

Course Code	Course Title	L	T	P	C
1152EC149	RADIO OVER FIBER SYSTEMS	3	0	0	3

**a) Course Category**

Program Elective

**b) Preamble**

This course provides the basic and concepts of Radio over Fiber systems, link design and mm wave signal generation and also enable the students to implement RoF concepts in cellular application

**c) Prerequisite**

Nil

**d) Related Courses**

Optical and Microwave Engineering

**e) Course Outcomes**

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the basic concepts of radio over fiber systems and their applications in real time.	K2
CO2	Identify the noise measures and distortions measures.	K2
CO3	Discuss radio over fiber link design and tradeoffs link parameter and amplifier.	K2
CO4	Describe the techniques for transporting RF signals over optical fibre	K2
CO5	Identify the cellular and UMTS architecture, Micro and Macro diversity	K2

<b>f)</b>	<b>Correlation of COs with POs</b>
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	L	M	L	L	-	-	L	-	-	-	L	-	-
CO2	L	L	M	-	-	-	-	-	-	-	-	-	-	-
CO3	-	L	-	-	M	-	-	-	-	-	-	-	L	-
CO4	M	L	-	-	L	-	-	-	-	-	-	-	L	-
CO5	M	-	-	L	L	L	-	-	-	L	L	-	L	-

**g) Course Content**

**UNIT I Introduction to Radio Over Fiber 9**

Trends in wireless communication, Transmission problems and solutions, Regulation and Standardization, Concept of RoF systems, Categories of RoF: types of transport-types of modulation-types of fiber- Subcarrier Multiplexing, Performance RoF systems: system performance characterization-system component effects- Improving system performance, Benefits, Limitations and Applications of RoF

**UNIT II Noise and Distortions 9**

Insertion loss and Noise figure concepts, Directed modulated optical links- Noise Figure of passive optical microwave devices, improving performance with low noise preamplifier, Optical links operating with external intensity modulators, Noise Figure of externally modulated links, Effect of fiber dispersion, Countermeasures to the dispersion-induced suppression of modulation

**UNIT III Link Design and Tradeoffs 9**

Introduction - Radio over Fiber link design issues- Link design examples - Link design tradeoffs: introduction - tradeoffs among intrinsic link parameters- Tradeoffs between intrinsic link and link with amplifiers.

**UNIT IV Techniques for Transporting RF Signals over Optical Fibre 9**

RF Signal Generation by Intensity Modulation and Direct Detection-Advantages-Disadvantages, Principle of Optical Heterodyning: Optical FM Filter System- Optical Frequency/Phase Locked-Loops-Optical Injection Locking, Techniques Based on Harmonics Generation-The FM IM Conversion - Modulation Sideband -Interferometer based Mixing, RoF Multiplexing Techniques-Sub-Carrier Multiplexing, Wavelength Division Multiplexing

**UNIT V ROF Technology for Cellular Applications 9**

Cellular systems, cellular architecture, UMTS architecture, WCDMA RoF systems, Micro diversity,

Macro diversity, Traffic estimation, Spectral efficiency, power level, multiple user interference, RoF for Hyper LAN2, Micro cellular communication networks.

**Total 45 Hrs**

## **h) Learning Resources**

### **Text Books**

1. Nathan J. Gomes, Paulo P. Monteiro and Atilio Gameiro "Next Generation wireless communications using Radio over Fiber" John Wiley & Sons, Ltd, 2012.
2. Hameed Al-Raweshidy, Shozo Komaki, "Radio Over fiber technologies for mobile communication networks" Artech House publications, London. 2002.

### **Reference Books**

1. CHARLES H. COX, III, "Analog optical Links, Theory and Practice" Cambridge University Press, 2004.
2. Igor Minin, "Microwave and millimeter wave technologies modern UWB antennas and equipment" In-Tech publication, 2010.