UNIVERSITATEA TEHNICĂ "GHEORGHE ASACHI" DIN IAŞI
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2023

SUBJECT No.1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 1.165 + 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.2dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 71.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 60Ω and a physical length which at 9.5GHz is equal to 3/5λ. The line is loaded with a shunt RC circuit with R = 45Ω and C = 0.364pF.
   a) Compute the input impedance at 9.5GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 11dB, G_2 = 16dB and G_3 = 10dB and noise factors F_1 = 2.75dB, F_2 = 2.15dB and F_3 = 2.80dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.3 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.773	-115.9°	4.401	68.3°	0.110	1.5°	0.308	-96.3°
T2	0.749	-92.0°	2.928	94.5°	0.093	34.3°	0.485	-61.6°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

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S U B J E C T   N o . 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: __________________________________   Group________

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 $0.820 + j\cdot 1.170$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 21.7dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 127.0µW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 65Ω and a physical length which at 8.3GHz is equal to 3/6λ. The line is loaded with a shunt RC circuit with R = 30Ω and C = 0.408pF.
   a) Compute the input impedance at 8.3GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 13dB, G_2 = 19dB and G_3 = 11dB and noise factors F_1 = 2.74dB, F_2 = 2.20dB and F_3 = 2.26dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.1 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.642	-162.9°	4.019	29.5°	0.131	-29.5°	0.159	-139.6°
T2	0.637	-127.9°	2.645	67.6°	0.110	20.5°	0.406	-82.1°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

S U B J E C T   N o . 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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·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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 21.7dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 143.5µW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 65Ω and a physical length which at 8.4GHz is equal to 1/3λ. The line is loaded with a series RL circuit with R = 50Ω and L = 0.617nH.
   a) Compute the input impedance at 8.4GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 17dB, G_2 = 15dB and G_3 = 13dB and noise factors F_1 = 2.44dB, F_2 = 2.15dB and F_3 = 2.11dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.0 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.648	-160.2°	4.042	31.5°	0.130	-28.2°	0.167	-136.1°
T2	0.640	-126.0°	2.660	69.0°	0.110	21.0°	0.410	-81.0°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

SUBJECT No.4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: ________________________________ Group_______

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·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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.4dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 51.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 55Ω and a physical length which at 7.4GHz is equal to 2/6λ. The line is loaded with a series RC circuit with R = 33Ω and C = 0.362pF.
   a) Compute the input impedance at 7.4GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 17dB, G_2 = 14dB and G_3 = 18dB and noise factors F_1 = 2.75dB, F_2 = 2.04dB and F_3 = 2.63dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.4 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.697	-144.0°	4.196	44.6°	0.124	-17.5°	0.223	-121.5°
T2	0.676	-114.0°	2.762	78.0°	0.104	25.2°	0.434	-74.4°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

S U B J E C T N o . 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: __________________________________ Group________

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 $1.005 - j\cdot 1.080$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.4dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 126.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 70Ω and a physical length which at 8.2GHz is equal to 5/8λ. The line is loaded with a shunt RL circuit with R = 52Ω and L = 0.612nH.
   a) Compute the input impedance at 8.2GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 11dB, G_2 = 15dB and G_3 = 17dB and noise factors F_1 = 2.08dB, F_2 = 2.46dB and F_3 = 2.84dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.5 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.617	-173.4°	3.927	21.5°	0.134	-34.9°	0.127	-153.7°
T2	0.625	-135.5°	2.585	62.0°	0.110	18.5°	0.390	-86.5°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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SUBJECT No.6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: ________________________________   Group_______

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 0.865 + j·0.795 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.3dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 78.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 90Ω and a physical length which at 9.8GHz is equal to 2/3λ. The line is loaded with a shunt RL circuit with R = 35Ω and L = 0.733nH.
   a) Compute the input impedance at 9.8GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 12dB, G_2 = 17dB and G_3 = 18dB and noise factors F_1 = 2.99dB, F_2 = 2.18dB and F_3 = 2.17dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.2 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.579	166.8°	3.765	7.0°	0.138	-44.6°	0.086	169.5°
T2	0.604	-149.0°	2.482	52.4°	0.110	14.8°	0.362	-94.4°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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
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S U B J E C T N o . 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 $0.790 - j\cdot 1.270$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.0dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 111.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 40Ω and a physical length which at 7.8GHz is equal to 1/3λ. The line is loaded with a series RL circuit with R = 67Ω and L = 1.088nH.
   a) Compute the input impedance at 7.8GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 15dB, G_2 = 14dB and G_3 = 11dB and noise factors F_1 = 2.23dB, F_2 = 2.01dB and F_3 = 2.74dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.7 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.749	-125.8°	4.343	59.8°	0.115	-5.3°	0.281	-105.1°
T2	0.721	-100.0°	2.872	88.5°	0.097	30.7°	0.465	-66.4°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

