King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE-407; Exam-2

Prob.1	Prob.2	Prob.3	**Total**

Answer **all THREE** question. All questions carry **equal** marks.

Name: ***I.D.***

Q.1 Design a 0.5dB equal-ripple low-pass filter (where circuit begins with shunt element) with Z_0=50 Ω, pass-band of 0 to 3 GHz and a minimum attenuation of 20 dB at 4.5 GHz.

(i) Draw the LC filter circuit

(ii) Find the values of the reactive elements **(with units)** of the filter.

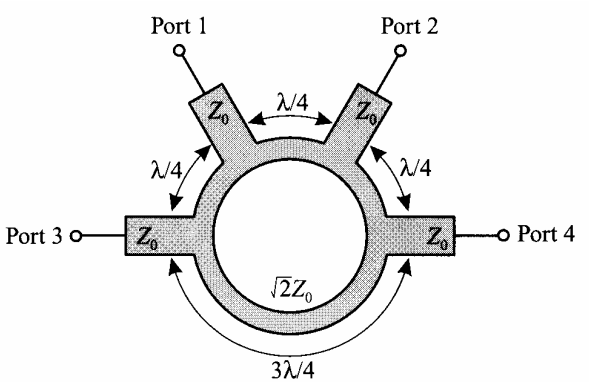
Q.2 Implement the filter solved in question 1 , using **stepped impedance method**, where the given printed board material has ε_r=4.2, h=0.79 mm and negligible thickness of the copper conductor. Assume the filter has highest practical line impedance is 120 Ω, lowest practical line impedance is 15 Ω.

(i) Find the electrical length (in degrees) of the microstrip segments realizing reactive elements of the filter.

(ii) Find the width (in mm) of the microstrip segments realizing reactive elements of the filter.

Q.3(a) Draw a three finger lunge coupler and write one advantage of this coupler?

Q.3(b) For the given hybrid-ring coupler, briefly explain, why $\sqrt{2}Z_0$ is selected as the characteristics impedance of the circular section.



Q.3(c) For a four port **20 dB coupler** with **30 dB directivity,** find the **isolation** (in dB) if the input power of the coupler is 5 mW. Assume all ports are matched or connected with proper matching.

Q.3(d) If the coupler of question 3(c) is implemented in on a substrate with dielectric constant of '2.2' and thickness of '0.127 cm', find the required width of the microstrip sections to implement a '50 Ω' device. Neglect the thickness of the copper conductor.

Given:

ε_0*= 8.854e-12 unit*

μ_0*=1.2566e-6 unit*