U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

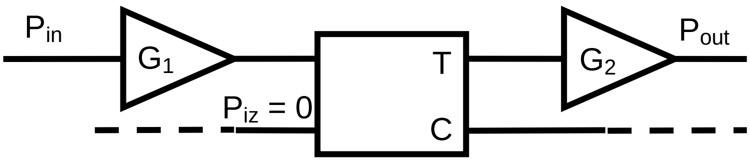
S U B J E C T N o . 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.735 + j·1.035 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.25dB and two matched amplifiers G_1 = 9.3dB and G_2 = 11.1dB. If the input power is 1.65mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.323 + j·0.314 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.90dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.3	11.6	6.5	8.0
Noise Factor [dB]	0.92	1.23	0.50	0.85

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.4	0.659	-142.0°	0.056	34.0°	9.549	90.3°	0.248	-96.6°
3.1	0.633	155.9°	0.099	24.3°	4.452	48.0°	0.295	147.4°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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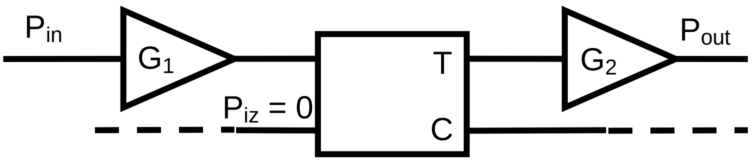
S U B J E C T   N o . 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.190 + j·1.110 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.25dB and two matched amplifiers G_1 = 8.2dB and G_2 = 10.5dB. If the input power is 2.15mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.296 + j·0.365 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.60dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.4	10.5	5.8	7.4
Noise Factor [dB]	0.97	1.28	0.53	0.84

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.1	0.975	-20.4°	0.010	79.4°	26.054	167.1°	0.263	-27.6°
1.5	0.973	-27.7°	0.020	71.2°	6.251	152.1°	0.536	-21.9°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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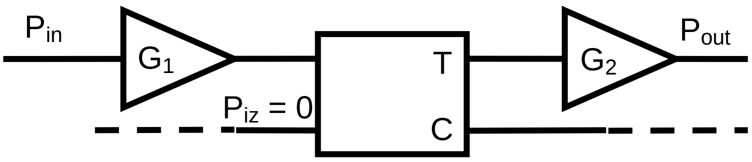
S U B J E C T   N o . 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.260 − j·0.850 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.85dB and two matched amplifiers G_1 = 6.0dB and G_2 = 10.1dB. If the input power is 1.15mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.272 + j·0.688 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.35dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.3	10.2	5.8	8.2
Noise Factor [dB]	1.05	1.20	0.57	0.78

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
3.1	0.605	161.6°	0.081	22.1°	4.816	49.4°	0.116	-140.7°
2.0	0.958	-36.5°	0.026	65.5°	6.157	143.4°	0.532	-28.6°

   a) Perform the µ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

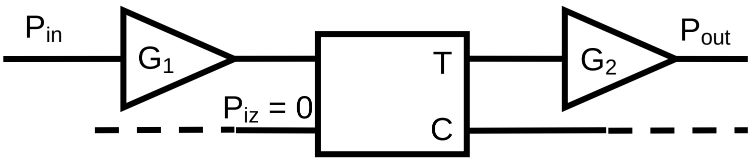
S U B J E C T   N o . 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $1.045 - j\cdot 0.955$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.25dB and two matched amplifiers G_1 = 9.5dB and G_2 = 9.4dB. If the input power is 1.80mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = -0.186 + j\cdot 0.223$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.05dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.0	11.2	5.7	8.6
Noise Factor [dB]	1.04	1.18	0.66	0.85

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.5	0.611	178.5°	0.072	26.6°	5.838	62.6°	0.150	-122.6°
3.2	0.917	-56.8°	0.039	52.5°	5.870	123.1°	0.520	-44.1°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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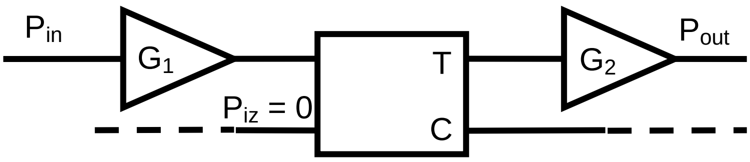
S U B J E C T   N o . 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.225 + j·1.045 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.50dB and two matched amplifiers G_1 = 8.9dB and G_2 = 11.9dB. If the input power is 1.15mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.468 + j·0.605 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 17.15dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.9	11.6	6.9	8.6
Noise Factor [dB]	0.93	1.20	0.64	0.71

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.5	0.804	-85.9°	0.036	53.3°	18.449	126.8°	0.288	-104.9°
2.1	0.955	-38.2°	0.027	64.5°	6.134	141.8°	0.531	-30.0°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
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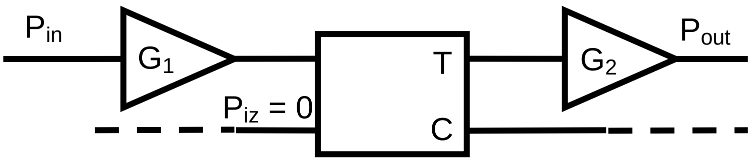
SUBJECT No.6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.800 - j\cdot 1.065$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.85dB and two matched amplifiers G_1 = 6.4dB and G_2 = 11.9dB. If the input power is 2.60mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.184 + j\cdot 0.176$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.45dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.3	10.3	6.1	7.5
Noise Factor [dB]	0.94	1.24	0.66	0.89

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.2	0.683	-141.3°	0.055	40.7°	10.171	94.3°	0.303	-153.5°
2.8	0.932	-50.1°	0.035	56.7°	5.965	129.8°	0.524	-39.0°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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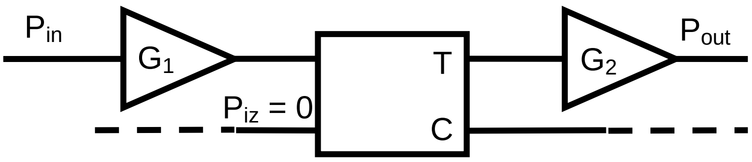
SUBJECT No.7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.035 + j·0.745 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.50dB and two matched amplifiers G_1 = 8.7dB and G_2 = 10.3dB. If the input power is 4.05mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.699 + j·0.258 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 13.60dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.0	11.4	5.2	7.2
Noise Factor [dB]	1.00	1.19	0.52	0.74

