Course Unit Descriptor

Study Programme: Biomedical engineering

Course Unit Title: Design of RF and microwave circuits

Course Unit Code: BMIM1F

Name of Lecturer(s): Sekulić Dalibor

Type and Level of Studies: Master

Course Status (compulsory/elective): elective

Semester (winter/ summer): winter

Language of instruction: english

Mode of course unit delivery (face-to-face/distance learning): face-to-face

Number of ECTS Allocated: 6

Prerequisites: none

Course Aims:.

Students will be familiar with principles of operation, modeling and design of passive components and circuits used at frequencies above 1 GHz. Training students to analyze the microwave networks by using the scattering parameters through solving practical problems. Training students for computer design of microwave circuits using specialized software packages for 2D, 2.5D circuits and 3D circuits.

Learning Outcomes:

Capability to understand principles of operation, potentials and limitations of components and circuits used in the state of the art and next generation of wireless systems (5G). Fundamental theoretical and practical engineering knowledge about of computer design of the modern microwave passive components and circuits. Understanding the basic concepts and steps in the design of microwave resonators, filters, antennas, power dividers, couplers, and attenuators. Students will be trained for design of microwave circuits by using modern CAD software packages through the following phases: creating model, performing numerical simulations, creating a layout, verification of laboratory prototype by measurement.

Syllabus.

Microwave network analysis. Z, Y, ABCD and S matrices. Definition and properties of scattering parameters. Basics of microwave measurements and characterization. Basic characteristics of microwave resonators. Transmission line resonators. Microwave planar resonators. Dielectric resonators. Excitation of resonators. Coupling coefficient and critical coupling. Gap–coupled microstrip resonator. Determining unloaded quality factor from two–port measurements. Theory microwave filters. Filter design by the insertion loss method. Scaling and transformation of filters. Richards' transformation. Kuroda's identities. Impedance and admittance inverters. Stepped?impedance filter design. Design of coupled microstrip line filters. Design of filters by using coupled resonators. Basic properties of power dividers and directional couplers. T–junction power divider. Resistive power divider. Design of Wilkinson power divider. Hybrid couplers (quadrature hybrid and magic–T hybrid). Microwave attenuators. Theory and design of ferrimagnetic components (isolators, phase shifters, circulators). Basic theory of receiving and transmitting antennas. Practical realization of microwave antennas and types. Design of microstrip antennas. Feeding techniques of microstrip antenna. Antenna arrays. Simulation, design and optimization of microwave circuits using specialized software packages for 2D and 2.5D circuits (Microwave Office) and 3D circuits (CST, COMSOL, HFSS).

Required Reading:

Weekly Contact Hours: 2	**Lectures: 3**	**Practical work: 1**

Teaching Methods:

Lectures. Auditory exercises. Computer exercises. Consultations.

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	**Final exam**	points
Attendance			
Computer exercises			

Tests (4x)			