SUBJECT No.8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: __________________________________ Group________

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 $1.060 - j\cdot 0.990$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.9dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 100.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 75Ω and a physical length which at 6.6GHz is equal to 1/3λ. The line is loaded with a series RC circuit with R = 58Ω and C = 0.518pF.
   a) Compute the input impedance at 6.6GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 12dB, G_2 = 17dB and G_3 = 12dB and noise factors F_1 = 2.48dB, F_2 = 2.27dB and F_3 = 2.55dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.8 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.555	113.5°	3.312	-27.9°	0.145	-68.9°	0.169	59.3°
T2	0.572	179.0°	2.242	30.0°	0.110	7.6°	0.306	-115.2°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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SUBJECT No.9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: __________________________________ Group________

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·0.935 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 17.4dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 148.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 55Ω and a physical length which at 9.6GHz is equal to 2/3λ. The line is loaded with a series RL circuit with R = 42Ω and L = 1.187nH.
   a) Compute the input impedance at 9.6GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 12dB, G_2 = 12dB and G_3 = 18dB and noise factors F_1 = 2.84dB, F_2 = 2.65dB and F_3 = 2.45dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.8 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.559	147.4°	3.619	-6.1°	0.143	-53.7°	0.088	112.1°
T2	0.586	-161.0°	2.398	44.6°	0.110	11.2°	0.338	-101.6°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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SUBJECT No.10

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: __________________________________ Group________

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 1.180 − j·0.805 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.6dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 52.0μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 60Ω and a physical length which at 7.5GHz is equal to 2/6λ. The line is loaded with a series RL circuit with R = 57Ω and L = 1.180nH.
   a) Compute the input impedance at 7.5GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 10dB, G_2 = 15dB and G_3 = 17dB and noise factors F_1 = 2.96dB, F_2 = 2.65dB and F_3 = 2.11dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.5 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.761	-120.8°	4.372	64.0°	0.112	-1.9°	0.295	-100.7°
T2	0.735	-96.0°	2.900	91.5°	0.095	32.5°	0.475	-64.0°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________ Group_______

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 $1.235 - j \cdot 1.250$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.2dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 68.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 65Ω and a physical length which at 6.6GHz is equal to 2/5λ. The line is loaded with a shunt RL circuit with R = 32Ω and L = 1.335nH.
   a) Compute the input impedance at 6.6GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 14dB, G_2 = 14dB and G_3 = 17dB and noise factors F_1 = 2.37dB, F_2 = 2.86dB and F_3 = 2.30dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.4 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.572	160.4°	3.716	2.6°	0.140	-47.6°	0.087	150.4°
T2	0.598	-153.0°	2.454	49.8°	0.110	13.6°	0.354	-96.8°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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SUBJECT No.12

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: __________________________________ Group________

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 1.020 − 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 17.7dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 146.0μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 95Ω and a physical length which at 8.7GHz is equal to 4/5λ. The line is loaded with a shunt RC circuit with R = 69Ω and C = 0.297pF.
   a) Compute the input impedance at 8.7GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 13dB, G_2 = 11dB and G_3 = 10dB and noise factors F_1 = 2.66dB, F_2 = 2.54dB and F_3 = 2.41dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.6 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.566	153.9°	3.668	-1.8°	0.141	-50.7°	0.087	131.2°
T2	0.592	-157.0°	2.426	47.2°	0.110	12.4°	0.346	-99.2°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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SUBJECT No.13

