

Ref No:

Sri Krishna Institute of Technology,  
Bangalore



## COURSE PLAN

Academic Year 2019-2020

Program:	B E – Electronics & Communication Engineering
Semester :	8
Course Code:	15EC81
Course Title:	Wireless Cellular and LTE 4G Broadband
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	ASHA B R

Academic Evaluation and Monitoring Cell

Sri Krishna Institute of Technology  
#29,Chimney hills,Hesaraghata Main road, Chikkabanavara Post  
Bangalore – 560090, Karnataka, INDIA  
Phone / Fax :08023721477/28392221/23721315  
Web: [www.skit.org.in](http://www.skit.org.in) , e-mail: [skitprinci@gmail.com](mailto:skitprinci@gmail.com)

## Table of Contents

<u>A. COURSE INFORMATION.....</u>	<u>2</u>
<u>1. Course Overview.....</u>	<u>2</u>
<u>2. Course Content.....</u>	<u>3</u>
<u>3. Course Material.....</u>	<u>4</u>
<u>4. Course Prerequisites.....</u>	<u>5</u>
<u>5. Content for Placement, Profession, HE and GATE.....</u>	<u>5</u>
<u>B. OBE PARAMETERS.....</u>	<u>5</u>
<u>1. Course Outcomes.....</u>	<u>5</u>
<u>2. Course Applications.....</u>	<u>6</u>
<u>3. Articulation Matrix.....</u>	<u>6</u>
<u>4. Curricular Gap and Content.....</u>	<u>7</u>
<u>C. COURSE ASSESSMENT.....</u>	<u>7</u>
<u>1. Course Coverage.....</u>	<u>7</u>
<u>2. Continuous Internal Assessment (CIA).....</u>	<u>7</u>
<u>D1. TEACHING PLAN - 1.....</u>	<u>8</u>
<u>Module - 1.....</u>	<u>8</u>
<u>Module – 2.....</u>	<u>9</u>
<u>E1. CIA EXAM – 1.....</u>	<u>10</u>
<u>a. Model Question Paper - 1.....</u>	<u>10</u>
<u>b. Assignment -1.....</u>	<u>10</u>
<u>D2. TEACHING PLAN - 2.....</u>	<u>11</u>
<u>Module – 3.....</u>	<u>11</u>
<u>Module – 4.....</u>	<u>12</u>
<u>E2. CIA EXAM – 2.....</u>	<u>13</u>
<u>a. Model Question Paper - 2.....</u>	<u>13</u>
<u>b. Assignment – 2.....</u>	<u>13</u>
<u>D3. TEACHING PLAN - 3.....</u>	<u>14</u>
<u>Module – 5.....</u>	<u>14</u>
<u>E3. CIA EXAM – 3.....</u>	<u>15</u>
<u>a. Model Question Paper - 3.....</u>	<u>15</u>
<u>b. Assignment – 3.....</u>	<u>15</u>
<u>F. EXAM PREPARATION.....</u>	<u>16</u>
<u>1. University Model Question Paper.....</u>	<u>16</u>
<u>2. SEE Important Questions.....</u>	<u>17</u>

### A. COURSE INFORMATION

#### 1. Course Overview

Degree:	BE	Program:	EC
---------	----	----------	----

Semester:	8	Academic Year:	2019-2020
Course Title:	Wireless Cellular and LTE 4G Broadband	Course Code:	15EC81
Credit / L-T-P:	4 / 4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	80 Marks
CIA Marks:	20 Marks	Assignment	1 / Module
Course Plan Author:	Asha B R	Sign ..	Dt:
Checked By:		Sign ..	Dt:
CO Targets	CIA Target : ..... %	SEE Target:	..... %

**Note:** Define CIA and SEE % targets based on previous performance.

## 2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute.

Mod ule	Content	Teaching Hours	Blooms Learning Levels
1	<p><b>Key Enablers for LTE features</b> :OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture.</p> <p><b>Wireless Fundamentals</b> : Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC – Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading</p>	10	L2
2	<p><b>Multicarrier Modulation:</b> OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE</p> <p><b>OFDMA and SC-FDMA:</b> OFDM with FDMA,TDMA,CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE</p> <p><b>Multiple Antenna Transmission and Reception:</b>Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial Multiplexing</p>	10	L2
3	<p><b>Overview and Channel Structure of LTE:</b> Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, UplinkSC-FDMA Radio Resource</p> <p><b>Downlink Transport Channel Processing:</b> Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink(</p>	10	L2
4	<p><b>Uplink Channel Transport Processing:</b> Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink <b>Physical Layer Procedures</b> :Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed</p>	10	L2

	loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink		
5	<b>Radio Resource Management and Mobility Management:</b> PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination	10	L2
-	<b>Total</b>		