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.8	0.632	-158.4°	0.062	31.2°	7.749	79.3°	0.204	-106.5°
3.5	0.903	-61.7°	0.042	49.2°	5.787	118.1°	0.515	-47.9°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

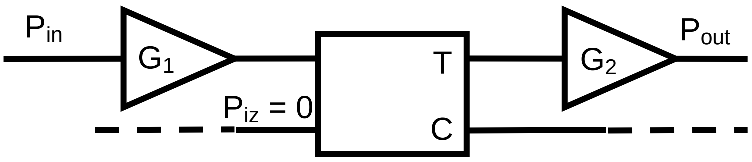
S U B J E C T   N o . 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.970 + j·1.190 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.20dB and two matched amplifiers G_1 = 9.0dB and G_2 = 8.3dB. If the input power is 3.10mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.296 + j·0.359 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.60dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.5	11.1	5.7	8.8
Noise Factor [dB]	0.95	1.25	0.54	0.79

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.8	0.632	163.7°	0.092	27.5°	4.903	54.4°	0.289	156.0°
0.8	0.991	-15.0°	0.011	79.8°	6.380	164.8°	0.541	-11.9°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

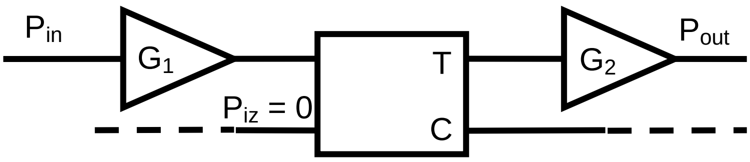
S U B J E C T N o . 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.945 - j\cdot 1.160$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.30dB and two matched amplifiers G_1 = 9.4dB and G_2 = 8.5dB. If the input power is 2.90mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.119 + j\cdot 0.398$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.95dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.3	10.9	5.6	8.5
Noise Factor [dB]	0.94	1.15	0.66	0.86

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.8	0.649	-166.0°	0.069	36.5°	7.248	77.5°	0.294	-174.9°
2.5	0.942	-45.1°	0.032	60.0°	6.035	134.9°	0.527	-35.2°

   a) Perform the µ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

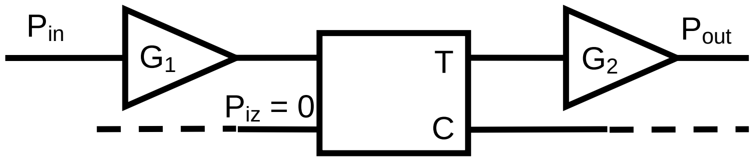
S U B J E C T N o . 1 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: __________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.980 + j·0.740 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.05dB and two matched amplifiers G_1 = 7.5dB and G_2 = 8.7dB. If the input power is 1.60mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.065 + j·0.637 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.35dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.3	10.2	6.9	7.4
Noise Factor [dB]	0.91	1.20	0.64	0.89

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.6	0.644	-150.9°	0.059	32.5°	8.540	84.6°	0.224	-101.8°
4.1	0.875	-70.9°	0.048	43.2°	5.623	108.5°	0.507	-55.0°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

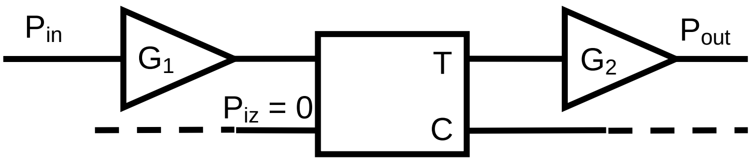
S U B J E C T   N o . 1 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.750 + j·1.105 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.60dB and two matched amplifiers G_1 = 7.3dB and G_2 = 10.3dB. If the input power is 3.20mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.713 + j·0.180 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.40dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.7	10.6	6.0	8.3
Noise Factor [dB]	0.99	1.18	0.65	0.77

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.4	0.669	-150.5°	0.060	39.2°	8.971	88.2°	0.300	-161.3°
2.4	0.946	-43.4°	0.031	61.0°	6.060	136.5°	0.528	-33.9°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

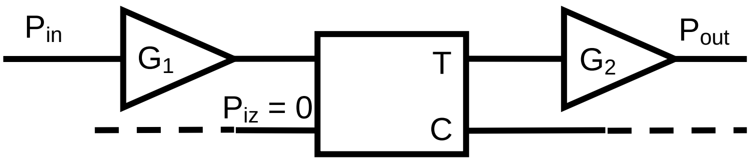
S U B J E C T   N o . 1 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: ________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.750 − j·0.940 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.70dB and two matched amplifiers G_1 = 6.9dB and G_2 = 11.2dB. If the input power is 3.95mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.379 + j·0.251 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.60dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.0	10.8	6.0	8.0
Noise Factor [dB]	0.97	1.13	0.51	0.83

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.6	0.657	-158.9°	0.064	37.8°	8.005	82.7°	0.297	-168.2°
2.6	0.939	-46.8°	0.033	58.8°	6.006	133.2°	0.526	-36.4°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

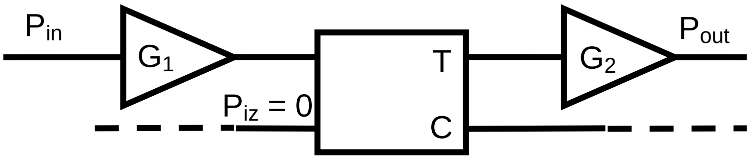
S U B J E C T   N o . 1 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.890 - j\cdot 0.950$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.25dB and two matched amplifiers G_1 = 6.6dB and G_2 = 11.9dB. If the input power is 3.25mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.062 + j\cdot 0.446$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.65dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.2	10.1	5.3	7.1
Noise Factor [dB]	1.00	1.21	0.59	0.70

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.2	0.677	-132.4°	0.053	35.9°	10.785	96.6°	0.275	-90.6°
3.8	0.889	-66.6°	0.045	46.2°	5.708	113.2°	0.512	-51.4°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

