**SRM Institute of Science and Technology**
**College of Engineering and Technology**

**Set A**

**DEPARTMENT OF ECE**

SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu

**Academic Year: 2024-2025 (ODD)**

**Test: CLAT- 1** **Date:12.6.2024**

**Course Code & Title: 18ECC301T Wireless Communication** **Duration: 3:10- 4:00 PM**

**Year & Sem: IV& VII** **Max. Marks: 25**

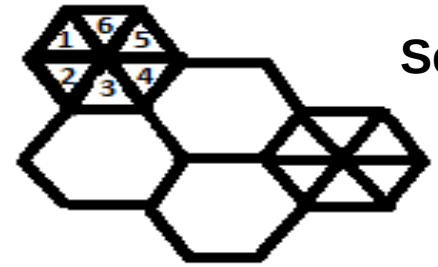
**Course Articulation Matrix:**

| 18ECC301T_Wireless Communication | PROGRAM OUTCOMES | | | | | | | | | | | | PROGRAM STUDENT OUTCOMES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COURSE OUTCOMES** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| Interpret the concepts of Wireless communication and basic cellular networks | 3 | - | - | 3 | - | - | - | - | - | - | - | 2 | - | - | - |
| Analyze different Radio wave propagation models for cellular communication | - | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - | 3 |
| Apply different multipath propagation channel models in wireless systems | - | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Illustrate the Link performance improvement techniques | - | 3 | - | - | - | - | 2 | - | - | - | - | - | - | - | 3 |
| Summarize different wireless communication standards and systems | - | - | 2 | - | - | 2 | - | - | - | - | - | - | 2 | - | - |

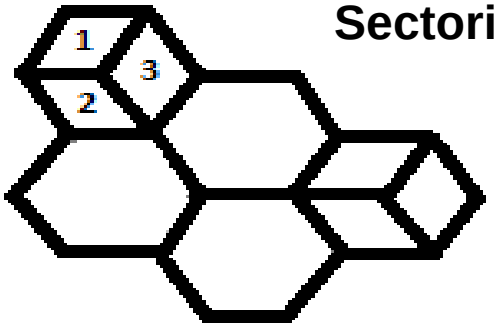
| **Part – A (5x1= 5Marks)** | | | | | |
|---|---|---|---|---|---|
| **Q. No** | **Answer all the questions** | **Marks** | **BL** | **CO** | **PO** |
| 1. | Identify the channel to be used for a transmission of device power level from mobile station to base station<br>a. Forward Control Channel<br>b **Reverse Control Channel**<br>c Forward Voice Channel<br>d Reverse Voice Channel | 1 | 1 | 1 | 1 |
| 2. | The data rate in 3G standard is<br>a. 144bps –2Kbps b. 144Kbps –2Gbps<br>c. **144kps- 2Mbps** d. 144Mbps- 2Gbps | 1 | 3 | 1 | 4 |
| 3. | Increase in capacity, without degradation in _____ efficiency is caused by sectoring.<br>a. Erlang b. Grade of service c.**Trunking** d.Meandering | 1 | 1 | 1 | 1 |
| 4. | A spectrum of 25 MHz is allocated to a cellular system which uses two 25 KHz simplex channels to provide full duplex voice channels. What is the number of channels available per cell for 4 cell reuse factor?<br>a.150 b. **125** c. 1000 d. 250 | 1 | 1 | 1 | 1 |
| 5. | A Signal to Interference ratio of 18.66dB with 6 co channels in the first tier of the system and with a path exponent value of 4.What will be the co -Channel reuse ratio ?<br>a. 3 b. **4.58** c.6 d.6.24 | 1 | 3 | 1 | 4 |
| **Part – B(2x 4= 8Marks)<br>Answer Any two questions** | | | | | |
| 6. | Discuss the concept of cell sectoring to improve capacity of a cellular system.<br>▪ The technique for decreasing the co-channel | | 4 | 1 | 4 |

interference & thus increasing the system performance by using directional antenna is known as Sectoring .

- Sectoring Can be done at $60^o$ & $120^0$ .