### 3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modul es	Details	Chapters in book	Availability
<b>A</b>	<b>Text books (Title, Authors, Edition, Publisher, Year.)</b>	-	-
1	Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg. and Emerging Technologies.	1,2,4,5,6,7,8,9,10	In dept. lib, in lib
<b>B</b>	<b>Reference books (Title, Authors, Edition, Publisher, Year.)</b>	-	-
3	LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.		
4	'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.		
5	3. 'LTE – The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.		
<b>C</b>	<b>Concept Videos or Simulation for Understanding</b>	-	-
C1	<a href="https://www.youtube.com/watch?v=-ymnQ5rpcYA&amp;list=PLbMVogVj5nJSi8FUsvglRxLtN1TNgy4nx">https://www.youtube.com/watch?v=-ymnQ5rpcYA&amp;list=PLbMVogVj5nJSi8FUsvglRxLtN1TNgy4nx</a>		
<b>D</b>	<b>Software Tools for Design</b>	-	-
<b>E</b>	<b>Recent Developments for Research</b>	-	-
	<a href="https://www.researchgate.net/publication/265014886_4G_Wireless_Technology_A_Brief_Review">https://www.researchgate.net/publication/265014886_4G_Wireless_Technology_A_Brief_Review</a>		
<b>F</b>	<b>Others (Web, Video, Simulation, Notes etc.)</b>	-	-
1	<a href="https://www.youtube.com/watch?v=AmBd1dKwoyY">https://www.youtube.com/watch?v=AmBd1dKwoyY</a>		

### 4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

Students must have learnt the following Courses / Topics with described Content . . .

Modul es	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level

## 5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level

## B. OBE PARAMETERS

### 1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

Modules	Course Code.#	Course Outcome At the end of the course, student should be able to . . .	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1	15EC81.1	Understand the basics of LTE standardization phases and specifications.	10	Lecture	CIA Assignment	L2
2	15EC81.2	Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principals.	10	Lecture PPT	CIA Assignment	L2
3	.15EC81.3	Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer. Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.	10	Lecture PPT	CIA Slip Test Assignment	L2
4	.15EC81.4	Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth.	10	Lecture / PPT	Assignment CIA	L2
5	.15EC81.5	Understand the basics of intercell interference.	10	Lecture PPT	CIA Assignment	L2
-	-	<b>Total</b>	<b>50</b>	-	-	<b>L2</b>

### 2. Course Applications

Write 1 or 2 applications per CO.

Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Sonar	CO1	L2

2	Underwater navigation and tracking	CO2	L2
3	Seismic exploration	CO3	L2
4	Weather and climate observation	CO4	L2
5	Oceanography , Marine biology	CO5	L2

### 3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

Mod ules	CO.#	Course Outcomes At the end of the course student should be able to . . .	Program Outcomes															Lev el		
			PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3			
1	15EC81.1	Understand the basics of LTE standardization phases and specifications.	2	1	2			1												
2	15EC81.2	Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principals.	2	2	2		1													
3	15EC81.3	Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer. Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.	2	2	3		2			1										
4	15EC81.4	Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth.	1	1	1		2	1												
5	15EC81.5	Understand the basics of intercell interference.	2	3	1	1		1			1									
-		Average																		
-	PO, PSO	1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design																		

### 4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Mod ules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

## C. COURSE ASSESSMENT

### 1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Key Enablers for LTE features Wireless Fundamentals	10	2	-	-	1	1	2	CO1	L2
2	Multicarrier Modulation OFDMA and SC-FDMA Multiple Antenna Transmission and Reception	10	2	-	-	1	1	2	CO2	L2
3	Overview and Channel Structure of LTE Downlink Transport Channel Processing	10	-	2	-	1	1	2	CO3	L2
4	Uplink Channel Transport Processing Physical Layer Procedures	10	-	2	-	1	1	2	CO4	L2
5	Radio Resource Management and Mobility Management	10	-	-	4	1	1	2	CO5	L2
-	<b>Total</b>	<b>50</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>10</b>	<b>-</b>	<b>-</b>