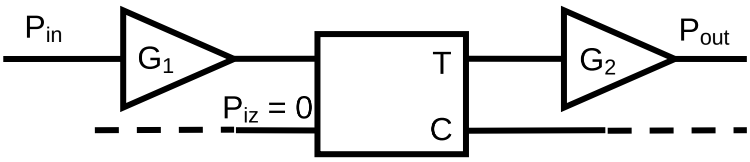
S U B J E C T   N o . 1 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.830 − j·0.955 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.10dB and two matched amplifiers G_1 = 6.4dB and G_2 = 9.4dB. If the input power is 2.55mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.006 + j·0.340 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.70dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.4	10.5	5.1	8.1
Noise Factor [dB]	1.04	1.25	0.62	0.77

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.1	0.688	-126.4°	0.051	37.4°	11.536	100.2°	0.290	-87.1°
3.0	0.925	-53.4°	0.037	54.7°	5.917	126.5°	0.523	-41.6°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

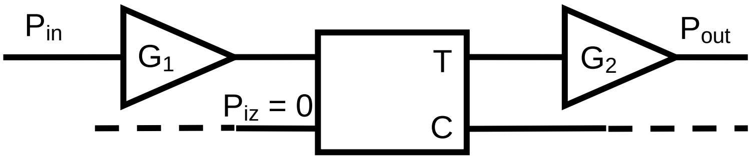
S U B J E C T N o . 1 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.795 − j·0.735 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.15dB and two matched amplifiers G_1 = 7.9dB and G_2 = 10.0dB. If the input power is 2.85mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.210 + j·0.145 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.10dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.0	11.9	6.7	7.8
Noise Factor [dB]	1.03	1.24	0.67	0.71

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.2	0.639	-179.3°	0.078	33.3°	6.081	67.7°	0.291	173.3°
3.2	0.635	153.4°	0.101	23.3°	4.316	46.0°	0.299	145.0°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

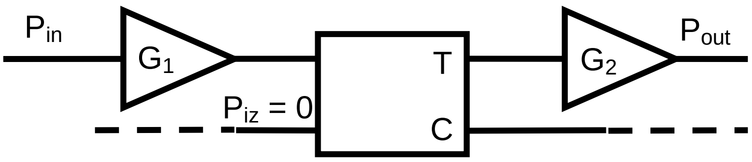
S U B J E C T   N o . 1 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.810 - j\cdot 0.770$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.55dB and two matched amplifiers G_1 = 8.9dB and G_2 = 9.6dB. If the input power is 3.75mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.099 + j\cdot 0.092$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.30dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.0	10.7	5.0	7.7
Noise Factor [dB]	1.00	1.25	0.52	0.71

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.2	0.927	-38.9°	0.019	71.3°	24.719	155.1°	0.276	-51.0°
3.0	0.634	158.5°	0.096	25.5°	4.590	50.1°	0.293	150.2°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

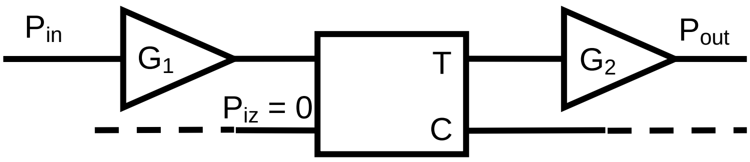
SUBJECT No.17

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.105 − j·1.140 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.30dB and two matched amplifiers G_1 = 8.7dB and G_2 = 10.0dB. If the input power is 1.75mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.065 + j·0.107 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.70dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.9	11.4	5.9	7.1
Noise Factor [dB]	1.03	1.29	0.68	0.83

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.2	0.618	-172.5°	0.068	28.5°	6.540	69.3°	0.173	-115.3°
3.1	0.922	-55.1°	0.038	53.5°	5.898	124.8°	0.521	-43.0°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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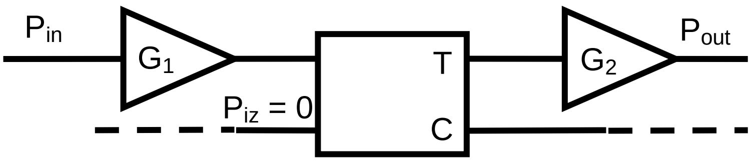
SUBJECT No.18

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: __________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.810 − j·1.140 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.60dB and two matched amplifiers G_1 = 9.0dB and G_2 = 8.8dB. If the input power is 3.45mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.503 + j·0.257 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.30dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.2	10.9	5.0	7.0
Noise Factor [dB]	1.03	1.14	0.55	0.79

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.8	0.732	-115.8°	0.046	45.4°	13.834	109.6°	0.302	-132.4°
1.0	0.987	-18.7°	0.014	77.3°	6.344	161.1°	0.539	-14.8°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

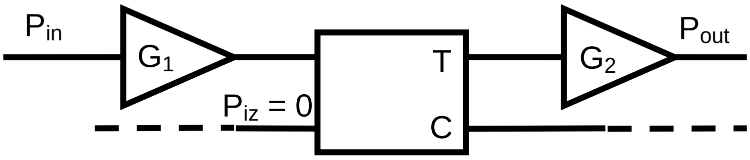
S U B J E C T   N o . 1 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: __________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.765 + j\cdot1.005$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.80dB and two matched amplifiers G_1 = 6.4dB and G_2 = 9.4dB. If the input power is 4.05mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = -0.281 + j\cdot0.668$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.80dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.1	10.3	5.6	7.1
Noise Factor [dB]	0.92	1.27	0.51	0.70

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.9	0.608	166.9°	0.078	23.6°	5.117	53.7°	0.126	-133.7°
1.8	0.965	-32.9°	0.024	68.0°	6.192	146.9°	0.533	-25.9°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

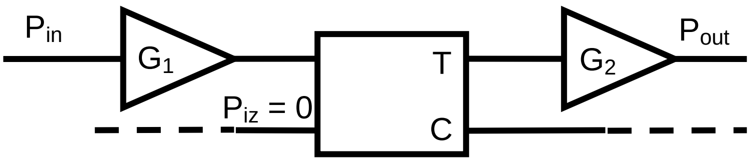
SUBJECT No.20

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.230 − j·0.950 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.40dB and two matched amplifiers G_1 = 8.6dB and G_2 = 11.9dB. If the input power is 3.75mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.193 + j·0.052 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.70dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.6	10.5	6.0	7.3
Noise Factor [dB]	0.98	1.18	0.58	0.75