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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·1.195 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.8dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 86.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 45Ω and a physical length which at 6.6GHz is equal to 2/3λ. The line is loaded with a shunt RL circuit with R = 59Ω and L = 0.986nH.
   a) Compute the input impedance at 6.6GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 15dB, G_2 = 15dB and G_3 = 14dB and noise factors F_1 = 2.04dB, F_2 = 2.60dB and F_3 = 2.08dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.1 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.786	-110.9°	4.430	72.6°	0.107	4.9°	0.322	-91.8°
T2	0.763	-88.0°	2.956	97.5°	0.091	36.1°	0.495	-59.2°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 $1.030 - j\cdot 1.085$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 21.9dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 141.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 35Ω and a physical length which at 8.6GHz is equal to 2/3λ. The line is loaded with a shunt RC circuit with R = 64Ω and C = 0.615pF.
   a) Compute the input impedance at 8.6GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 17dB, G_2 = 17dB and G_3 = 16dB and noise factors F_1 = 2.38dB, F_2 = 2.74dB and F_3 = 2.25dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.0 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.792	-108.5°	4.445	74.8°	0.105	6.6°	0.329	-89.6°
T2	0.770	-86.0°	2.970	99.0°	0.090	37.0°	0.500	-58.0°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 1.245 + j·1.150 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 21.1dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 91.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 45Ω and a physical length which at 7.1GHz is equal to 3/5λ. The line is loaded with a shunt RC circuit with R = 40Ω and C = 0.638pF.
   a) Compute the input impedance at 7.1GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 16dB, G_2 = 17dB and G_3 = 18dB and noise factors F_1 = 2.08dB, F_2 = 2.53dB and F_3 = 2.98dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.2 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.553	134.1°	3.506	-14.9°	0.144	-59.7°	0.108	84.5°
T2	0.578	-169.0°	2.338	39.0°	0.110	9.4°	0.324	-106.8°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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SUBJECT No.16

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 1.050 + j·0.890 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.5dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 112.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 40Ω and a physical length which at 7.6GHz is equal to 2/6λ. The line is loaded with a shunt RL circuit with R = 70Ω and L = 0.961nH.
   a) Compute the input impedance at 7.6GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 15dB, G_2 = 17dB and G_3 = 11dB and noise factors F_1 = 2.06dB, F_2 = 2.04dB and F_3 = 2.36dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.2 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.635	-165.5°	3.996	27.5°	0.131	-30.9°	0.151	-143.1°
T2	0.634	-129.8°	2.630	66.2°	0.110	20.0°	0.402	-83.2°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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
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S U B J E C T N o . 1 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.6dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 126.5μW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 35Ω and a physical length which at 6.8GHz is equal to 2/8λ. The line is loaded with a series RC circuit with R = 70Ω and C = 0.609pF.
   a) Compute the input impedance at 6.8GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 16dB, G_2 = 19dB and G_3 = 19dB and noise factors F_1 = 2.65dB, F_2 = 2.97dB and F_3 = 2.70dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.1 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.722	-135.9°	4.273	51.1°	0.121	-12.2°	0.251	-114.2°
T2	0.694	-108.0°	2.813	82.5°	0.101	27.3°	0.446	-71.1°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

SUBJECT No.18

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 1.170 + j·0.870 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.8dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 147.0μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 45Ω and a physical length which at 9.1GHz is equal to 2/5λ. The line is loaded with a shunt RL circuit with R = 29Ω and L = 1.240nH.
   a) Compute the input impedance at 9.1GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 16dB, G_2 = 12dB and G_3 = 12dB and noise factors F_1 = 2.49dB, F_2 = 2.12dB and F_3 = 2.46dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.8 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.598	178.6°	3.859	15.4°	0.136	-38.9°	0.102	-164.3°
T2	0.616	-141.2°	2.540	57.8°	0.110	17.0°	0.378	-89.8°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

SUBJECT No.19

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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·1.145 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.5dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 131.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 70Ω and a physical length which at 7.7GHz is equal to 7/8λ. The line is loaded with a series RC circuit with R = 30Ω and C = 0.454pF.
   a) Compute the input impedance at 7.7GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 11dB, G_2 = 18dB and G_3 = 10dB and noise factors F_1 = 2.04dB, F_2 = 2.58dB and F_3 = 2.15dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.8 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.664	-154.8°	4.093	35.9°	0.128	-24.6°	0.186	-131.2°
T2	0.652	-122.0°	2.694	72.0°	0.108	22.4°	0.418	-78.8°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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S U B J E C T   N o . 2 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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 1.070 + 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.4dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 140.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 65Ω and a physical length which at 8.5GHz is equal to 2/6λ. The line is loaded with a shunt RC circuit with R = 57Ω and C = 0.281pF.
   a) Compute the input impedance at 8.5GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 14dB, G_2 = 14dB and G_3 = 14dB and noise factors F_1 = 2.28dB, F_2 = 2.82dB and F_3 = 2.26dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.1 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.582	170.1°	3.789	9.2°	0.138	-43.1°	0.086	179.1°
T2	0.607	-147.0°	2.496	53.7°	0.110	15.4°	0.366	-93.2°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: __________________________________ Group________