### 2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam - 1	15	CO1, CO5	L2,L2
3, 4	CIA Exam - 2	15	CO2, CO3	L2
5	CIA Exam - 3	15	CO4	L2
1, 2	Assignment - 1	05	CO1, CO5	L2, L2
3, 4	Assignment - 2	05	CO2, CO3	L2
5	Assignment - 3	05	CO4	L2
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities - Mini Project	-		
	<b>Final CIA Marks</b>		<b>-</b>	<b>-</b>

## D1. TEACHING PLAN - 1

### Module - 1

Title:	Key enablers for LTE features,Wireless Fundamentals	Appr Time:	10 Hrs
a	<b>Course Outcomes</b>	-	<b>Blooms</b>

-	The student should be able to:	-	<b>Level</b>
1	Understand the basics of LTE standardization phases and specifications.	CO1	L2
<b>b</b>	<b>Course Schedule</b>	-	-
<b>Class No</b>	<b>Module Content Covered</b>	<b>CO</b>	<b>Level</b>
1	OFDM	CO1	L2
2	Single carrier FDMA	CO1	L2
3	Single carrier FDE	CO1	L2
4	Channel Dependent Multi user Resource Scheduling	CO1	L2
5	Multi antenna Techniques	CO1	L2
6	IP based Flat network Architecture	CO1	L2
7	LTE Network Architecture.	CO1	L2
8	Mitigation of Broadband Fading	CO1	L2
9	Statistical models, Mitigation of Narrow band Fading	CO1	L2
10	Fading in BWC, Modeling BWC – Empirical models	CO1	L2
<b>c</b>	<b>Application Areas</b>	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	WLAN,W/WAN,WPAN,WMAN	CO1	L2
2	Mobile computing	CO1	L2
<b>d</b>	<b>Review Questions</b>		
-			
1	Briefly explain different generations of cellular networks.	CO1	L2
2	Explain with neat flow diagram AMPS mobile originated cell.	CO1	L2
3	Mention the differences between 1G and 2G cellular systems.	CO1	L2
4	Explain CDMA 2000.	CO1	L2
5	Briefly explain the technique employed in an early AM wireless transmitter systems with a neat diagram.	CO1	L2
6	Explain various steps in AMPS mobile terminated call.	CO1	L2
7	Explain the characteristics of 2G and 3G cellular systems.	CO1	L2
8	With a neat diagram,explain the network elements of SS7 system.	CO1	L2
9	Write a note on basic characteristics of 4G cellular system.	CO1	L2
<b>e</b>	<b>Experiences</b>	-	-
1		CO1	L2
2			

## Module – 2

Title:	Multicarrier Modulation , OFDMA and SC-FDMA , Multiple antenna transmission and reception	Appr Time:	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	<b>CO</b>	<b>Blooms Level</b>
-		-	
1	Explain the system architecture of LTE and E-UTRAN,	CO2	L2
2	The layer of LTE based on the use of OFDMA and SC-FDMA principals.	CO2	L2
<b>b</b>	<b>Course Schedule</b>	-	-
<b>Class No</b>	<b>Portion covered per hour</b>	-	-
1	OFDM basic	CO2	L2
2	OFDM in LTE,	CO2	L2



3	Timing and Frequency Synchronization,	CO2	L2
4	PAR, SC-FDE	CO2	L2
5	OFDM with FDMA, TDMA,CDMA	CO2	L2
6	OFDMA, SC-FDMA	CO2	L2
7	OFDMA and SC-FDMA in LTE , Spatial Diversity overview	CO2	L2
8	Receive Diversity, Transmit Diversity	CO2	L2
9	Interference cancellation and signal enhancement	CO2	L2
10	Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial multiplexing	CO2	L2
<b>c</b>	<b>Application Areas</b>	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Digital television , audio broadcasting	CO2	L2
2	Power line networks,4G mobile communications	CO2	L2
<b>d</b>	<b>Review Questions</b>	-	-
-			
1	Draw the neat block diagram of common cellular system and explain base station system components.	CO2	L2
2	Explain power control and power saving schemes in cellular systems.	CO2	L2
3	Explain the following capacity expansion techniques.	CO2	L2
4	Explain mobility management concept. Explain the functions of location management with a figure.	CO2	L2
5	Determine frequency reuse distance for a cluster size of 7 and a cell radius of 6 km.	CO2	L2
6	With suitable diagram explain the GSM channel concept.	CO2	L2
7	With a neat flow diagram GSM inter BSC bandover operation.	CO2	L2
<b>e</b>	<b>Experiences</b>	-	-
1			
2			