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.1	0.690	-135.6°	0.053	41.7°	10.915	97.7°	0.303	-149.2°
1.1	0.983	-20.6°	0.015	76.1°	6.317	159.3°	0.539	-16.2°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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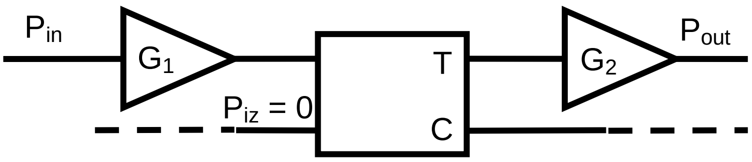
SUBJECT No.21

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.960 − j·0.850 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.50dB and two matched amplifiers G_1 = 7.7dB and G_2 = 8.3dB. If the input power is 1.10mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.367 + j·0.183 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.50dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.8	10.6	6.5	7.3
Noise Factor [dB]	0.92	1.17	0.53	0.75

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.3	0.666	-137.6°	0.054	34.9°	10.124	93.4°	0.259	-94.0°
1.7	0.968	-31.2°	0.023	69.1°	6.210	148.7°	0.534	-24.6°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

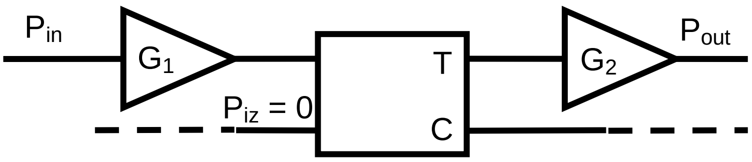
S U B J E C T N o . 2 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $1.205 - j\cdot 1.270$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.00dB and two matched amplifiers G_1 = 8.8dB and G_2 = 9.0dB. If the input power is 3.30mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = -0.606 + j\cdot 0.132$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.40dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.4	11.4	5.1	8.8
Noise Factor [dB]	0.93	1.24	0.58	0.85

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.0	0.702	-129.9°	0.051	42.7°	11.753	101.3°	0.304	-144.3°
3.3	0.636	151.1°	0.103	22.2°	4.193	43.9°	0.302	142.2°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

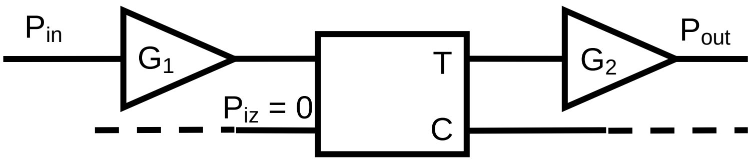
S U B J E C T   N o . 2 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.195 + j·0.920 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.55dB and two matched amplifiers G_1 = 7.0dB and G_2 = 11.0dB. If the input power is 3.15mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.334 + j·0.212 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.65dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.9	11.7	5.5	8.3
Noise Factor [dB]	1.05	1.15	0.52	0.85

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.1	0.640	-175.9°	0.076	34.2°	6.341	70.2°	0.289	176.1°
3.6	0.899	-63.3°	0.043	48.4°	5.763	116.5°	0.515	-49.0°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

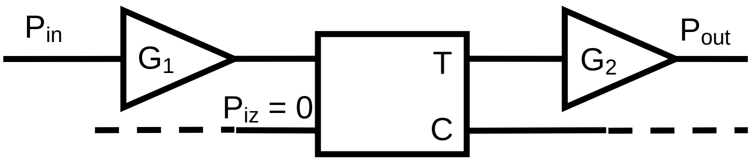
S U B J E C T N o . 2 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.100 + j·1.285 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.70dB and two matched amplifiers G_1 = 9.0dB and G_2 = 9.1dB. If the input power is 3.65mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.415 + j·0.337 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.25dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.2	11.7	6.2	7.2
Noise Factor [dB]	0.91	1.19	0.57	0.84

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
3.0	0.607	164.2°	0.080	22.9°	4.960	51.5°	0.121	-137.5°
2.3	0.949	-41.7°	0.030	62.3°	6.082	138.2°	0.529	-32.7°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I

Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
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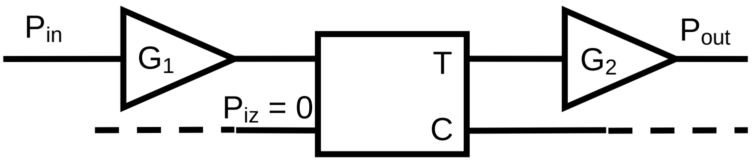
S U B J E C T N o . 2 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.035 + j·0.820 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.40dB and two matched amplifiers G_1 = 8.4dB and G_2 = 10.6dB. If the input power is 1.20mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.658 + j·0.359 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.40dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.3	10.2	5.9	7.3
Noise Factor [dB]	0.99	1.23	0.60	0.81

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.5	0.663	-154.6°	0.062	38.6°	8.464	85.4°	0.299	-165.0°
4.6	0.847	-79.1°	0.051	38.2°	5.480	100.2°	0.498	-60.5°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I

Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

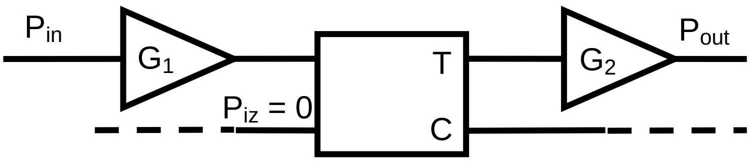
S U B J E C T N o . 2 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.720 + j·1.235 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.95dB and two matched amplifiers G_1 = 7.0dB and G_2 = 9.7dB. If the input power is 1.75mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.351 + j·0.499 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.80dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.5	10.7	5.8	8.2
Noise Factor [dB]	0.90	1.20	0.60	0.84

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.9	0.648	-169.5°	0.071	35.7°	6.923	74.9°	0.291	-177.6°
2.7	0.935	-48.5°	0.034	57.7°	5.983	131.4°	0.525	-37.8°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