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 0.935 + j·1.265 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.0dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 80.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 50Ω and a physical length which at 9.3GHz is equal to 6/8λ. The line is loaded with a shunt RC circuit with R = 62Ω and C = 0.304pF.
   a) Compute the input impedance at 9.3GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 11dB, G_2 = 13dB and G_3 = 11dB and noise factors F_1 = 2.26dB, F_2 = 2.41dB and F_3 = 2.30dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.2 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.780	-113.4°	4.416	70.5°	0.108	3.2°	0.315	-94.1°
T2	0.756	-90.0°	2.942	96.0°	0.092	35.2°	0.490	-60.4°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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 : MDCR - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2023

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 $1.280 - j\cdot 1.020$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.1dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 75.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 95Ω and a physical length which at 9.7GHz is equal to 4/6λ. The line is loaded with a shunt RL circuit with R = 38Ω and L = 1.202nH.
   a) Compute the input impedance at 9.7GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 11dB, G_2 = 17dB and G_3 = 14dB and noise factors F_1 = 2.79dB, F_2 = 2.72dB and F_3 = 2.71dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.0 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.585	173.3°	3.813	11.4°	0.137	-41.6°	0.086	-171.3°
T2	0.610	-145.0°	2.510	55.0°	0.110	16.0°	0.370	-92.0°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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·1.165 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.5dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 68.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 50Ω and a physical length which at 7.9GHz is equal to 2/5λ. The line is loaded with a series RL circuit with R = 47Ω and L = 1.369nH.
   a) Compute the input impedance at 7.9GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 17dB, G_2 = 12dB and G_3 = 11dB and noise factors F_1 = 2.76dB, F_2 = 2.49dB and F_3 = 2.87dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.1 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.553	137.5°	3.539	-12.7°	0.144	-58.2°	0.098	88.7°
T2	0.579	-167.0°	2.354	40.5°	0.110	9.7°	0.327	-105.4°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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 0.865 + j·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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.4dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 90.0µW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 70Ω and a physical length which at 9.8GHz is equal to 4/8λ. The line is loaded with a shunt RC circuit with R = 68Ω and C = 0.320pF.
   a) Compute the input impedance at 9.8GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 10dB, G_2 = 14dB and G_3 = 13dB and noise factors F_1 = 2.71dB, F_2 = 2.64dB and F_3 = 2.88dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.9 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.656	-157.5°	4.068	33.7°	0.129	-26.4°	0.176	-133.7°
T2	0.646	-124.0°	2.677	70.5°	0.109	21.7°	0.414	-79.9°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

S U B J E C T N o . 2 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 0.875 + j·0.990 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.6dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 79.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 95Ω and a physical length which at 7.3GHz is equal to 3/6λ. The line is loaded with a series RC circuit with R = 39Ω and C = 0.598pF.
   a) Compute the input impedance at 7.3GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 14dB, G_2 = 16dB and G_3 = 15dB and noise factors F_1 = 2.55dB, F_2 = 2.19dB and F_3 = 2.12dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.5 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.569	157.1°	3.692	0.4°	0.141	-49.2°	0.087	140.8°
T2	0.595	-155.0°	2.440	48.5°	0.110	13.0°	0.350	-98.0°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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
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Course : MDCR - EDID407
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S U B J E C T N o . 2 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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 0.995 + 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.8dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 112.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 55Ω and a physical length which at 9.8GHz is equal to 3/5λ. The line is loaded with a shunt RL circuit with R = 45Ω and L = 0.507nH.
   a) Compute the input impedance at 9.8GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 10dB, G_2 = 15dB and G_3 = 15dB and noise factors F_1 = 2.71dB, F_2 = 2.29dB and F_3 = 2.39dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.9 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.556	144.2°	3.595	-8.3°	0.143	-55.2°	0.088	102.5°
T2	0.583	-163.0°	2.384	43.3°	0.110	10.6°	0.334	-102.8°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

UNIVERSITATEA TEHNICĂ "GHEORGHE ASACHI" DIN IAŞI
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SUBJECT No.27

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________ Group_______

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 0.965 + j·0.995 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 17.3dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 146.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 40Ω and a physical length which at 7.0GHz is equal to 7/8λ. The line is loaded with a series RL circuit with R = 55Ω and L = 1.678nH.
   a) Compute the input impedance at 7.0GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 14dB, G_2 = 10dB and G_3 = 17dB and noise factors F_1 = 2.23dB, F_2 = 2.18dB and F_3 = 2.97dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.7 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.604	-178.7°	3.882	17.4°	0.135	-37.6°	0.110	-160.7°
T2	0.619	-139.3°	2.555	59.2°	0.110	17.5°	0.382	-88.7°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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SUBJECT No.28

