

**DEPARTMENT OF ECE**

**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

<b>COURSE OUTLINE TEMPLATE</b>			
<b>Course Title</b>	<b>Broadband Wireless Technologies</b>		
<b>Course Code</b>	EC604	<b>No. of Credits</b>	3
<b>Department</b>	ECE	<b>Faculty</b>	Dr.P.Muthuchidambaranathan
<b>Pre-requisites Course Code</b>	Engineering Electromagnetics, Digital Communication		
<b>Course Coordinator(s) (if, applicable)</b>	Dr.P.Muthuchidambaranathan		
<b>Other Course Teacher(s)/Tutor(s) E-mail</b>	muthuc@nitt.edu	<b>Telephone No.</b>	0431-2503309
<b>Course Type</b>	Core course		
<b>COURSE OVERVIEW</b>			
<b>COURSE CONTENT</b>			
<p><b>Introduction to Wireless Communication. The Cellular concept, System design, Capacity improvement in cellular systems, Co channel interference reduction. Intelligent cell concept and applications. Technical Challenges.</b></p> <p><b>Mobile radio propagation: Reflection, Diffraction. Outage probability under path loss and Shadowing. Calculation of boundary coverage and area coverage. Practical link budget design using path loss models.</b></p> <p><b>Fading. Multipath Propagation. Parameters of mobile multipath channels. Statistical Channel models, Diversity Schemes and Combining Techniques. Design parameters at the base station. RAKE receiver.</b></p> <p><b>Multuser Systems: CDMA- Principle, Network design, Link capacity, Power control. WCDMA- Network planning, MC-CDMA, OFDM, Cellular mobile communication beyond 3G.</b></p> <p><b>Wireless Systems and Standards. Ultra-wideband communications. Smart antenna systems, Beam forming. MIMO Systems. Massive MIMO. 4G and beyond 4G. NOMA and 5G.</b></p>			
<b>COURSE OBJECTIVES</b>			
<ul style="list-style-type: none"> <li>• To expose the students to understand mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards.</li> </ul>			

<b>COURSE OUTCOMES (CO)</b>			
<b>Course Outcomes</b>			<b>Aligned Programme Outcomes (PO)</b>
CO1: Interpret the cellular system design and technical challenges.			<b>PO1 – H</b>
CO2: Compare/ Contrast the various techniques involved in mobile radio propagation, fading, diversity concepts and the multipath channel.			<b>PO4 – H</b>
CO3: Summarize the design parameters, link design, smart antenna, beam forming and MIMO systems.			<b>PO4 – H</b>
CO4: Compare/ Contrast Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts.			<b>PO1 – H PO3 – M</b>
CO5: summarize the principles and applications of wireless systems and standards.			<b>PO 10 - H</b>
<b>COURSE TEACHING AND LEARNING ACTIVITIES</b>			
<b>S.No.</b>	<b>Week</b>	<b>Topic</b>	<b>Mode of Delivery</b>
<b>1.</b>	<b>Week 1</b>	Introduction to Wireless Communication , The Cellular concept, System design, Problems	<b>Online</b>
<b>2.</b>	<b>Week 2</b>	Capacity improvement in cellular systems, Problems, Co channel interference reduction	<b>Online</b>
<b>3.</b>	<b>Week 3</b>	Intelligent cell concept and applications, Technical Challenges, Mobile radio propagation	<b>Online</b>
<b>4.</b>	<b>Week 4</b>	Reflection, Diffraction, Problems, Wireless Channels, Fading	<b>Online</b>
<b>5.</b>	<b>Week 5</b>	Multipath Propagation. Channel modeling, Diversity Schemes and Combining Techniques	<b>Online</b>
<b>6.</b>	<b>Week 6</b>	Design parameters at the base station, Mobile Station	<b>Online</b>
<b>7.</b>	<b>Week 7</b>	Practical link budget design using path loss models, Smart antenna systems	<b>Online</b>
<b>8.</b>	<b>Week 8</b>	Beamforming, MIMO Systems	<b>Online</b>

9.	<b>Week 9</b>	RAKE receiver, Multiuser Systems	<b>Online</b>
10.	<b>Week 10</b>	CDMA- Principle, Network design, Link capacity, Power control	<b>Online</b>
11.	<b>Week 11</b>	WCDMA-Network planning, MC-CDMA	<b>Online</b>
12.	<b>Week 12</b>	OFDM, Cellular mobile communication beyond 3G	<b>Online</b>
13.	<b>Week 13</b>	GSM, GPRS, IS 95	<b>Online</b>
14.	<b>Week 14</b>	UMTS, WLAN, WPAN, WMAN, Ultra Wideband communications	<b>Online</b>
15.	<b>Week 15</b>	4G and beyond 4G, massive MIMO, NOMA	<b>Online</b>

#### **COURSE ASSESSMENT METHODS**

<b>S.No.</b>	<b>Mode of Assessment</b>	<b>Week/Date</b>	<b>Duration</b>	<b>% Weightage</b>
1.	Written Test -1 (Unit 1, 2)	Week-7	1 hour	20
2.	Written Test – 2 (Unit 3, 4)	Week - 13	1 hour	20
3.	Assignment	Week – 14, 15		10
4.	Seminar	Week 10-15		20
5.	Compensation assessment for absentees	Week 16	1 hour	20
6.	End Semester Exam (All Units)	Week-17	2 Hours	30

#### **ESSENTIAL READINGS : Textbooks, reference books, journals, etc**

##### **Text Books**

A.F.Molisch, *Wireless Communications*, Wiley, 2005.

A.Goldsmith, *Wireless Communications*, Cambridge University Press, 2005.

##### **Reference Books**

P. Muthu Chidambara Nathan, *“Wireless Communications”*, PHI, 2013.

D.Tse, P.Viswanath, *“Fundamentals of Wireless Communication”*, Cambridge University Press, 2005.

S.G. Glisic, *“Advanced Wireless Communications”*, 4G Technologies, Wiley, 2004.

W. C. Y.Lee, *“Mobile Communication Engineering”*, (2/e), McGraw- Hill, 1998.

Gordon L.Stubder, *“Principles of Mobile Communication”*, 3rd edition, Springer, 2013.

Recent literature in *Broadband Wireless Technologies*.

**COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)**

**Class Committee meetings, Student Feedback**

**COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)**

**Min. 75% attendance is required for the students to appear for end semester examination  
Passing Min.: As per NITT norms**

**ADDITIONAL COURSE INFORMATION**

The Course Coordinator is available for consultation at times that are displayed on the coordinator's office notice board. Queries may also be emailed to the Course Coordinator directly at [muthuc@nitt.edu](mailto:muthuc@nitt.edu)

**FOR SENATE'S CONSIDERATION**

 \_\_\_\_\_ **Course Faculty**  \_\_\_\_\_ **CC-Chairperson**  \_\_\_\_\_ **HOD**