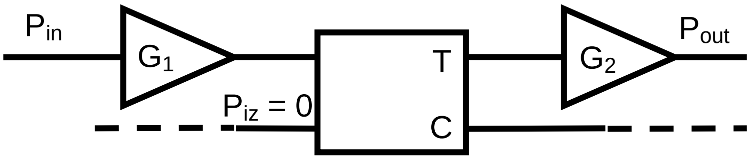
S U B J E C T   N o . 2 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $1.220 - j\cdot 0.980$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.75dB and two matched amplifiers G_1 = 7.1dB and G_2 = 10.7dB. If the input power is 3.90mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.498 + j\cdot 0.110$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 14.95dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.3	11.9	6.1	7.3
Noise Factor [dB]	0.99	1.10	0.65	0.74

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.7	0.752	-107.3°	0.043	47.4°	15.166	114.5°	0.300	-125.0°
4.5	0.854	-77.6°	0.051	39.2°	5.506	101.9°	0.499	-59.4°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

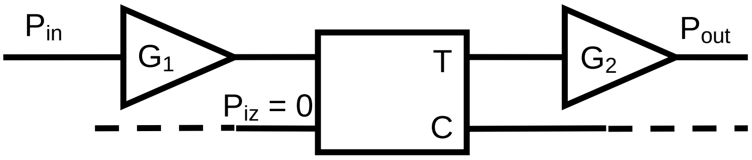
S U B J E C T   N o . 2 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.095 + j·1.065 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.45dB and two matched amplifiers G_1 = 8.1dB and G_2 = 11.1dB. If the input power is 2.65mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.018 + j·0.720 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.30dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.6	10.0	6.5	7.0
Noise Factor [dB]	0.93	1.16	0.67	0.78

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.0	0.644	-172.8°	0.074	35.0°	6.621	72.6°	0.290	179.4°
0.9	0.989	-16.9°	0.012	78.8°	6.361	162.9°	0.541	-13.4°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

UNIVERSITATEA TEHNICĂ "GHEORGHE ASACHI" DIN IAŞI
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

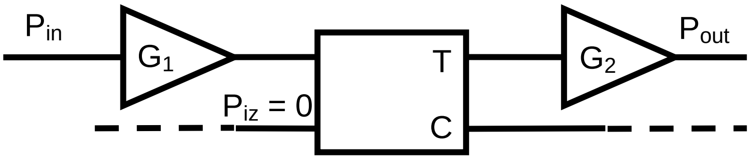
SUBJECT No.29

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $1.010 - j\cdot 1.015$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.70dB and two matched amplifiers G_1 = 9.9dB and G_2 = 8.8dB. If the input power is 2.65mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.485 + j\cdot 0.279$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.10dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.3	11.0	5.3	8.6
Noise Factor [dB]	1.08	1.28	0.64	0.76

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.3	0.637	178.1°	0.081	32.5°	5.846	65.5°	0.288	170.1°
1.2	0.981	-22.3°	0.016	74.9°	6.307	157.5°	0.538	-17.6°

   a) Perform the µ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

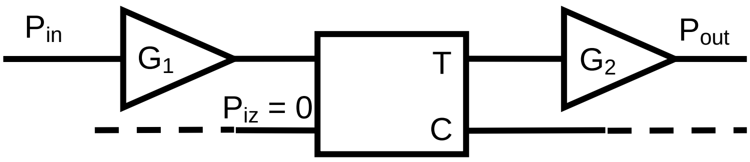
S U B J E C T N o . 3 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.260 + j·1.295 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.15dB and two matched amplifiers G_1 = 8.0dB and G_2 = 11.7dB. If the input power is 2.85mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.072 + j·0.459 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.35dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.9	11.1	6.4	7.6
Noise Factor [dB]	0.94	1.27	0.67	0.79

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.5	0.651	-146.5°	0.057	33.3°	9.008	87.4°	0.235	-99.5°
5.0	0.821	-85.2°	0.054	34.5°	5.345	94.1°	0.487	-64.8°

   a) Perform the µ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

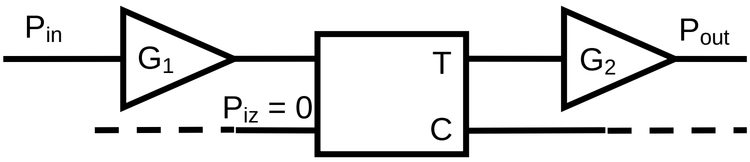
S U B J E C T   N o . 3 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.120 − j·1.025 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.35dB and two matched amplifiers G_1 = 9.5dB and G_2 = 10.3dB. If the input power is 4.05mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.066 + j·0.323 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.65dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.5	11.8	5.7	7.8
Noise Factor [dB]	0.99	1.12	0.67	0.72

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.7	0.655	-162.5°	0.067	37.2°	7.606	80.1°	0.296	-171.5°
4.9	0.828	-83.7°	0.054	35.5°	5.363	95.7°	0.489	-63.8°

   a) Perform the µ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
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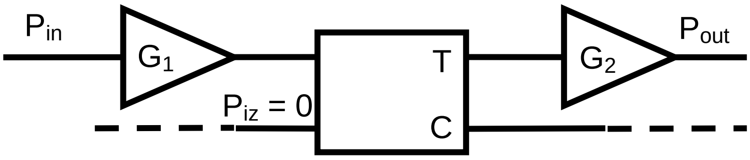
S U B J E C T   N o . 3 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.925 - j\cdot 0.760$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.95dB and two matched amplifiers G_1 = 9.6dB and G_2 = 10.7dB. If the input power is 1.15mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.093 + j\cdot 0.067$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 17.25dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.8	10.7	6.8	7.9
Noise Factor [dB]	1.06	1.20	0.56	0.72

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.0	0.624	-165.6°	0.065	29.8°	7.078	74.2°	0.188	-110.9°
2.2	0.951	-40.0°	0.029	63.2°	6.093	140.1°	0.530	-31.2°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

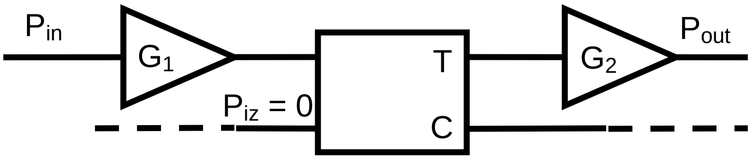
S U B J E C T N o . 3 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.095 − j·0.755 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.55dB and two matched amplifiers G_1 = 8.2dB and G_2 = 10.4dB. If the input power is 1.95mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.623 + j·0.246 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.65dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.6	10.2	6.0	7.8
Noise Factor [dB]	1.08	1.18	0.55	0.71

