

**The Islamia University of Bahawalpur**  
**Department of Telecommunication Engineering**

**Complex Engineering Problem**

Course: Microwave Engineering	Instructor: Dr. Abdul Aziz
BSc. Telecommunication Engineering, Session 2017-2021	Max. Marks: 20
5 <sup>th</sup> Semester (Fall-2019)	Submission deadline: 20 <sup>th</sup> May, 2020
Submission guidelines: a) Deadline will not be extended in any case. b) Submission will be group-wise (2-3 Students in each group). c) IUB plagiarism policy will be observed for the CEP report.	

**Design and analysis of a microwave filter that may help to solve a recent problem of wireless communication or satellite communication using a numerical problem solver.**

**1. Problem Statement:**

Design and analysis of a microwave filter that may help to solve a recent problem of wireless communication or satellite communication using a numerical problem solver HFSS or CST Microwave Studio (some recent research publication from IEEE Microwave and Wireless Components Letters will be provided to students for this purpose). It should include following:

- a) Brief description of the problem and related literature review.
- b) Calculate initial design parameters of the required microwave filter for the designed frequency band.
- c) Develop model of the microwave filter.
- d) Calculate scattering parameters of the developed model through numerical simulation.
- e) Optimize design parameters to achieve optimum scattering parameters.
- f) Demonstrate potential application of the designed microwave filter, its impact for society, sustainable development and possible future development.

**2. Background and Getting Knowledge of:**

Electromagnetic (EM) simulation is inherent in analysis and design of microwave components. Available simulation packages allow engineers to obtain accurate responses of microwave structures. In the same time the task of microwave component design can be formulated and solved as an optimization problem where the objective function is supplied by an EM solver. Computationally efficient microwave filter designs can be realized using optimization. In this problem, the student will learn simulation-driven design methods to solve microwave engineering problems for diverse environment.

### 3. Justification of CEP attributes

Sr.	Complex Problems Definitions	Complex Problems Description
1.	Range of conflicting requirements	a. To calculate initial design parameters those may achieve all the diverse requirements of a frequency band. b. To achieve compact geometry that may be suitable for the diverse environments and situations. c. To select most suitable numerical simulation model to solve the problem efficiently.
2.	Depth of Knowledge Required	a. Knowledge of basic microwave network analysis techniques b. Knowledge of scattering parameters c. Knowledge of standards and materials used for microwave devices
3.	Depth of Analysis Required	a. Analysis and optimization of scattering parameters for the designed microwave circuit. b. Verification of the performance of microwave circuit through numerical solvers. c. Limitations of the available design methods, fabrication techniques, materials, volume and weight.
4.	Selection of design parameters, Coding	a. Selection of different design parameters according to the limitations of environment and fabrication. b. Development of simulation model in a numerical solver according to design specifications.
5.	Interdependence	a. All the theoretical and practical design tasks for a microwave filter are highly interdependent.

### 4. Outcomes and mapping with PLOs

CLOs	Description	Taxonomy Level	PLOs
CLO1	To DESIGN a microwave device using at least two numerical solvers to achieve required characteristics for the given design specifications.	Cognitive-6	PLO3
CLO2	To Investigate the performance parameters of designed microwave device.	Cognitive -5	PLO4
CLO3	To Recognize importance of microwave engineering and its impact on society.	Affective -3	PLO6
CLO4	To Demonstrate knowledge of microwave devices and its need for sustainable development.	Affective -3	PLO7
CLO5	To Adapt management skills to manage projects of microwave filter design in a multidisciplinary environment.	Affective -4	PLO11
CLO6	To Adapt lifelong learning skills required to achieve technological developments in the field of microwave filter design.	Affective -4	PLO12

### 5. Deliverables

Final deliverables are as follows;

- Simulation Model in HFSS/CST Microwave Studio
- Complete Project Presentation in the form of PowerPoint PPT.
- A summary report comprising analysis of results and optimization technique.

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