## E1. CIA EXAM – 1

### a. Model Question Paper - 1

Crs Code:		Sem:	I	Marks:		Time:		
Course:								
-	-	<b>Note: Answer all questions, each carry equal marks. Module : 1, 2</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
1	a	Explain advantages of OFDM which led to its selection for LTE.				8	CO1	L2
	b	With a neat figure explain 3GPP evolution towards a flat LTE SAE architecture.				7	CO1	L2
		<b>OR</b>						
2	a	List and explain different equalization methods.				8	CO1	L2
	b	Briefly explain path loss and shadowing in wireless channel.				7	CO1	L2
		<b>OR</b>						
3	a	Draw the neat block diagram of common cellular system and explain base station system components.				8	CO2	L2
	b	Explain the following capacity expansion techniques.				7	CO2	L2
		<b>OR</b>						
4	a	Determine frequency reuse distance for a cluster size of 7 and a cell radius of 6 km.				8	CO2	L2
	b	With a neat flow diagram GSM inter BSC bandover operation.				7	CO2	L2

**b. Assignment -1**

Model Assignment Questions							
Crs Code:	15EC81	Sem:	8	Marks:	5	Time:	90 – 120 minutes
Course:	Wireless Cellular and LTE 4G Broadband						
SNo	Assignment Description	Marks	CO	Level			
1	Briefly explain different generations of cellular networks.	5	CO1	L2			
2	Explain with neat flow diagram AMPS mobile originated cell.	5	CO1	L2			
3	Mention the differences between 1G and 2G cellular systems.	5	CO1	L2			
4	Explain CDMA 2000.	5	CO1	L2			
5	Briefly explain the technique employed in an early AM wireless transmitter systems with a neat diagram.	5	CO1	L2			
6	Explain various steps in AMPS mobile terminated call.	5	CO1	L2			
7	Explain the characteristics of 2G and 3G cellular systems.	5	CO1	L2			
8	<b>With a neat diagram, explain the network elements of SS7 system.</b>	5	CO1	L2			
9	<b>Write a note on basic characteristics of 4G cellular system.</b>	5	CO1	L2			
10	Draw the neat block diagram of common cellular system and explain base station system components.	5	CO2	L2			
11	Explain power control and power saving schemes in cellular systems.	5	CO2	L2			
12	Explain the following capacity expansion techniques.	5	CO2	L2			
13	Explain mobility management concept. Explain the functions of location management with a figure.	5	CO2	L2			
14	Determine frequency reuse distance for a cluster size of 7 and a cell radius of 6 km.	5	CO2	L2			
15	With suitable diagram explain the GSM channel concept.	5	CO2	L2			
16	With a neat flow diagram GSM inter BSC handover operation.	5	CO2	L2			

**D2. TEACHING PLAN - 2****Module – 3**

Title:	Overview and channel structure of LTE, <b>Downlink Transport Channel Processing</b>	Appr Time:	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	<b>CO</b>	<b>Blooms Level</b>
-	At the end of the topic the student should be able to . . .	-	<b>Level</b>
1	Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.	CO3	L2
<b>b</b>	<b>Course Schedule</b>		
<b>Class No</b>	<b>Portion covered per hour</b>	-	-
1	Introduction to LTE	CO3	L3
2	Channel Structure of LTE	CO3	L3
3	Downlink OFDMA Radio Resource	CO3	L2
4	<b>Downlink Transport Channel Processing</b> Overview	CO3	L2
5	Down link shared channels	CO3	L2

6	Down link shared channels	CO3	L2
7	Broadcast channels	CO3	L2
8	Multi cast channels, Downlink physical channels	CO3	L2
9	H-ARQ on Down link, Up link SC-FDMA Radio Resource	CO3	L2
10	Broadcast channels	CO3	L2
<b>d</b>	<b>Review Questions</b>	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Discuss with the help of a neat diagram the working of signaling model also explain the different protocols.	CO3	L2
2	With a neat schematic explain the working of GSM network and system architecture.	CO3	L2
3	What is MSRN? What is the purpose of MSRN ? Explain the GSM cell setup using MSRN.	CO3	L2
4	With a neat diagram explain I) GSM service request operation) GSM authentication operations.	CO3	L2
5	Explain differences between cell splitting and cell sectoring capacity expansion techniques with a neat diagram	CO3	L2
6	Name three basic functions performed by the location management and explain cellular location updating with figure.	CO3	L2
<b>e</b>	<b>Experiences</b>	-	-
1		CO6	L2
2			