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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·1.045 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 17.5dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 104.0μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 45Ω and a physical length which at 7.5GHz is equal to 6/8λ. The line is loaded with a series RL circuit with R = 71Ω and L = 1.417nH.
   a) Compute the input impedance at 7.5GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 11dB, G_2 = 13dB and G_3 = 18dB and noise factors F_1 = 2.41dB, F_2 = 2.30dB and F_3 = 2.00dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.0 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.553	141.0°	3.571	-10.5°	0.144	-56.7°	0.088	92.9°
T2	0.580	-165.0°	2.370	42.0°	0.110	10.0°	0.330	-104.0°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

S U B J E C T N o . 2 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 0.895 + j·1.210 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.2dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 130.0μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 85Ω and a physical length which at 10.0GHz is equal to 6/8λ. The line is loaded with a shunt RC circuit with R = 37Ω and C = 0.310pF.
   a) Compute the input impedance at 10.0GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 19dB, G_2 = 19dB and G_3 = 17dB and noise factors F_1 = 2.30dB, F_2 = 2.67dB and F_3 = 2.50dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.3 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.554	130.7°	3.474	-17.0°	0.144	-61.3°	0.118	80.3°
T2	0.577	-171.0°	2.322	37.5°	0.110	9.1°	0.321	-108.2°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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 1.155 + 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.6dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 92.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 70Ω and a physical length which at 6.6GHz is equal to 1/3λ. The line is loaded with a series RC circuit with R = 31Ω and C = 0.402pF.
   a) Compute the input impedance at 6.6GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 12dB, G_2 = 18dB and G_3 = 18dB and noise factors F_1 = 2.46dB, F_2 = 2.95dB and F_3 = 2.59dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.4 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.767	-118.4°	4.387	66.2°	0.111	-0.2°	0.301	-98.5°
T2	0.742	-94.0°	2.914	93.0°	0.094	33.4°	0.480	-62.8°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: ___________________________________ Group________

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 $1.050 - j\cdot 1.165$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**

2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.7dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 96.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**

3. A transmission line has a characteristic impedance 60Ω and a physical length which at 8.2GHz is equal to 2/6λ. The line is loaded with a shunt RC circuit with R = 41Ω and C = 0.566pF.
   a) Compute the input impedance at 8.2GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**

4. You must cascade three amplifiers, in the specified order, having gains G_1 = 14dB, G_2 = 11dB and G_3 = 18dB and noise factors F_1 = 2.14dB, F_2 = 2.28dB and F_3 = 2.92dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**

5. The scattering parameters of two transistors at 8.7 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.563	150.7°	3.644	-3.9°	0.142	-52.2°	0.087	121.6°
T2	0.589	-159.0°	2.412	45.9°	0.110	11.8°	0.342	-100.4°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