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.4	0.867	-72.4°	0.032	58.1°	20.587	135.0°	0.292	-88.8°
5.3	0.801	-89.7°	0.056	31.8°	5.244	89.7°	0.479	-67.9°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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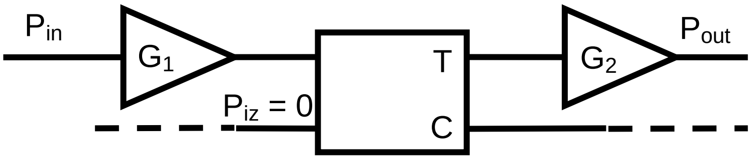
SUBJECT No.34

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.005 + j·1.000 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.60dB and two matched amplifiers G_1 = 6.1dB and G_2 = 11.3dB. If the input power is 1.20mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.077 + j·0.311 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.90dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.6	11.0	6.4	8.6
Noise Factor [dB]	1.09	1.22	0.63	0.82

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.3	0.615	-175.3°	0.069	27.9°	6.276	67.1°	0.164	-117.7°
4.0	0.880	-69.8°	0.047	44.2°	5.654	109.9°	0.509	-53.8°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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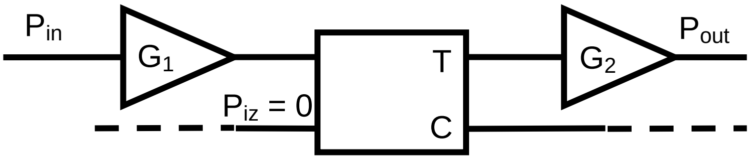
SUBJECT No.35

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.135 + j·0.885 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.90dB and two matched amplifiers G_1 = 9.9dB and G_2 = 9.6dB. If the input power is 1.25mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.191 + j·0.767 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.85dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.8	10.3	6.7	8.7
Noise Factor [dB]	1.08	1.12	0.62	0.73

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.8	0.606	169.7°	0.077	24.4°	5.280	55.8°	0.132	-130.5°
1.3	0.979	-24.1°	0.017	73.6°	6.284	155.7°	0.538	-19.1°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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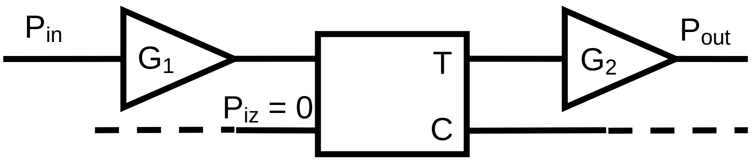
SUBJECT No.36

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.725 - j\cdot 0.960$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.20dB and two matched amplifiers G_1 = 8.0dB and G_2 = 9.3dB. If the input power is 2.50mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.093 + j\cdot 0.068$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.85dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.2	10.0	6.3	8.5
Noise Factor [dB]	0.92	1.15	0.66	0.74

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.9	0.630	-162.1°	0.063	30.4°	7.400	76.6°	0.197	-108.6°
4.8	0.834	-82.2°	0.053	36.3°	5.422	97.4°	0.492	-62.7°

   a) Perform the µ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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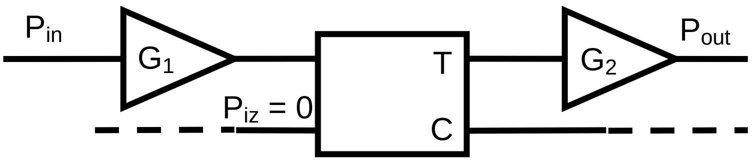
SUBJECT No.37

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.920 − j·0.915 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.50dB and two matched amplifiers G_1 = 8.9dB and G_2 = 8.9dB. If the input power is 1.15mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.088 + j·0.785 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.05dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.1	11.2	6.9	8.5
Noise Factor [dB]	1.02	1.20	0.53	0.77

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.7	0.607	172.7°	0.075	25.1°	5.459	58.1°	0.138	-127.6°
3.3	0.912	-58.4°	0.040	51.4°	5.839	121.5°	0.518	-45.4°

   a) Perform the µ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
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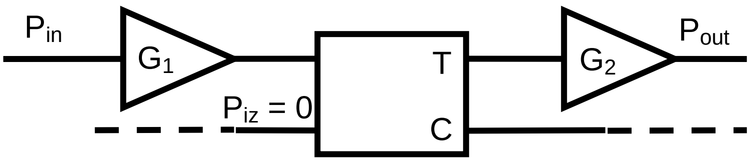
S U B J E C T N o . 3 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.010 − j·0.865 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.35dB and two matched amplifiers G_1 = 9.8dB and G_2 = 8.8dB. If the input power is 2.15mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.318 + j·0.652 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.75dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.4	10.4	5.7	7.1
Noise Factor [dB]	0.96	1.21	0.61	0.73

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.5	0.635	172.1°	0.085	30.6°	5.424	61.1°	0.289	164.4°
1.6	0.971	-29.5°	0.021	70.1°	6.231	150.4°	0.535	-23.2°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
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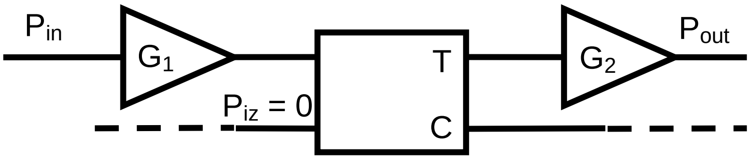
S U B J E C T   N o . 3 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.175 − j·0.910 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.25dB and two matched amplifiers G_1 = 7.2dB and G_2 = 9.7dB. If the input power is 1.65mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.444 + j·0.229 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 17.50dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.7	11.3	6.6	8.9
Noise Factor [dB]	0.99	1.15	0.60	0.85