**Sectoring- $60^o$**




**Sectoring- $120^o$**

- Co-channel Interference in a cellular system may be decreased by replacing a single Omni directional antenna at the base station by several directional antenna, each radiating with in a specific sector.
- When sectoring is employed, the channels used in a particular cell are broken down into sectored groups & are used only with in a Particular sector Assuming N=7 for the case $120^o$ Sector. The number of interference in the first tier is reduced from 6 to 2.
- This is because only 2 of 6 co-channel Cells receive interference with a Particular sectored group as shown.
- Out of 6 co-channel cells, 3 are on Right & 3 are on Left of middle cell.
- With Omni directional antenna due to presence of 6 cells, they can interfere (in tier) with middle $5^{th}$ block.
- Now, only 2 antenna will interfere with the middle one, so the number is reduced to 2 from 6.

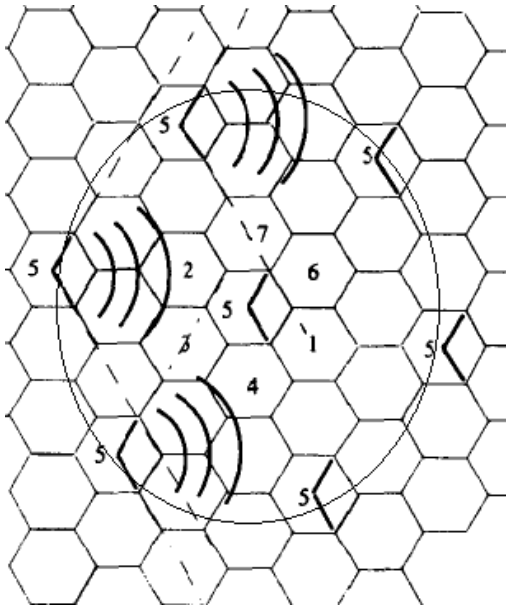



Fig 2 marks , explanation 2 marks

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| 7. | Define co channel reuse ratio and What is the co-channel reuse ratio for a cluster size 7.<br><br>Frequency reuse implies that in a given coverage area there are several cells<br>that use the same set of frequencies. These cells are called **Co-Channel cells** & interference b/w signals from these cells is called **Co-Channel Interference.**<br><br>**Co-Channel Reuse ratio**, is related to cluster size<br><br>$Q = \frac{D}{R} = \sqrt{3N}$<br><br>A **small value of Q** provides **larger capacity,** Since the cluster size N is small.<br>▪ A **large value of Q** improves the **Transmission Quality,** Due to smaller level of<br>co-channel interference.<br>Therefore a **Trade-off** must be made b/w these two objectives in actual cellular design.<br><br>For N=7, Q=(3x7)^0.5=4.58. | 2 marks each | 3 | 1 | 4 |
| 8. | How many users can be supported for 0.5% blocking probability for the following number of trunked channels in a blocked call cleared system? (a) 10 (b) 20. Assumed that each user generates 0.1 Erlangs of traffic.<br><br>No: of Channels / Capacity in Erlangs for grade of service<br>=0.01 \| =0.005 \| =0.002 \| =0.001<br>2 \| 0.153 \| 0.105 \| 0.065 \| 0.046<br>4 \| 0.869 \| 0.701 \| 0.535 \| 0.439<br>5 \| 1.36 \| 1.13 \| 0.900 \| 0.762<br>10 \| 4.46 \| 3.96 \| 3.43 \| 3.09<br>20 \| 12.0 \| 11.1 \| 10.1 \| 9.41<br><br>Given C=10, GoS=0.005,<br><br>From the table,<br><br>We have A=3.96.<br><br>Then, the no: of users will be A/Au=3.96/0.1= 39.6 approximated to 39 users.<br><br>Similarly, For C=10, GoS=0.005, we have from table, A= 11.1. which gives U=no:of users as =A/Au=11.1/0.1=111 users. | 2 marks each | 4 | 1 | 4 |