UNIVERSITATEA TEHNICĂ "GHEORGHE ASACHI" DIN IAŞI
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2023

SUBJECT No.32

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 $1.045 - j\cdot 1.035$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.1dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 111.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 80Ω and a physical length which at 7.1GHz is equal to 3/6λ. The line is loaded with a series RC circuit with R = 40Ω and C = 0.432pF.
   a) Compute the input impedance at 7.1GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 18dB, G_2 = 15dB and G_3 = 13dB and noise factors F_1 = 2.14dB, F_2 = 2.92dB and F_3 = 2.38dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.9 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.736	-130.7°	4.314	55.5°	0.118	-8.7°	0.267	-109.6°
T2	0.707	-104.0°	2.844	85.5°	0.099	28.9°	0.455	-68.8°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 1.130 + 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.8dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 143.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 95Ω and a physical length which at 7.1GHz is equal to 3/6λ. The line is loaded with a series RL circuit with R = 58Ω and L = 1.606nH.
   a) Compute the input impedance at 7.1GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 19dB, G_2 = 14dB and G_3 = 12dB and noise factors F_1 = 2.05dB, F_2 = 2.34dB and F_3 = 2.10dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.4 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.623	-170.8°	3.950	23.5°	0.133	-33.5°	0.135	-150.2°
T2	0.628	-133.6°	2.600	63.4°	0.110	19.0°	0.394	-85.4°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 $1.015 - j\cdot 1.245$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.5dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 93.0μW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 90Ω and a physical length which at 9.7GHz is equal to 1/3λ. The line is loaded with a shunt RC circuit with R = 66Ω and C = 0.383pF.
   a) Compute the input impedance at 9.7GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 19dB, G_2 = 16dB and G_3 = 16dB and noise factors F_1 = 2.63dB, F_2 = 2.34dB and F_3 = 2.51dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.2 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.714	-138.6°	4.248	49.0°	0.122	-13.9°	0.241	-116.7°
T2	0.688	-110.0°	2.796	81.0°	0.102	26.6°	0.442	-72.2°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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
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S U B J E C T N o . 3 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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·0.880 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.0dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 67.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 95Ω and a physical length which at 9.8GHz is equal to 4/6λ. The line is loaded with a shunt RL circuit with R = 71Ω and L = 1.063nH.
   a) Compute the input impedance at 9.8GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 19dB, G_2 = 11dB and G_3 = 16dB and noise factors F_1 = 2.15dB, F_2 = 2.91dB and F_3 = 2.18dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.7 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.673	-152.1°	4.119	38.1°	0.127	-22.8°	0.195	-128.8°
T2	0.658	-120.0°	2.711	73.5°	0.107	23.1°	0.422	-77.7°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

S U B J E C T N o . 3 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 0.990 + j·0.985 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.5dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 78.5µW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 60Ω and a physical length which at 7.8GHz is equal to 4/6λ. The line is loaded with a shunt RC circuit with R = 36Ω and C = 0.331pF.
   a) Compute the input impedance at 7.8GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 11dB, G_2 = 12dB and G_3 = 18dB and noise factors F_1 = 2.21dB, F_2 = 2.62dB and F_3 = 2.02dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.8 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.742	-128.3°	4.328	57.6°	0.117	-7.0°	0.274	-107.4°
T2	0.714	-102.0°	2.858	87.0°	0.098	29.8°	0.460	-67.6°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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 : MDCR - EDID407
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S U B J E C T N o . 3 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________ Group_______

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 0.755 + j·0.705 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.2dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 64.5µW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 35Ω and a physical length which at 7.9GHz is equal to 4/6λ. The line is loaded with a series RC circuit with R = 29Ω and C = 0.426pF.
   a) Compute the input impedance at 7.9GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 16dB, G_2 = 15dB and G_3 = 11dB and noise factors F_1 = 2.39dB, F_2 = 2.09dB and F_3 = 2.60dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.6 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.681	-149.4°	4.145	40.3°	0.126	-21.1°	0.204	-126.4°
T2	0.664	-118.0°	2.728	75.0°	0.106	23.8°	0.426	-76.6°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

SUBJECT No.38

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 1.250 − j·1.275 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 19.9dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 85.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 40Ω and a physical length which at 7.4GHz is equal to 1/6λ. The line is loaded with a shunt RL circuit with R = 55Ω and L = 1.165nH.
   a) Compute the input impedance at 7.4GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 13dB, G_2 = 15dB and G_3 = 15dB and noise factors F_1 = 2.18dB, F_2 = 2.70dB and F_3 = 2.24dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.5 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.554	123.8°	3.409	-21.4°	0.144	-64.3°	0.138	71.9°
T2	0.575	-175.0°	2.290	34.5°	0.110	8.5°	0.315	-111.0°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

SUBJECT No.39

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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·1.255 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.6dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 137.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 40Ω and a physical length which at 9.5GHz is equal to 4/5λ. The line is loaded with a shunt RC circuit with R = 64Ω and C = 0.253pF.
   a) Compute the input impedance at 9.5GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 14dB, G_2 = 12dB and G_3 = 15dB and noise factors F_1 = 2.76dB, F_2 = 2.86dB and F_3 = 2.67dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.5 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.689	-146.7°	4.170	42.4°	0.125	-19.3°	0.214	-123.9°
T2	0.670	-116.0°	2.745	76.5°	0.105	24.5°	0.430	-75.5°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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
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Domain: Telecommunication Technologies and Systems
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S U B J E C T   N o . 4 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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 $0.765 - j\cdot 0.985$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 21.4dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 73.0μW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 50Ω and a physical length which at 8.5GHz is equal to 2/3λ. The line is loaded with a shunt RC circuit with R = 46Ω and C = 0.738pF.
   a) Compute the input impedance at 8.5GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 17dB, G_2 = 16dB and G_3 = 17dB and noise factors F_1 = 2.38dB, F_2 = 2.54dB and F_3 = 2.75dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 8.3 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.575	163.6°	3.740	4.8°	0.139	-46.1°	0.087	160.0°
T2	0.601	-151.0°	2.468	51.1°	0.110	14.2°	0.358	-95.6°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

