

## **Engineering focus module:    Telecommunications engineering**

### **30 hours indicative time**

One or more examples of telecommunications engineering must be used to develop an understanding of the scope and nature of this profession.

Some examples include: telephone systems (fixed and mobile), radio systems, television systems and satellite communication systems.

### **Outcomes**

A student:

- H1.1 describes the scope of engineering and critically analyses current innovations
- H1.2 differentiates between the properties and structure of materials and justifies the selection of materials in engineering applications
- H2.2 analyses and synthesises engineering applications in specific fields and reports on the importance of these to society
- H3.1 demonstrates proficiency in the use of mathematical, scientific and graphical methods to analyse and solve problems of engineering practice
- H3.2 uses appropriate written, oral and presentation skills in the preparation of detailed engineering reports
- H3.3 develops and uses specialised techniques in the application of graphics as a communication tool
- H4.1 investigates the extent of technological change in engineering
- H4.3 applies understanding of social, environmental and cultural implications of technological change in engineering to the analysis of specific engineering problems
- H5.2 selects and uses appropriate management and planning skills related to engineering
- H6.1 demonstrates skills in research and problem-solving related to engineering

<ul style="list-style-type: none"> <li>▪ <b>Scope of the profession</b></li> </ul>	
<i>Students learn about:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ nature and scope of telecommunications engineering</li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ health and safety issues</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ training for the profession</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ career prospects</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ relations with the community</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ technologies unique to the profession</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ legal and ethical implications</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ engineers as managers</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ current applications and innovations</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

<i>Students learn to:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ define the responsibilities of the telecommunications engineer</li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ describe the nature and range of the work of telecommunications engineers</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

<ul style="list-style-type: none"> <li>▪ examine projects and innovations in the telecommunications profession</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ analyse the training and career prospects within telecommunications engineering</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

<ul style="list-style-type: none"> <li>▪ <b>Historical and societal influences</b></li> </ul>	
<i>Students learn about:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ historical development within the telecommunications industry</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ the effect of telecommunications engineering innovation on people's lives</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ materials and techniques used over time and development of cathode ray television including B/W and colour</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

<i>Students learn to:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ research the history of technological change in the field of telecommunications</li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ describe the nature of engineering systems in the</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

telecommunications field and the importance of this to society	
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<ul style="list-style-type: none"> <li>▪ <b>Engineering materials</b></li> </ul>	
<i>Students learn about:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ specialized testing <ul style="list-style-type: none"> <li>– voltage, current, insulation</li> <li>– signal strength and testing</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ copper and its alloys used in telecommunications including copper beryllium, copper zinc, electrolytic tough pitched copper <ul style="list-style-type: none"> <li>– structure/property relationships and their application</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ semiconductors such as transistors, zener diodes, light emitting diodes and laser diodes <ul style="list-style-type: none"> <li>– uses in telecommunications</li> </ul> </li> </ul>	
<ul style="list-style-type: none"> <li>▪ polymers <ul style="list-style-type: none"> <li>– insulation materials</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ fibre optics <ul style="list-style-type: none"> <li>– types and applications</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

– materials	
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<i>Students learn to:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ analyse structure, properties, uses and appropriateness of materials in telecommunications engineering applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ select and justify materials and processes used in telecommunications engineering</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ identify the types and functions of common semiconductors used in the telecommunications industry</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ describe the uses and applications of polymers and fibre optics in telecommunications</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

<ul style="list-style-type: none"> <li>▪ <b>Engineering electricity/electronics</b></li> </ul>
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<i>Students learn about:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ telecommunications including:               <ul style="list-style-type: none"> <li>– analogue and digital systems</li> <li>– modulation, demodulation</li> <li>– radio transmission (AM, FM, digital)</li> <li>– digital television transmission and display media such as plasma, LED, LCD, 3D</li> <li>– telephony: fixed and mobile</li> <li>– transmission media                   <ul style="list-style-type: none"> <li>– cable</li> <li>– wireless</li> <li>– infrared</li> <li>– microwave</li> <li>– fibre-optic</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ satellite communication systems, geostationary, low orbit satellite and GPS</li> </ul>	<ul style="list-style-type: none"> <li>▪ Satellites           <ul style="list-style-type: none"> <li>– Satellite Communication Systems are used to mainly amplify signals from stations on Earth and extend the line of sight microwave signals.</li> </ul> </li> <li>▪ Polar Orbits           <ul style="list-style-type: none"> <li>– Polar orbits consider satellites to orbits in the pole of Earth.</li> </ul> </li> <li>▪ Geostationary Orbits           <ul style="list-style-type: none"> <li>– Satellites that are under Geostationary orbits are in a fix position above the Earth’s atmosphere. They have an orbital period of 24 hours, and is usually located at the equator. Used for GPS and location tracking systems.</li> </ul> </li> <li>▪ Low Earth Orbit Satellite           <ul style="list-style-type: none"> <li>– Satellites that orbit lower can closer to Earth are in Low Earth Orbit, as they will be moving much faster and have short periods. They will be in different location at different time period.</li> </ul> </li> <li>▪ GPS           <ul style="list-style-type: none"> <li>–</li> </ul> </li> </ul>

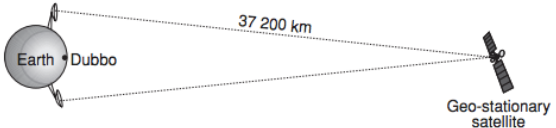


Figure 1.4 Geo-stationary or geo-synchronous satellites have a time delay of around a quarter to half a second due to their distance from earth

- digital technology (AND, NAND, NOR, OR GATES)

- Logic Gates 0 == False, 1 == True.**

Usually has **4 Outcomes**.

