

Curs 1

2026/2027

Dispozitive și circuite de microunde pentru radiocomunicații

Disciplina 2026/2027

- 2C/1L/1P, **DCMR (CDM)**
- Minim 14 prezente (curs+laborator+proiect)
- Curs - **conf. Radu Damian**
 - Vineri 8-10/**Video (istoric)**, C1, corp C
 - E – **40%** din nota
 - probleme + (2p prez. curs) + (3 teste) + (bonus activitate)
 - primul test L1: ~01.10.2025 (t2 si t3 neanuntate la **curs**)
 - 3pz (C) $\approx$ +0.5p (**2p** max)
 - toate materialele permise

Disciplina 2026/2027

- 2C/1L/1P, **DCMR (CDM)**
- Laborator – **conf. Radu Damian**
 - Miercuri 08-16, **II.13**
 - Joi 12-20, **I.08**
 - L – **30%** din nota
 - ADS, tema personala
 - prezenta + **rezultate personale!**
 - P – **30%** din nota
 - ADS, tema personala
 - S1÷14: P, 7L, 4P
 - prezenta cu alte grupe **permisa** in limita numarului de calculatoare disponibile

Documentatie

■ <https://rf-opto.etti.tuiasi.ro>



Microwave and Optoelectronics Laboratory
Faculty of Electronics, Telecommunications and Information Technology
Gheorghe Asachi Technical University of Iasi

[Main](#) [Courses ▾](#) [Master ▾](#) [Staff ▾](#) [Research ▾](#) [Students ▾](#)

 ▾

[English](#)[Romana](#)

Microwave Devices and Circuits for Radiocommunicati

Course: DCMR (2024-2025)

Course Coordinator: Assoc.P. Dr. Radu-Florin Damian
Code: DOS412T
Discipline Type: DOS; Alternative, Specialty
Credits: 4
Enrollment Year: 4, **Sem.** 7

Activities

Course: Instructor: Assoc.P. Dr. Radu-Florin Damian, 2 Hours/Week, Specialization Section, Timetable:
Laboratory: Instructor: Assoc.P. Dr. Radu-Florin Damian, 1 Hours/Week, Group, Timetable:

Evaluation

Type: **Exam**

A: 50%, (Test/Colloquium)
B: 25%, (Seminary/Laboratory/Project Activity)
D: 25%, (Homework/Specialty papers)

Grades

[Aggregate Results](#)

Documentatie

- RF-OPTO
 - <https://rf-opto.etti.tuiasi.ro> ~~Moodle~~
- Fotografie
 - de trimis pe [rf-opto](#)
 - necesara la laborator/curs
 - bonus activitate 0.5p/1p

Fotografii



Date:

Grupa	5304 (2015/2016)
Specializarea	Tehnologii si sisteme de telecomunicatii
Marca	5184

[Trimite email acestui student](#) | [Adauga acest student la lista \(0\)](#)

Detalii curente

Observatii

Finantare	Buget
Bursa	Fara Bursa



Date:

Grupa	5304 (2015/2016)
Specializarea	Tehnologii si sisteme de telecomunicatii
Marca	5244

[Trimite email acestui student](#) | [Adauga acest student la lista \(0\)](#)

Detalii curente

Observatii

Finantare	Buget
Bursa	Bursa de Studii



Date:

Grupa	5304 (2015/2016)
Specializarea	Tehnologii si sisteme de telecomunicatii
Marca	5184

[Acceseaza ca acest student](#)

Note obtinute

Disciplina	Tin	Data	Descriere	Nota	Puncte	Obs.
TW			Tehnologii Web			
	N	17/01/2014	Nota Finala	10	-	
	A	17/01/2014	Coloana Tehnologii Web 2013/2014	10	7.55	
	B	17/01/2014	Laborator Tehnologii Web 2013/2014	9	-	
	B	17/01/2014	Tema Tehnologii Web 2013/2014	9	-	

Fotografii

Grupa 5403

Nr.	Student	Prezent	Nr.	Student	Prezent	Nr.	Student	Prezent
1	ANGHELUS DOMIT-MARIUS	☐ Puncte: 0 Nota: 0 Obs:	2	ANTIGHIN FLORIN-RAZVAN	☐ Puncte: 0 Nota: 0 Obs:	3	ANTONICA BIANCA	☐ Puncte: 0 Nota: 0 Obs:
4	APOSTOL PAVEL-MANUEL	☐ Puncte: 0 Nota: 0 Obs:	5	BALASCA TALIAN-PETRU	☒ Puncte: 0 Nota: 0 Obs:	6	BOSTAN ANDREI-PETRICU	☐ Puncte: 0 Nota: 0 Obs:
7	BOTIZAT EMANUEL	☐ Puncte: 0 Nota: 0 Obs:	8	BUTUNOI GEORGE-MADALIN	☐ Puncte: 0 Nota: 0 Obs:	9	CHILEA SALUCA-MARIA	☐ Puncte: 0 Nota: 0 Obs:
10	CHRISTOIU ECATERINA	☐ Puncte: 0 Nota: 0 Obs:	11	COJOC MARIUS	☒ Puncte: 0 Nota: 0 Obs:	12	COJOCARIU AUSA-FLORINA	☐ Puncte: 0 Nota: 0 Obs:

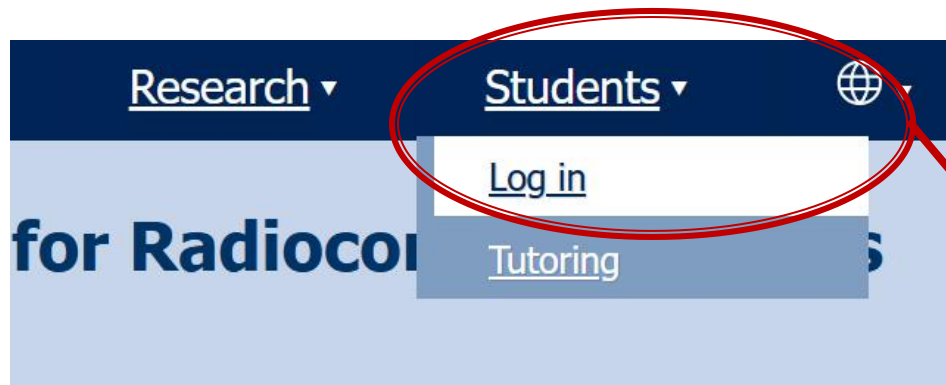
Nr.	Student	Prezent
2	ANTIGHIN FLORIN-RAZVAN	☐ Puncte: 0 Nota: 0 Obs:

Adrese email

- ~~Sefii de grupa (L1)~~
 - lista cu adrese de email **utilizate** de toti studentii
 - poate fi @student.etti.tuiasi.ro (@gmail @yahoo etc.)
 - **rdamian@etti.tuiasi.ro**

Acces

- Personalizat (parola), Generic (email)



A screenshot of a login form. The form has a light blue background. At the top, there is a 'Login' heading. Below the heading, there is a text prompt: 'Use the Registration no. and your'. There are three input fields: 'Registration no.', 'Email/Password', and 'Write the code below'. Each input field is circled in red. Below the 'Write the code below' field, there is a CAPTCHA image showing the code '5dd64f9'. At the bottom of the form, there is a 'Send' button.

Other data

[Link Teams](#) (link, 0 Bytes, en, )

[Manual examen on-line](#) (pdf, 2.65 MB, ro, )

[Simulare Examen](#) (video) (mp4, 65.12 MB, ro, )

[DCMR Linii de transmisie](#) (video) (mp4, 174.88 MB, ro, )

Online – Numar matricol (marca)

- accesul la **examene** necesita **parola** primita prin email + RF-opto26

Propose email adresse(s)

The password is communicated during the lectures. It is necessary t

Password

Registration no.

Name of the student

Proposed email 1

Proposed email 2

Write the code below

RF-OPTO

English | Romana |

Main Courses Master Staff Research **Students**

Login Tutoring

Login

Use the Registration no. and your email or the password received by email

Registration no.

Email/Password

Write the code below

Parola

■ primita prin email

Important message from RF-OPTO

Inbox x



Radu-Florin Damian

to me, POPESCU



Romanian

> English

[Translate message](#)



Laboratorul de Microunde si Optoelectronica
Facultatea de Electronica, Telecomunicatii si Tehnologia Informatiei
Universitatea Tehnica "Gh. Asachi" Iasi

In atentia: POPESCU GOPO ION

Parola pentru a accesa examenele pe server-ul **rf-opto** este

Parola: [REDACTED]

Identificati-va pe [server](#), cu parola, cat mai rapid, pentru confirmare.

Memorati acest mesaj intr-un loc sigur, pentru utilizare ulterioara

Attention: POPESCU GOPO ION

The password to access the exams on the **rf-opto** server is

Password: [REDACTED]

Login to the [server](#), with this password, as soon as possible, for confirmation.