UNIVERSITATEA TEHNICĂ "GHEORGHE ASACHI" DIN IAŞI
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2023

SUBJECT No.41

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________ Group_______

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·1.275 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.5dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 140.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 50Ω and a physical length which at 7.8GHz is equal to 6/8λ. The line is loaded with a series RC circuit with R = 63Ω and C = 0.279pF.
   a) Compute the input impedance at 7.8GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 14dB, G_2 = 13dB and G_3 = 17dB and noise factors F_1 = 2.84dB, F_2 = 2.21dB and F_3 = 2.03dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.9 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.591	176.0°	3.836	13.4°	0.136	-40.3°	0.094	-167.8°
T2	0.613	-143.1°	2.525	56.4°	0.110	16.5°	0.374	-90.9°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: __________________________________   Group________

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·0.750 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.3dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 148.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 95Ω and a physical length which at 8.6GHz is equal to 4/6λ. The line is loaded with a shunt RC circuit with R = 29Ω and C = 0.566pF.
   a) Compute the input impedance at 8.6GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 13dB, G_2 = 13dB and G_3 = 16dB and noise factors F_1 = 2.89dB, F_2 = 2.88dB and F_3 = 2.58dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 5.6 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.755	-123.3°	4.357	61.9°	0.114	-3.6°	0.288	-102.9°
T2	0.728	-98.0°	2.886	90.0°	0.096	31.6°	0.470	-65.2°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

SUBJECT No.43

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: ________________________________ Group_______

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 $1.275 - j\cdot 1.055$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 20.4dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 63.0μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 50Ω and a physical length which at 8.8GHz is equal to 2/6λ. The line is loaded with a shunt RC circuit with R = 53Ω and C = 0.466pF.
   a) Compute the input impedance at 8.8GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 16dB, G_2 = 18dB and G_3 = 10dB and noise factors F_1 = 2.25dB, F_2 = 2.45dB and F_3 = 2.48dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.7 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.554	116.9°	3.344	-25.7°	0.145	-67.4°	0.159	63.5°
T2	0.573	-179.0°	2.258	31.5°	0.110	7.9°	0.309	-113.8°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: ________________________________   Group_______

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 0.965 + 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.9dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 145.0µW compute the power at the input port (**<u>in mW</u>**). **(1p)**
   c) In the same situation compute the power at the through port (**<u>in dBm and mW</u>**). **(1p)**
3. A transmission line has a characteristic impedance 80Ω and a physical length which at 9.7GHz is equal to 3/6λ. The line is loaded with a series RC circuit with R = 39Ω and C = 0.336pF.
   a) Compute the input impedance at 9.7GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 10dB, G_2 = 16dB and G_3 = 14dB and noise factors F_1 = 2.95dB, F_2 = 2.43dB and F_3 = 2.34dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.6 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.554	120.3°	3.377	-23.5°	0.145	-65.9°	0.149	67.7°
T2	0.574	-177.0°	2.274	33.0°	0.110	8.2°	0.312	-112.4°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **<u>between</u>** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: __________________________________   Group_______

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 $1.250 - j\cdot 0.835$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 17.8dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 70.5μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 55Ω and a physical length which at 8.2GHz is equal to 4/8λ. The line is loaded with a shunt RC circuit with R = 33Ω and C = 0.557pF.
   a) Compute the input impedance at 8.2GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 15dB, G_2 = 17dB and G_3 = 17dB and noise factors F_1 = 2.01dB, F_2 = 2.48dB and F_3 = 2.81dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.6 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.610	-176.1°	3.905	19.5°	0.134	-36.2°	0.118	-157.2°
T2	0.622	-137.4°	2.570	60.6°	0.110	18.0°	0.386	-87.6°

   a) Perform the μ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session ______June_______ / __2023