- **AND GATE**

In an AND GATE, When the **two inputs are True (1,1)** then it will be True (1), hence **otherwise, a False (0)**.

- **OR GATE**

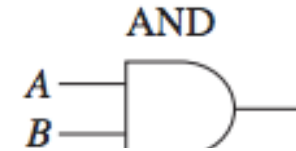
In an OR GATE, when **both inputs are True (1,1)**, or if **either one of the inputs are True (1,0), (0,1)** then it will output True (1), hence **otherwise a False (0)**.

- **NAND GATE**

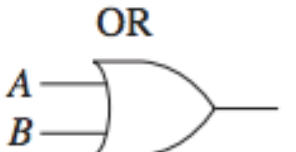
An NAND GATE stands for **Not AND GATE**, symbolising its outcome will be **opposite of an AND GATE (They have a dot)**. If **both inputs are True (1,1)**, it will outcome a False (0), hence **otherwise the outcome is True (1)**.

- **NOR GATE**

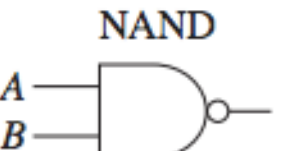
An NOR GATE stands for **Not OR GATE**, symbolising its outcome will be **opposite of an OR GATE (They have a dot)**. If **both inputs are True (1,1)** or **either inputs one input is True (1,0), (0,1)**, the it will outcome a False (0), hence **otherwise, it displays True (1)**.



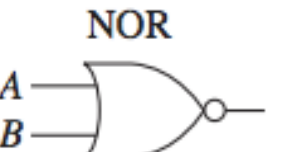
Input 1	Input 2	Output
	1	
1		



Input 1	Input 2	Output
	1	1
1		1
1	1	1



Input 1	Input 2	Output
		1
	1	1
1		1
1	1	



Input 1	Input 2	Output
		1
	1	
1		
1	1	

<i>Students learn to:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>describe the basic concepts and application of modulation/ demodulation in telecommunications</li> </ul>	<ul style="list-style-type: none"> <li>A</li> </ul>
<ul style="list-style-type: none"> <li>describe the types and methods of radio and digital television</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>

transmission and reception systems in telecommunications	
<ul style="list-style-type: none"> <li>▪ contrast the differences in fixed and mobile telephony systems in telecommunications</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ distinguish the communication bands in the electromagnetic spectrum</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ contrast the differences in transmission media</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ describe the types and methods of radio and digital television transmission and reception systems in telecommunications</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
<ul style="list-style-type: none"> <li>▪ contrast the differences in fixed and mobile telephony systems in telecommunications</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>

<ul style="list-style-type: none"> <li>▪ <b>Engineering materials</b></li> </ul>	
<i>Students learn about:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ freehand and technical pictorial drawing, graphical design drawings</li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>



<ul style="list-style-type: none"> <li>▪ computer graphics; computer aided drawing (CAD) <ul style="list-style-type: none"> <li>– graphical design</li> <li>– in the solution of problems</li> </ul> </li> </ul>	▪
<ul style="list-style-type: none"> <li>▪ collaborative work practices</li> </ul>	▪
<ul style="list-style-type: none"> <li>▪ Engineering Report writing</li> </ul>	▪

<i>Students learn to:</i>	<i>Notes:</i>
<ul style="list-style-type: none"> <li>▪ produce pictorial drawings</li> </ul>	<ul style="list-style-type: none"> <li>▪ A</li> </ul>
<ul style="list-style-type: none"> <li>▪ justify computer graphics as a communication tool and problem solving device for telecommunications engineering</li> </ul>	▪
<ul style="list-style-type: none"> <li>▪ work with others and identify the benefits of working as a team</li> </ul>	▪
<ul style="list-style-type: none"> <li>▪ complete an Engineering Report on the telecommunications engineering profession with reference to the following aspects:</li> </ul>	▪

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| <ul style="list-style-type: none"><li>- nature and range of the work of telecommunications engineers</li><li>- engineers as managers</li><li>- technologies unique to the profession</li><li>- current projects and innovations</li><li>- health and safety issues</li><li>- ethics related to the profession and community career prospects</li><li>- training for the professions</li><li>- use of appropriate computer software and presentation technique</li></ul> |  |
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