| | | | | | |
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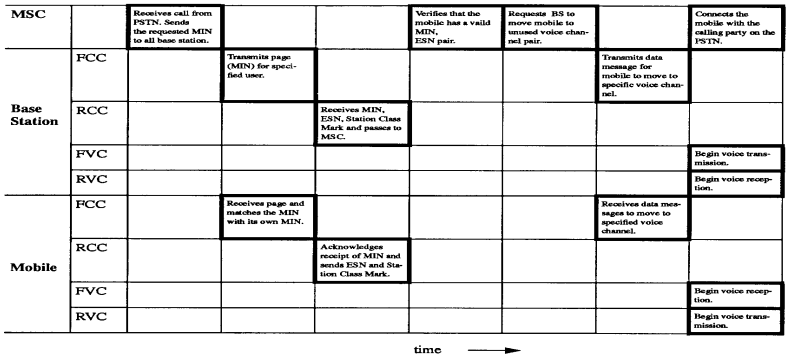
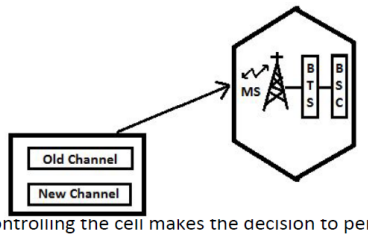
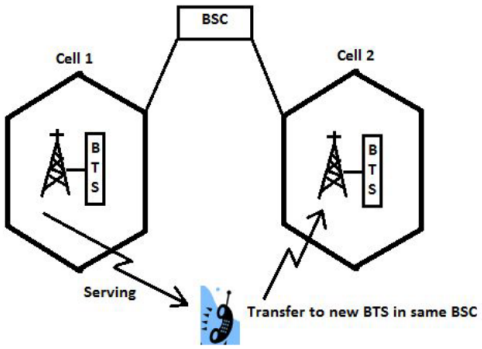
| | | | | | |
| **Part – C (1 x 12= 12Marks)**<br>**Answer all the questions** | | | | | |
| | | | | | |
| 9a. | With the help of timing diagram, explain how a call is initiated by a landline to a mobile user.<br>  <br><br>every phone scans the same channels while idle. When a telephone call is placed to a mobile user, the MSC dispatches the request to all base stations in the cellular system. The *mobile identification number* (MIN), which is the subscriber's telephone number, is then broadcast as a paging message over all of the forward control channels throughout the cellular system. The mobile receives the paging message sent by the base station which it monitors, and responds by identifying itself over the reverse control channel. The base station relays the acknowledgment sent by the mobile and informs the MSC of the handshake. Then, the MSC instructs the base station to move the call to an unused voice channel within the cell (typically, between ten to sixty voice channels and just one control channel are used in each cell's base station). At this point the base station signals the mobile to change frequencies to an unused forward and reverse voice channel pair, at which point another data message (called an *alert*) is transmitted over the forward voice channel to instruct the mobile telephone to ring, thereby instructing the mobile user to answer the phone. Figure 1.6 shows the sequence | Timing diagram 6 marks, explanation 6 marks | 3 | 1 | 12 |
| | **(OR)** | | | | |
| 9b. | Elaborate on the types of handoff based on the cell, BSC and MSC switching.<br><br>Types of Handoff<br>1) Intra-cell-Intra BSC Handover<br>2) Inter-cell-Intra BSC Handover<br>3) Inter-cell-Inter BSC Handover<br>4) Inter MSC Handover<br>1) **Intra-cell-Intra BSC Handover :** Smallest of the Handover is the intra-cell handover where the subscriber is handed over to another traffic channel (generally in another frequency) with in same cell.<br>  <br><br>▪ In this case, BSC controlling the cell makes the decision to perform handover. | Each 3 marks | 2 | 1 | 1 |

**2) Inter-cell-Intra BSC Handover :**

- The subscriber moves from cell1 to cell 2 but within BSC.
- In this case, the handover process is carried out by the BSC.
- Traffic connection with cell 1 is released when the connection with cell 2 is setup successfully.

