SEMESTER S8

RF ENGINEERING

Course Code	PEECT862	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Microwaves &Antennas	Course Type	Theory

Course Objectives:

1. To learn the analysis, design and simulation of Radio Frequency (RF) Circuits and Components for wireless communication systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	RF circuit introduction - Importance of radio frequency design, RF behaviour of resistors inductors and capacitors Planar Transmission Lines – Micro strip lines and Strip lines – Constructional Features Impedance Matching Networks-Design of Matching Circuits using Lumped Elements, Single Stub tuning, Quarter-Wave Transformers, Multi-Section Transformer – Binomial Transformer	9
2	RF Filter Design- Filter Design using insertion loss technique –Active RF components- Bipolar Junction Transistor – Construction-Functionality-Power Frequency Limitations of High Frequency transistors. GaAs devices - Familiarization of RF Field Effect Transistors and High Electron Mobility Transistors–Constructional details RF circuit measurements and characterization- Using Vector Network analyser – S parameter, Reflection Coefficient and Insertion Loss Measurement Modelling and Simulation of RF circuits using – Open source or Commercial EM Simulation Software	11
3	Amplifier design using S-parameters - Characteristics of Amplifier Power Relations, Stability Considerations – Stability Circles, Tests for	8

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	Unconditional Stability High frequency amplifier design – Single stage amplifier Design – Design for maximum gain, Low noise amplifier design	
4	Basic oscillator model -Feedback oscillator design—Negative Resistance Oscillator- Dielectric Resonator Oscillator - YIG Tuned Oscillator Mixer - Basic characteristics – Single-Ended Mixer Design, Single-balanced and double-balanced mixers	**8**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

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Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the basic idea about RF networks and working of RF filter circuits	**K2**
CO2	Describe the behaviour of RF components and application of Network analyser in parameter measurement	**K2**
CO3	Apply the principle of RF networks in the designing of RF amplifiers,	**K3**
CO4	Apply the principle of RF networks in the designing RF Oscillators and Mixers	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**											**2**
CO2	**3**				**3**							**2**
CO3	**3**	**3**	**3**	**3**	**2**							
CO4	**3**	**3**	**3**	**3**	**2**							

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	RF Circuit Design: Theory & Applications	Ludwig, Reinhold	Pearson Education India	2/e., 2000.
2	Microwave and RF design of wireless systems	Pozar, David M.	John Wiley & Sons	2/e, 2011

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Advanced RF & microwave circuit design: the ultimate guide to superior design.	Radmanesh, Matthew M	Author House,	2/e, 2017
2	Secrets of RF circuit design	Carr, Joseph J.	McGraw-Hill Education.	2/e, 2001
3	Radio-frequency and microwave communication circuits: analysis and design.	Misra, Devendra K	John Wiley & Sons,	2/e, 2019
4	Radio Frequency & Microwave Electronics	Mathew M. Radmanesh	Pearson Education Asia,	2nd Edition, 2017
5	RF/microwave circuit design for wireless applications.	Rohde, Ulrich L., and David P. Newkirk	John Wiley & Sons,	2nd Edition, 2017
6	Radio frequency circuit design.	Davis, W. Alan, and Krishna Kumar Agarwal.	John Wiley,	2nd Edition, 2017
7	RF Circuit Design.	Christopher, Bowick, Ajluni Cheryl, and Blyler John.	Newnes,	2nd Edition, 2015
8	Design of RF and microwave amplifiers and oscillators.	Abrie, Pieter LD.	Artech House	2nd Edition, 2019

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc23_ee36/preview
2	https://archive.nptel.ac.in/courses/108/105/108105189/
3	https://archive.nptel.ac.in/courses/117/102/117102012/