

1. Module details**Module name****Cellular Communications Systems 1****Module duration**

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 - 40 hours.

Module code

NUE153

Discipline code

0703215 Communication Engineering/Technologies.

2. Module purpose

This module will provide students with the knowledge and skills to understand the operation of Cellular Communication Systems.

3. PrerequisitesNE39 Communication Fundamentals.
NUE180 Receiver and Transmitter Circuits.
NUE032 Personal Radio Communications.**4. Relationship to competency standards**

This module provides part of the underpinning knowledge and skills in the 'Evidence Guide' of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from NUEITAB.

5. Content**Evolution of the Land Mobile Radio Communication Systems architecture**Radio Despatch system
Multichannel Radio Telephone system
Radio Paging system
Common User Despatch system**Operational advantages of a Cellular Radio Telephone Communication system, over the conventional Radio Telephone System**Transmission quality
At call accessibility
Frequency reuse patterns
Expansion of network capacity**Overview of typical Cellular Radio Communication System**Cellular network configuration
Transmission of signalling information
Mobile location information in-call Handover

	<p>Overview of the Advance Mobile Phone System (AMPS) architecture Tx,Fx frequency allocation Network configuration Transceiver architecture</p> <p>Key features of a typical GSM system Limitations of the AMPS system Key GSM features</p> <p>Outline of Teleservices provided by the GSM Digital Air Interface International roaming ISDN Services</p> <p>GSM network architecture overview Mobile Station Base Station Subsystem Network Subsystem Frequency allocations of the GSM system</p>
<p>6. Assessment strategy</p>	
<p>Assessment methods</p>	<p>Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.</p>
<p>Conditions of assessment</p>	<p>Learning and assessment will take place in an environment that is conducive to a learner’s development.</p>
<p>7. Learning outcome details</p>	
<p>Learning outcome 1</p>	<p>Briefly describe the evolution of the Land Mobile Radio Communication Systems architecture.</p>
<p>Assessment criteria</p>	<p>1.1 Describe the architecture of a conventional, single channel, Radio Dispatch, point to multipoint transceiver system, used by taxis, firemen, ambulances, police and delivery fleets.</p> <p>1.2 Describe the architecture of a conventional Radio Telephone multi-channel transceiver system in which: - Telephones can dial and receive calls via a public telephone system - Users queue for a free channel.</p>

- 1.3 Describe the architecture of a conventional, single channel, simplex Radio Paging system, including:
 - Voice paging units
 - Bleep paging unit
 - Public telephone access.

- 1.4 Describe the architecture of a Common User Dispatch system, in which:
 - Multiple transceivers share multiple channels
 - Equipment automatically selects a free channel
 - Requests for channels are automatically queued
 - Call to individual transceivers or fleet calls can be made
 - The system can leave a message of call waiting.

- 1.5 Describe, in block diagram form, the Autopatch Repeater that connects the radio transceivers to the telephone lines by remote control.

Learning outcome 2

Describe the principle operational advantages of a Cellular Radio Telephone Communication system over the conventional Radio Telephone System.

Assessment criteria

- 2.1 Describe the operational advantages of a cellular radio telephone communication system in terms of:
 - Good transmission quality
 - Accessibility of an idle transmission channel, at call
 - Frequency reuse, that allows cells within the system to use the same frequency channel, without interference between the channels
 - Expandable capacity.

Learning outcome 3

Overview of a typical Cellular Radio Communication system.

Assessment criteria

- 3.1 Describe the Cell Structure, in terms of:
- Repeat patterns
 - Frequency reuse, D/R ratio of a particular cell repeat pattern
 - Fading of signal strength as the mobile moves from one cell to another (Rayleigh fading effect)
 - Path loss using Hata's formulae
 - Restructure of existing cell plan to increase network capacity.
- 3.2 Describe the transmission of signalling information in the direction of:
- Land to Mobile (L-M)
 - Mobile to Land (M-L).
- 3.3 Describe the Mobile Location registration process.

Learning outcome 4

Describe the Advanced Mobile Phone System (AMPS) architecture.

Assessment criteria

- 4.1 Outline the following operational aspects of the (AMPS) in terms of:
- Tx, Fx, Frequency spectrum
 - Total Access Communication System (TACS) frequency spectrum
 - Mobile Power levels
 - The potential expansion of system capacity.
- 4.2 Describe the AMPS Network configuration relating to:
- Call Processing events
 - Procedures
 - Land to Mobile (L-M) call
 - Mobile to Land (M-L) call
 - Mobile Location Registration Process
 - Location Registration Procedure
 - Call Set up.
- 4.3 Describe the sequence of events when the mobile originates the call.
- 4.4 Describe the sequence of events when the Network originates the call.
- 4.5 Describe the transceiver architecture of an AMPS cellular mobile transceiver incorporating:
- The sophisticated analogue circuitry
 - Digital circuitry
 - The microprocessor micro-control circuitry.

Learning outcome 5

Describe the operating principles of typical Cellular Radio Communication systems.

Assessment criteria

- 5.1 Describe the characteristics of the AMPS Cellular Radio Communication system.
- 5.2 Describe the key GSM features including:
 - Single RF carrier
 - CODEC half time frame
 - Resistance to co-channel interference
 - Periodic location updates of mobiles
 - Discontinuous receive mode.

Learning outcome 6

Outline the services provided by the GSM.

Assessment criteria

- 6.1 Describe the operating characteristics of the digital air interface providing an entirely digital link between the mobile and base station, and the base station and Public Switched Telephone Network (PSTN).
- 6.2 Outline the technical requirement for international roaming.
- 6.3 Describe the characteristic of Supplementary Integrated Services Digital Network (ISDN) services including:
 - Call Barring
 - Call Forwarding relating to Short Messaging Service (SMS)
 - International roaming
 - Digital voice encryption
 - Subscriber identity module (SIM) card billing and user ID
 - PIN entry and disabling
 - Emergency calling
 - Access to circuit switched public data networks
 - Fax
 - Teletex
 - Cell broadcasting
 - Advice of charge services.

Learning outcome 7	Describe the architecture of the GSM network.
Assessment criteria	<p>7.1 Outline the relevant parameters of a mobile station, including:</p> <ul style="list-style-type: none"> - Tx power levels in Watts or dBm's' - Sub system block diagram of a typical GSM mobile phone - Network Station Subsystem - Network Subsystem. <p>7.2 Describe the autpatch cable connection to other services such as:</p> <ul style="list-style-type: none"> - PSDN - ISDN. <p>7.3 List the frequency allocations for the GSM system.</p>
8. Delivery of the module	
Delivery strategy	<p>Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective method to achieve this is by integration of theory and practice where students learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require learning outcome sequence other than that indicated in the module.</p>
Resource requirements	<p>Resources should be sufficient for students to carry-out learning activities on an individual basis. This could include:</p> <ul style="list-style-type: none"> - Suitable workshops/laboratories - Suitable tools and equipment.
Suggested references	<p>Gary Miller. <i>Modern Electronic Communication</i> 5th Edition Prentice Hall Book Company.</p> <p>Developments in Cellular Radio. Seminar sponsored by the Mobile Users Association.</p> <p>Technical Articles:</p> <ul style="list-style-type: none"> - Mobilesat Revealed, <i>Electronics Australia</i> February 1992. Author: B. Woodward. - Cellular Radio put in the test. <i>Australian Electronics Engineering</i> – February 1985
Occupational health and safety requirements	<p>A safe and healthy environment will be provided for students and teachers as well as the particular safety procedures followed as part of the learning / teaching activity and content.</p>