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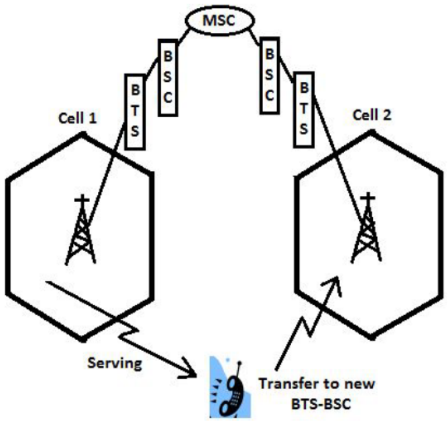
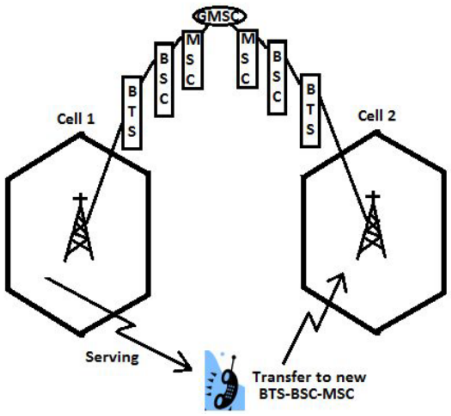
**3) Inter-cell-Inter BSC Handover :**

- The subscriber moves from cell1 to cell 2 which is served by another BSC.
- In this case, handover process is carried out by the MSC, but the decision to make the handover is still done by the first BSC.
- Traffic connection with the first BSC & BTS is released when the connection with the new BSC & BTS is setup successfully.

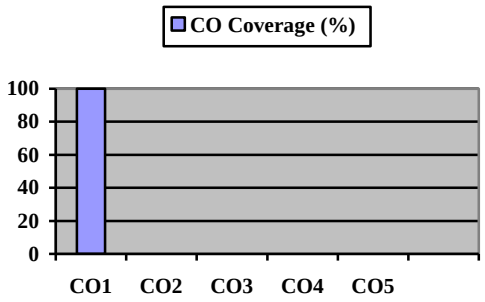


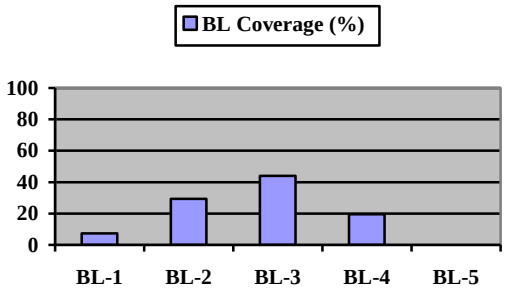

**4) Inter MSC Handover :**

- The subscriber moves from cell1 to cell 2 which is served by another MSC.
- In this case, handover process is carried out by the GMSC.
- Traffic connection with the first BTS-BSC-MSC is released when the connection with the new BTS-BSC-MSC is setup successfully.




**Course Outcome (CO) and Bloom's level (BL) Coverage in Questions**




## Evaluation Sheet

**Name of the Student:** **Register No.:**

| Part – A (5x1= 5 Marks) | | | | | |
|---|---|---|---|---|---|
| **Q. No** | **CO** | **PO** | **Maximum Marks** | **Marks Obtained** | **Total** |
| 1 | 1 | 1 | 1 | | |
| 2 | 1 | 4 | 1 | | |
| 3 | 1 | 1 | 1 | | |
| 4 | 1 | 1 | 1 | | |
| 5 | 1 | 1 | 1 | | |
| Part – B (2x 4= 8 Marks) | | | | | |
| 6 | 1 | 4 | 4 | | |
| 7 | 1 | 4 | 4 | | |
| 8 | 1 | 4 | 4 | | |
| Part- C (1 x 12 =12 Marks) | | | | | |
| 9a | 1 | 1 | 12 | | |
| 9b | 1 | 1 | 12 | | |

**Consolidated Marks:**

| CO | Maximum Marks | Marks Obtained |
|---|---|---|
| 1 | 25 | |
| Total | 25 | |

| PO | Maximum Marks | Marks Obtained |
|---|---|---|
| PO-1 | 15 | |
| PO-4 | 14 | |
| PO-12 | 12 | |
| Total | 41 | |

**Signature of Course Teacher**