#### Module – 4

Title:	<b>Uplink Channel Transport Processing,Physical Layer Procedures</b>	Appr Time:	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	<b>CO</b>	<b>Blooms Level</b>
-	At the end of the topic the student should be able to . . .	-	
1	Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth.	CO4	L2
<b>b</b>	<b>Course Schedule</b>		
<b>Class No</b>	<b>Portion covered per hour</b>	-	-
1	Overview, Uplink shared channels	CO4	L2
2	Uplink Control Information	CO4	L2
3	Uplink Reference signals	CO4	L2
4	Random Access Channels	CO4	L2
5	H-ARQ on uplink	CO4	L2
6	Hybrid – ARQ procedures	CO4	L2
7	Quality Indicator CQI feedback	CO4	L2
8	Precoder for closed loop MIMO Operations	CO4	L2
9	Uplink channel sounding	CO4	L2
10	Buffer status Reporting in uplink	CO4	L2
11	Scheduling and Resource Allocation	CO4	L2
12	Cell Search, Random Access Procedures	CO4	L2
13	Power Control in uplink	CO4	L2
<b>d</b>	<b>Review Questions</b>	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Draw and explain uplink channel coding processing?	CO4	L2

2	with neat diagram explain uplink shared channel?	CO4	L2
3	Briefly explain about uplink control information with channel coding UCI and PUCCH?	CO4	L2
4	With neat sketch mapping of physical resource blocks for PUCCH?	CO4	L2
5	Explain uplink reference signal sequence and mapping of demodulation reference signals?	CO4	L2
6	Explain random access channels?	CO4	L2
7	Briefly explain H-ARQ in uplink?	CO4	L2
8	Explain H-ARQ feedback for downlink transmission?	CO4	L2
9	Explain H-ARQ indicator for uplink transmission?	CO4	L2
10	Explain channel quality indicator feedback and CQI estimation?	CO4	L2
11	Derive precoder estimation for multicarrier systems?	CO4	L2
12	Explain buffer status reporting in uplink?	CO4	L2
13	Explain scheduling and resource allocation?	CO4	L2
14	Explain cell search with neat diagram?	CO4	L2
15	With neat diagram explain random access procedures?	CO4	L2
<b>e</b>	<b>Experiences</b>	-	-
1		CO7	L2
2			

## E2. CIA EXAM – 2

### a. Model Question Paper - 2

Crs Code:	15EC81	Sem:	8	Marks:	30	Time	75 MINUTES	
Course:								
-	-	<b>Note: Answer all questions, each carry equal marks. Module : 3, 4</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
1	a	Discuss with the help of a neat diagram the working of signaling model also explain the different protocols.				8	CO3	L2
	b	What is MSRN? What is the purpose of MSRN ? Explain the GSM cell setup using MSRN.				7	CO3	L2
		OR						
2	a	Name three basic functions performed by the location management and explain cellular location updating with figure.				8	CO3	L2
	b	With a neat diagram explain I) GSM service request operation) GSM authentication operations.				7	CO3	L2
		OR						
3	a	Briefly explain about uplink control information with channel coding UCI and PUCCH?				8	CO4	L2
	b	Explain uplink reference signal sequence and mapping of demodulation reference signals?				7	CO4	L2
		OR						
4	a	Explain channel quality indicator feedback and CQI estimation?				8	CO4	L2
	b	With neat diagram explain random access procedures?				7	CO4	L2

### b. Assignment – 2

<b>Model Assignment Questions</b>								
Crs Code:	15EC81	Sem:	8	Marks:	5	Time:	90 – 120 minutes	
Course:	Wireless Cellular and LTE 4G Broadband							
<b>SNo</b>	<b>Assignment Description</b>					<b>Marks</b>	<b>CO</b>	<b>Level</b>