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.6	0.609	175.7°	0.074	25.8°	5.644	60.3°	0.143	-124.6°
4.3	0.866	-74.3°	0.049	41.2°	5.588	105.1°	0.504	-57.3°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
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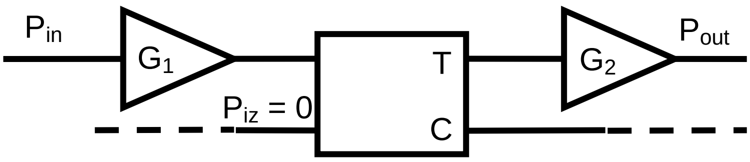
S U B J E C T N o . 4 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.950 + j·1.240 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.70dB and two matched amplifiers G_1 = 6.1dB and G_2 = 11.2dB. If the input power is 2.10mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.020 + j·0.209 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 17.15dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.0	11.5	6.0	8.3
Noise Factor [dB]	1.05	1.22	0.65	0.77

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.3	0.676	-146.2°	0.058	40.0°	9.523	91.2°	0.303	-158.0°
1.9	0.962	-34.7°	0.025	66.6°	6.173	145.1°	0.533	-27.3°

   a) Perform the µ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A   T E H N I C Ă   " G H E O R G H E   A S A C H I "   D I N   I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

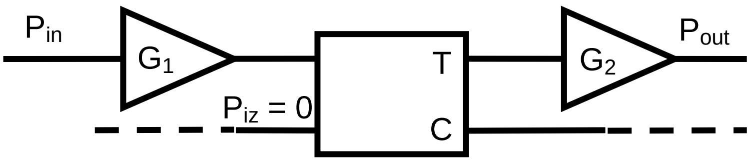
S U B J E C T   N o . 4 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.720 + j·1.115 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.00dB and two matched amplifiers G_1 = 8.6dB and G_2 = 9.4dB. If the input power is 1.65mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.338 + j·0.327 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.55dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.4	10.0	6.9	8.8
Noise Factor [dB]	0.98	1.17	0.65	0.86

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.9	0.717	-123.4°	0.049	43.9°	12.733	105.2°	0.303	-138.8°
3.7	0.887	-64.7°	0.044	47.1°	5.701	114.8°	0.512	-50.2°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

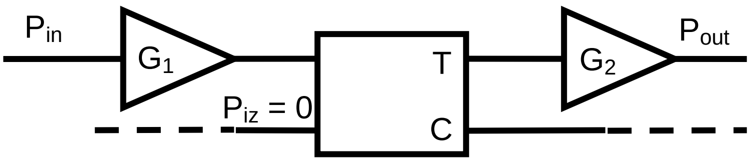
S U B J E C T N o . 4 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $0.985 - j\cdot 1.175$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.35dB and two matched amplifiers G_1 = 8.8dB and G_2 = 10.7dB. If the input power is 1.25mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = -0.097 + j\cdot 0.071$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.90dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.7	11.1	6.9	7.3
Noise Factor [dB]	0.97	1.17	0.62	0.87

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.7	0.639	-154.8°	0.060	31.8°	8.124	81.8°	0.215	-104.3°
4.7	0.841	-80.7°	0.052	37.3°	5.454	98.7°	0.494	-61.6°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

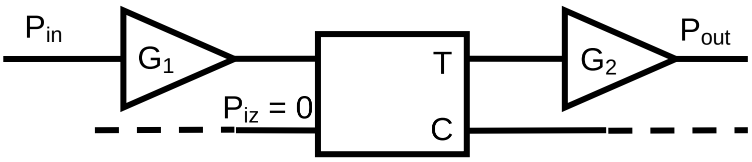
S U B J E C T N o . 4 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.745 − j·0.835 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.45dB and two matched amplifiers G_1 = 7.6dB and G_2 = 9.5dB. If the input power is 1.10mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.308 + j·0.105 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.90dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.9	10.9	6.6	8.5
Noise Factor [dB]	1.02	1.26	0.50	0.75

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.7	0.632	166.6°	0.090	28.5°	5.067	56.6°	0.289	158.8°
4.4	0.859	-76.1°	0.050	40.1°	5.535	103.6°	0.503	-58.3°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

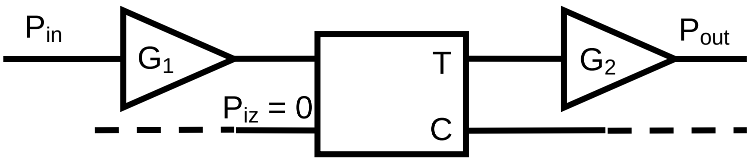
S U B J E C T N o . 4 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.280 + j·1.205 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.30dB and two matched amplifiers G_1 = 6.9dB and G_2 = 8.3dB. If the input power is 3.45mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.262 + j·0.099 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.45dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.8	10.6	6.6	8.2
Noise Factor [dB]	0.90	1.23	0.58	0.89

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.6	0.634	169.4°	0.088	29.6°	5.243	58.8°	0.287	161.4°
2.9	0.927	-51.8°	0.036	55.9°	5.938	128.1°	0.524	-40.4°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

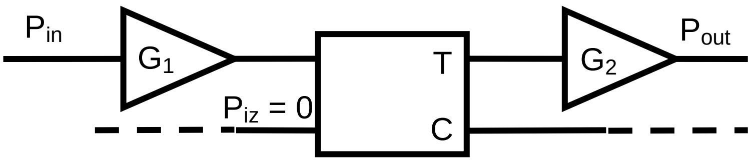
S U B J E C T   N o . 4 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.910 − j·1.295 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.85dB and two matched amplifiers G_1 = 7.9dB and G_2 = 8.3dB. If the input power is 1.20mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = -0.345 + j·0.191 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.35dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.9	11.6	6.2	8.1
Noise Factor [dB]	1.01	1.25	0.64	0.70

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.6	0.777	-97.5°	0.040	50.0°	16.735	120.2°	0.295	-115.2°
3.4	0.909	-60.1°	0.041	50.4°	5.817	119.8°	0.518	-46.5°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

UNIVERSITATEA TEHNICĂ "GHEORGHE ASACHI" DIN IAŞI
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

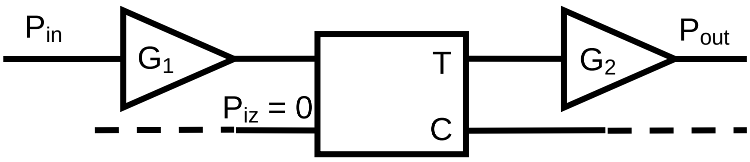
SUBJECT No.46

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $1.125 - j\cdot 1.015$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.20dB and two matched amplifiers G_1 = 9.7dB and G_2 = 9.7dB. If the input power is 2.30mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.043 + j\cdot 0.433$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.40dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.1	10.5	5.6	8.4
Noise Factor [dB]	0.95	1.11	0.64	0.70

