c) Foreign agent**
 b) Mobile agent     d) User agent

37. The hosts which are basically stationary hosts who move from one fixed site to another from time to time but use the network only when they are physically connected to it are called _____

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a) **Migratory hosts**                    c) Mobile hosts

b) Stationary hosts                       d) Random hosts

39. The hosts who compute on the run and want to maintain their connections as they move around _____

a) Migratory hosts                        **c) Mobile hosts**

b) Stationary hosts                       d) Random hosts

40. What is the type of network in which the routers themselves are mobile?

a) Wide Area Network                      c) **Mobile Ad-hoc Network**

b) Mobile Network                         d) Local Area Network