1	Discuss with the help of a neat diagram the working of signaling model also explain the different protocols.	5	CO3	L2
2	With a neat schematic explain the working of GSM network and system architecture.	5	CO3	L2
3	What is MSRN? What is the purpose of MSRN ? Explain the GSM cell setup using MSRN.	5	CO3	L2
4	With a neat diagram explain I) GSM service request operation) GSM authentication operations.	5	CO3	L2
5	Explain differences between cell splitting and cell sectoring capacity expansion techniques with a neat diagram	5	CO3	L2
6	Name three basic functions performed by the location management and explain cellular location updating with figure.	5	CO3	L2
7	Draw and explain uplink channel coding processing?	5	CO4	L2
8	with neat diagram explain uplink shared channel?	5	CO4	L2
9	Briefly explain about uplink control information with channel coding UCI and PUCCH?	5	CO4	L2
10	With neat sketch mapping of physical resource blocks for PUCCH?	5	CO4	L2
11	Explain uplink reference signal sequence and mapping of demodulation reference signals?	5	CO4	L2
12	Explain random access channels?	5	CO4	L2
13	Briefly explain H-ARQ in uplink?	5	CO4	L2
14	Explain H-ARQ feedback for downlink transmission?	5	CO4	L2
15	Explain H-ARQ indicator for uplink transmission?	5	CO4	L2
16	Explain channel quality indicator feedback and CQI estimation?	5	CO4	L2
17	Derive precoder estimation for multicarrier systems?	5	CO4	L2
18	Explain buffer status reporting in uplink?	5	CO4	L2
19	Explain scheduling and resource allocation?	5	CO4	L2
20	Explain cell search with neat diagram?	5	CO4	L2
21	With neat diagram explain random access procedures?	5	CO4	L2

### D3. TEACHING PLAN - 3

#### Module – 5

Title:	<b>Radio Resource Management and Mobility Management</b>	Appr Time:	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	<b>CO</b>	<b>Blooms Level</b>
-	At the end of the topic the student should be able to . . .	-	<b>Level</b>
1	Understand the basics of inter cell interference.	CO5	L2
<b>b</b>	<b>Course Schedule</b>	-	-
<b>Class No</b>	<b>Portion covered per hour</b>	-	-
1	Introduction to Radio Resource Management	CO5	L2
2	Radio resource allocation and managing	CO5	L2
3	Mobility Management using PDCP	CO5	L2
4	PDCP overview	CO5	L2
5	MAC overview	CO5	L2
6	RLC overview	CO5	L2
7	RRC overview	CO5	L2
8	Mobility Management techniques	CO5	L2

9	Intra-cell Interference Coordination	CO5	L2
10	Intra-cell Interference Coordination revision	CO5	L2
<b>c</b>	<b>Application Areas</b>	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Oceanography, Marine biology	CO5	L2
<b>d</b>	<b>Review Questions</b>	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Draw and explain PDCP overview?	CO5	L2
2	Briefly explain MAC/RLC overview?	CO5	L2
3	What is the purpose of MAC and RLC layers?	CO5	L2
4	Explain RRC functions?	CO5	L2
5	Explain RRC states with neat diagram?	CO5	L2
6	What is mobility management?	CO5	L2
7	With neat sketch explain (i) s1 mobility (ii) x2 mobility	CO5	L2
8	Explain intercell interference coordination techniques upload and download link power levels?	CO5	L2
<b>e</b>	<b>Experiences</b>	-	-
1			
2			

### E3. CIA EXAM – 3

#### a. Model Question Paper - 3

Crs Code	15EC81	Sem:	8	Marks:	30	Time:	75 MINUTES	
Course:	Wireless Cellular and LTE 4G Broadband							
-	-	<b>Note: Answer all questions, each carry equal marks. Module : 5</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
1	a	Draw and explain PDCP overview?				8	CO5	L2
	b	Explain RRC states with neat diagram?				7	CO5	L2
		OR						
2	a	What is the purpose of MAC and RLC layers?				8	CO5	L2
	b	With neat sketch explain (i) s1 mobility (ii) x2 mobility				7	CO5	L2
		OR						
3	a	Briefly explain MAC/RLC overview?				8	CO5	L2
	b	What is mobility management?				7	CO5	L2
		OR						
4	a	Explain intercell interference coordination techniques upload and download link power levels?				8	CO5	L2
	b	Explain RRC functions?				7	CO5	L2