SUBJECT No.46

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 $1.005 - j\cdot 1.190$ compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.9dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 72.0μW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 75Ω and a physical length which at 8.9GHz is equal to 4/6λ. The line is loaded with a series RC circuit with R = 73Ω and C = 0.363pF.
   a) Compute the input impedance at 8.9GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 12dB, G_2 = 10dB and G_3 = 17dB and noise factors F_1 = 2.03dB, F_2 = 2.08dB and F_3 = 2.29dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 7.3 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.629	-168.2°	3.973	25.5°	0.132	-32.2°	0.143	-146.7°
T2	0.631	-131.7°	2.615	64.8°	0.110	19.5°	0.398	-84.3°

   a) Perform the μ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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·0.925 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 18.3dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 110.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 50Ω and a physical length which at 8.1GHz is equal to 2/5λ. The line is loaded with a series RL circuit with R = 40Ω and L = 1.230nH.
   a) Compute the input impedance at 8.1GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 18dB, G_2 = 12dB and G_3 = 14dB and noise factors F_1 = 2.45dB, F_2 = 2.42dB and F_3 = 2.50dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.9 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.555	110.0°	3.279	-30.0°	0.145	-70.5°	0.179	55.1°
T2	0.571	177.0°	2.226	28.5°	0.110	7.3°	0.303	-116.6°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian   Student: _________________________________   Group_______

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 1.165 − 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.0dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 71.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 35Ω and a physical length which at 7.1GHz is equal to 2/8λ. The line is loaded with a series RC circuit with R = 56Ω and C = 0.435pF.
   a) Compute the input impedance at 7.1GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 12dB, G_2 = 11dB and G_3 = 19dB and noise factors F_1 = 2.46dB, F_2 = 2.64dB and F_3 = 2.93dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.3 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.705	-141.3°	4.222	46.8°	0.123	-15.7°	0.232	-119.1°
T2	0.682	-112.0°	2.779	79.5°	0.103	25.9°	0.438	-73.3°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: _________________________________ Group_______

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 0.955 − 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 measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 17.8dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 91.5µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 95Ω and a physical length which at 8.6GHz is equal to 3/6λ. The line is loaded with a series RC circuit with R = 73Ω and C = 0.337pF.
   a) Compute the input impedance at 8.6GHz **(2p)**
   b) If following a fault, the line becomes open-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 16dB, G_2 = 10dB and G_3 = 11dB and noise factors F_1 = 2.75dB, F_2 = 2.61dB and F_3 = 2.74dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 6.0 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.730	-133.2°	4.299	53.3°	0.120	-10.4°	0.260	-111.8°
T2	0.700	-106.0°	2.830	84.0°	0.100	28.0°	0.450	-70.0°

   a) Perform the µ-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**

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Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
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SUBJECT No.50

Time allowed: 2 hours; All materials/equipments authorized

Instructor: Assoc. Prof. Radu Damian Student: __________________________________ Group________

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 1.250 − j·0.750 compute the admittance **(1p)** and then plot on a Smith Chart (external circle and complex plane axes) the corresponding point **(1p)**
2. A measurement system uses an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 22.3dB.
   a) Design an ideal coupled line coupler for the specified coupling factor. **(1p)**
   b) If the power at the coupled port is measured to be 54.0µW compute the power at the input port (**in mW**). **(1p)**
   c) In the same situation compute the power at the through port (**in dBm and mW**). **(1p)**
3. A transmission line has a characteristic impedance 50Ω and a physical length which at 7.5GHz is equal to 5/8λ. The line is loaded with a shunt RL circuit with R = 35Ω and L = 0.638nH.
   a) Compute the input impedance at 7.5GHz **(2p)**
   b) If following a fault, the line becomes short-circuited which will be the input impedance? **(1p)**
4. You must cascade three amplifiers, in the specified order, having gains G_1 = 16dB, G_2 = 10dB and G_3 = 11dB and noise factors F_1 = 2.27dB, F_2 = 2.99dB and F_3 = 2.52dB.
   a) Compute the overall gain. **(0.5p)**
   b) Compute the overall noise factor. **(1.5p)**
5. The scattering parameters of two transistors at 9.4 GHz are as follows:

	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
T1	0.554	127.2°	3.441	-19.2°	0.144	-62.8°	0.128	76.1°
T2	0.576	-173.0°	2.306	36.0°	0.110	8.8°	0.318	-109.6°

   a) Perform the µ'-test for both transistors. **(1p)**
   b) Which of the two transistors has better stability? **(0.5p)**
   c) Compute the unilateral figure of merit for transistor T1. **(0.5p)**
   d) Compute maximum stable gain for transistor T2. **(0.5p)**
   e) The two transistors are cascaded in the order T1-T2. Design the match **between** the two transistors (max gain) with stubs (shunt stub, at least one solution) **(2p)**
   f) Draw the match schematic. **(0.5p)**