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.3	0.901	-57.5°	0.026	63.8°	22.663	144.2°	0.282	-72.6°
5.1	0.814	-86.7°	0.055	33.5°	5.323	92.6°	0.484	-65.9°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

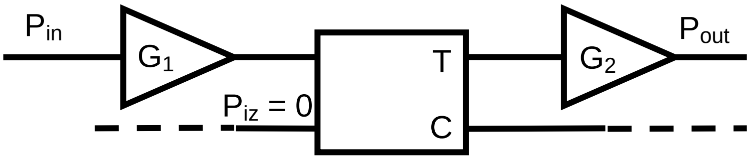
S U B J E C T   N o . 4 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: __________________________________   Grupa________

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.090 + j·1.290 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.70dB and two matched amplifiers G_1 = 9.1dB and G_2 = 8.7dB. If the input power is 2.15mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.470 + j·0.539 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.40dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	8.8	11.0	6.5	7.9
Noise Factor [dB]	1.07	1.14	0.58	0.79

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.9	0.635	161.1°	0.094	26.5°	4.736	52.2°	0.292	153.1°
4.2	0.869	-72.9°	0.049	42.0°	5.601	106.7°	0.507	-56.2°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

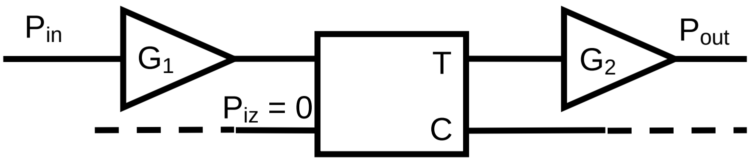
S U B J E C T   N o . 4 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: _________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 0.820 + j·0.720 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 5.80dB and two matched amplifiers G_1 = 9.6dB and G_2 = 9.3dB. If the input power is 2.10mW compute the output power (**<u>in mW</u>**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.116 + j·0.117 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.80dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.2	11.8	6.5	7.1
Noise Factor [dB]	0.95	1.12	0.69	0.79

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.4	0.611	-178.3°	0.071	27.3°	6.044	64.8°	0.157	-119.7°
3.9	0.881	-67.8°	0.046	45.2°	5.668	111.8°	0.510	-52.6°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDC - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2021

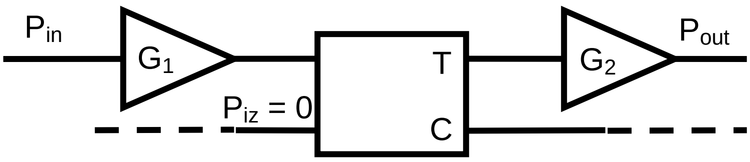
S U B J E C T   N o . 4 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian   Student: __________________________________   Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to 1.005 + j·0.725 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 6.95dB and two matched amplifiers G_1 = 9.3dB and G_2 = 11.6dB. If the input power is 3.30mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) Γ = 0.448 + j·0.484 .
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 15.55dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.2	11.4	5.8	7.1
Noise Factor [dB]	1.02	1.10	0.52	0.85

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**
5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.1	0.619	-168.8°	0.066	29.3°	6.797	71.8°	0.180	-113.0°
1.4	0.977	-25.9°	0.019	72.5°	6.271	154.0°	0.536	-20.4°

   a) Perform the μ-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**

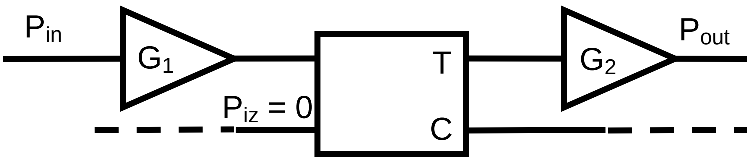
SUBJECT No.50

Time allowed: 2 hours; All materials/equipments authorized

Instructor: conf. Radu Damian Student: _________________________________ Grupa_______

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must be accompanied by the submission of the script/project at the end of the examination.

1. For a normalized impedance equal to $1.060 - j\cdot 1.105$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A circuit contains an ideal lossless coupler (matched on all ports with infinite isolation) with a coupling factor C = 4.45dB and two matched amplifiers G_1 = 9.9dB and G_2 = 11.0dB. If the input power is 3.40mW compute the output power (**in mW**) **(2p)**



3. A 50Ω source is connected to an unknown load resulting an reflection coefficient (as seen by the source) $\Gamma = 0.036 + j\cdot 0.484$.
   a) Compute the impedance of the unknown load. **(1p)**
   b) Compute the reflection coefficient seen by the source if we connect to the 50Ω source two devices identical to the unknown load determined at **a)** in parallel. **(1p)**
   c) For **b)** design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   d) Draw the match schematic. (**0.5p**)
4. In order to obtain an 16.90dB gain (minimum) amplifier you must cascade two devices (amplifiers). You have available the four devices in the following table.

Device	**1**	**2**	**3**	**4**
Gain [dB]	9.9	11.0	6.0	7.2
Noise Factor [dB]	1.03	1.11	0.53	0.75

   a) Specify any two devices you can use to meet the amplifier requirements. **(0.5p)**
   b) Of all the combinations that meet the requirements, which one has the minimum noise factor? Explain your choice. **(1.5p)**

5. The scattering parameters of a transistor at two frequencies are as follows:

f [GHz]	S_{11}		S_{12}		S_{21}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.4	0.634	175.1°	0.083	31.6°	5.633	63.3°	0.286	167.3°
5.2	0.808	-88.2°	0.055	32.6°	5.302	91.3°	0.483	-66.9°

   a) Perform the μ'-test at both frequencies. **(1.5p)**
   b) At which of the two frequencies the transistor has better stability? (**0.5p**)
   c) At the frequency determined at **b)** assume the transistor unilateral and compute the maximum transducer power gain **(in dB)**. (**1p**)
   d) Determine the error in the transducer power gain computation induced by the unilateral assumption **(in dB)**. **(1p)**