Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC702	Mobile Communication System	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Exam Duration (Hrs.)	Term Work	Practical and Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test2	Avg.					
ECC702	Mobile Communication System	20	20	20	80	03	--	--	100

Course Pre-requisite:

ECC405 - Principles of Communication Engineering
ECC501 - Digital Communication
ECC602 - Computer Communication and Networks

Course Objectives:

1. To understand the cellular fundamentals and different types of radio propagation models.
2. To study evolution of 2G and 3G mobile technologies.
3. To illustrate the working principle of LTE.
4. To learn the concepts of emerging technologies for 4 G standards and beyond.

Course Outcomes:

After successful completion of the course student will be able to:

1. Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems.
2. Classify different types of propagation models and analyse the link budget.
3. Compare and contrast GSM, GPRS, HSCSD, EDGE and IS-95 Technologies.
4. Apply the concepts of 3G technologies for UMTS and CDMA 2000.
5. Describe the features and working principle of 3GPP LTE.
6. Discuss the emerging technologies for upcoming mobile communication systems.

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Module No.	Unit No.	Topics	Hrs.
1.0		**Fundamentals of Mobile Communication**	**07**
	1.1	Introduction to Wireless Communication: Mobile Radio Telephony, Examples of Wireless Communication Systems	01
	1.2	The Cellular Concept System Design Fundamentals: Frequency reuse, Channel assignment strategies, Interference and system capacity, Trunking and Grade of service, Improving Coverage and Capacity in Cellular System and related problems.	06
2.0		**Mobile Radio Propagation**	**08**
	2.1	Large scale fading: Free space propagation model, ground reflection (two-ray) model, practical Link budget design using path loss models. Self-learning: Basic propagation mechanisms, reflection, diffraction and scattering.	03
	2.2	Small scale fading: Small-scale multipath propagation, parameters of mobile multipath channels, types of small-scale fading, Rayleigh and Ricean distributions.	02
	2.3	Features of all conventional multiple access techniques: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Space Spectrum Multiple Access (SSMA), Space Division Multiple Access (SDMA), Orthogonal Frequency Division Multiple Access (OFDMA), OFDM-PAPR	03
3.0		**2G Technologies**	**08**
	3.1	GSM: GSM Network Architecture, air interface specifications, GSM signaling protocol architecture, GSM channels, GSM services and features, GSM multifare structure, GSM speech coding, GSM Call procedures, Authentication and security in GSM, and handoff procedures in GSM.	04
	3.2	GSM evolution: GPRS, HSCSD and EDGE architecture, radio specifications	02
	3.3	IS-95: CDMA air interface, CDMA channels, power control in CDMA system, handoff, and RAKE receiver.	02
4.0		**3G Technologies**	**05**
	4.1	UMTS: Objectives, standardization and releases, network architecture, air interface specifications, channels, security procedure, W-CDMA air interface, attributes of W-CDMA system, W-CDMA channels.	03
	4.2	Cdma2000 cellular technologies: Forward and Reverse Channels, Handoff and Power Control.	02
5.0		**3GPP LTE**	**06**
	5.1	Introduction, system overview: Frequency bands and spectrum flexibility, network structure, protocol structure.	02
	5.2	Physical layer: Frames, slots, and symbols, modulation, coding, multiple-antenna techniques	02
	5.3	Logical and Physical Channels: Mapping of data onto (logical) sub-channels, Establishing a connection, Physical layer retransmissions and reliability, Power control, and handover.	02
6.0		**Advanced techniques for 4G deployment and beyond**	**05**
	6.1	Multi-antenna Techniques: Smart antennas, Multiple input Multiple output systems.	02
	6.2	Cognitive radio: Architecture, spectrum sensing. Software Defined Radio (SDR): Components and Applications.	02

	6.4	Introduction to 5G network and technologies used in 5G such as small cell concept, Massive MIMO, Beamforming, NOMA, and mm wave).	01
		Total	**39**

Textbooks:

1. T. L. Singal "wireless communications", Mc Graw Hill Education.
2. Theodore S. Rappaport "wireless communications - principles and practice", PEARSON, Second edition.
3. Andreas F. Molisch "wireless communications" WILEY INDIA PVT LTD, Second edition.

Reference Books:

1. Upena Dalal "Wireless and Mobile Communicationsl", Oxford university Press
2. Vijay K.Garg "Wireless Communications and Networking" ,Morgan–Kaufmann series in Networking-Elsevier.
3. J. H. Reed, Software-Defined Radio, Prentice-Hall, 2002
4. W. C. Y. Lee, Mobile Communication, Wiley
5. David Tse, Pramod Viswanath "Fundamentals of Wireless Communication" published by Cambridge University Press

E - Resources:

NPTEL courses:

1. http://nptel.ac.in/courses/117104099/ - (Advanced 3G and 4G Wireless Mobile communications)
2. https://nptel.ac.in/courses/117/102/117102062/ - (Wireless Communications)
3. Virtual lab: http://vlab.co.in

Internal Assessment (20-Marks):

Internal Assessment (IA) consists of two class tests of 20 marks each. IA-1 is to be conducted on approximately 40% of the syllabus completed and IA-2 will be based on remaining contents (approximately 40% syllabus but excluding contents covered in IA-I). Duration of each test shall be one hour. Average of the two tests will be considered as IA marks.

End Semester Examination (80-Marks):

Weightage to each of the modules in end-semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of **total 06** questions, each carrying **20 marks**.
2. **Question No: 01** will be **compulsory** and based on entire syllabus wherein 4 to 5 sub-questions will be asked.
3. Remaining questions will be mixed in nature and randomly selected from all the modules.
4. Weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
5. **Total 04 questions** need to be solved.