**b. Assignment – 3**

Model Assignment Questions							
Crs Code:	15EC81	Sem:	8	Marks:	5	Time:	90 – 120 minutes
Course:	Wireless Cellular and LTE 4G Broadband						
SNo	Assignment Description				Marks	CO	Level
1	Draw and explain PDCP overview?				5	CO5	L2
2	Briefly explain MAC/RLC overview?				5	CO5	L2
3	What is the purpose of MAC and RLC layers?				5	CO5	L2
4	Explain RRC functions?				5	CO5	L2
5	Explain RRC states with neat diagram?				5	CO5	L2
6	What is mobility management?				5	CO5	L2
7	With neat sketch explain (i) s1 mobility (ii) x2 mobility				5	CO5	L2
8	Explain intercell interference coordination techniques upload and download link power levels?				5	CO5	L2

**F. EXAM PREPARATION****1. University Model Question Paper**

Course:	Wireless Cellular and LTE 4G Broadband				Month / Year	May /2018	
Crs Code:	15EC81	Sem:	8	Marks:	80	Time:	180 minutes
Module	Answer all FIVE full questions. All questions carry equal marks.				Marks	CO	Level
1	a	Briefly explain key enabling technologies in OFDM?			8	CO1	L2
	b	Draw and explain LTE network architecture?			8	CO1	L2
OR							
1	a	Derive path loss ? or Friss transmission formula? Explain shadowing?			9	CO1	L2
	b	With neat diagram explain AM and coding			7	CO1	L2
2	a	Briefly explain OFDM in LTE?			9	CO2	L2
	b	Explain SC-FDE system description?			7	CO2	L2
OR							
	a	Explain spatial diversity with array gain and diversity gain?			8	CO2	L2
	b	Briefly explain spatial multiplexing with open loop MIMO?			8	CO2	L2
3	a	With neat sketch end-to-end network architecture in LTE?			8	CO3	L2
	b	Explain logical channels?			8	CO3	L2

		or			
	a	with neat diagram explain downlink shared channel?	8	CO3	L2
	b	With neat sketch H-ARQ in the downlink?	8	CO3	L2
4	a	with neat diagram explain uplink shared channel?	8	CO4	L2
	b	Explain uplink reference signal sequence and mapping of demodulation reference signals?	8	CO4	L2
		or			
	a	Explain H-ARQ feedback for downlink transmission?	8	CO4	L2
	b	With neat diagram explain random access procedures?	8	CO4	L2
5	a	Draw and explain PDCP overview?	8	CO5	
	b	Explain RRC states with neat diagram?	8	CO5	
		or			
	a	What is mobility management?	8	CO5	
	b	Explain intercell interference coordination techniques upload and download link power levels?	8	CO5	

## 2. SEE Important Questions

Course:					Month / Year	July / 2018	
Crs Code:	1	Sem:		Marks:		Time:	
	<b>Note</b> Answer all FIVE full questions. All questions carry equal marks.					-	-
Mod ule	Qno.	Important Question			Marks	CO	Year
1	a	Briefly explain key enabling technologies in OFDM?			8	CO1	2018
	b	Draw and explain LTE network architecture?			8	CO1	2018
		OR					
1	a	Derive path loss ? or Friss transmission formula? Explain shadowing?			9	CO1	2018
	b	With neat diagram explain AM and coding			7	CO1	2018
2	a	Briefly explain OFDM in LTE?			9	CO2	2018
	b	Explain SC-FDE system description?			7	CO2	2018
		OR					2018
	a	Explain spatial diversity with array gain and diversity gain?			8	CO2	2018
	b	Briefly explain spatial multiplexing with open loop MIMO?			8	CO2	2018
							2018
3	a	With neat sketch end-to-end network architecture in LTE?			8	CO3	2018
	b	Explain logical channels?			8	CO3	2018
		or					2018
	a	with neat diagram explain downlink shared channel?			8	CO3	2018
	b	With neat sketch H-ARQ in the downlink?			8	CO3	2018
							2018
4	a	with neat diagram explain uplink shared channel?			8	CO4	2018
	b	Explain uplink reference signal sequence and mapping of demodulation			8	CO4	2018



		reference signals?			
		or			2018
	a	Explain H-ARQ feedback for downlink transmission?	8	CO4	2018
	b	With neat diagram explain random access procedures?	8	CO4	2018
					2018
5	a	Draw and explain PDCP overview?	8	CO5	2018
	b	Explain RRC states with neat diagram?	8	CO5	2018
		or			2018
	a	What is mobility management?	8	CO5	2018
	b	Explain intercell interference coordination techniques upload and download link power levels?	8	CO5	2018