Save this message in a safe place for later use

Reply

Reply all

Forward

Subject	Correspondents
Important message from RF-OPTO	POPESCU GOPO ION
Validation of MDCK exam from 02/05/2020	[REDACTED]
[REDACTED]	[REDACTED]

From: Me <rdamian@etti.tuiasi.ro>

Subject: Important message from RF-OPTO

To: [REDACTED]

Cc: Me <rdamian@etti.tuiasi.ro>



Laboratorul de Microunde si Optoelectronica
Facultatea de Electronica, Telecomunicatii si Tehnologia Informatiei
Universitatea Tehnica "Gh. Asachi" Iasi

In atentia: POPESCU GOPO ION

Parola pentru a accesa examenele pe server-ul **rf-opto** este

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Memorati acest mesaj intr-un loc sigur, pentru utilizare ulterioara

Attention: POPESCU GOPO ION

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Password: [REDACTED]

Login to the [server](#), with this password, as soon as possible, for confirmation.

Save this message in a safe place for later use

Manual examen online

- Aplicatia de examen online utilizata intens la:
 - curs (teme + prezenta?)
 - laborator (date + rezultate)
 - proiect (date + predare)
 - **examen?**

Materials

Other data

[Manual examen on-line](#) (pdf, 2.65 MB, ro, )

[Simulare Examen](#) (video) (mp4, 65.12 MB, ro, )

Microwave Devices and Circuits (Englis

Examen online

- intotdeauna **contratimp**
 - perioada lunga (predare proiect/rezultate laborator)
 - ~~perioada scurta~~ (teste: 15min, examen: 2h)

The screenshot shows a web interface for an online exam. At the top is a dark blue navigation bar with links: Start, Didactic, Master, Colectiv, Cercetare, and **Studenti**. Below this is a lighter blue bar with links: Note, Lista Studenti, **Examine**, and Fotografii. A horizontal timeline of exam stages is displayed, with the first stage, 'Anunț 17:28 (29/04/2020)', highlighted with a red circle. The other stages are: 'Material suport 17:30 (29/04/2020)', 'Subiecte 17:32 (29/04/2020)', 'Rezultate 17:35 (29/04/2020)', 'Finalizare 17:45 (29/04/2020)', and 'Confirmare 17:45 (30/04/2020)'. To the right of the timeline, another red circle highlights a message: 'Urmatorul interval de timp in. 01 m 08 s Reincarca acum'. Below the timeline, the section 'Anunț' contains the text: 'In acest examen se verifica diverse actiuni ale studentilor pentru examen'. Underneath, the section 'Ora pe server' states: 'Toate examenele sunt bazate pe fusul orar al server-ului (ar putea sa fie diferit de timpul local). Pentru referinta ora pe server este acum: 29/04/2020 17:28:51', with the timestamp circled in red.

Anunț	Material suport	Subiecte	Rezultate	Finalizare	Confirmare
17:28 (29/04/2020)	17:30 (29/04/2020)	17:32 (29/04/2020)	17:35 (29/04/2020)	17:45 (29/04/2020)	17:45 (30/04/2020)

Anunț

In acest examen se verifica diverse actiuni ale studentilor pentru examen

Ora pe server

Toate examenele sunt bazate pe fusul orar al server-ului (ar putea sa fie diferit de timpul local). Pentru referinta ora pe server este acum:

29/04/2020 17:28:51

Urmatorul interval de timp in.
01 m 08 s
[Reincarca acum](#)

Prezenta, Liste

D: 15%, (Teme de casa/Lucrari de specialitate)

Note

[Rezultate totale](#)

Prezenta

[Curs](#)
[Laborator](#)

Liste

[Studenti care nu pot intra in examen](#)
[Bonus-uri acumulate](#)

Materiale

- Prezenta
- Minim 14 prezente
- Bonus
- Teme proiect
- etc.

Bonus

Grupa	Prezente curs	B. prezenta	B. activitate	B. foto	B. T1	B. T2	B. T3	Total Bonus	Obs.
5408	2	0	0	1	0.5	0	0.1	1.6	-
5408	15.5	2	1.6	1	0	0.2	0.3	5.1	-
5408	2.1	0	0	1				1	-
5408	11	1.5	0	0	0.25	0	0	1.75	-
5408	5	0.5	0	1	0.75	0.2	0	2.45	-
5408	8.875	1	0.4	1	0.85	0.1		3.35	-
5408	0	0	0	1				1	-
5408	0	0	0	1				1	-
5408	14.5	2	0.6	1	0.63	0.2	0	4.43	-
5408	6.65	1	0	1	0.13	0	0.1	2.23	-
5408	9.2	1.5	0	1	0		0	2.5	-
5408	7.8	1	0	1	0.5	0	0.2	2.7	-
5408	3	0.5	0	1			0	1.5	-
5408	1.6	0	0	1	0			1	-
5408	4.5	0.5	0	1	0.48			1.98	-
5408	8	1	0.05	1	0.38	0	0	2.43	-
5408	1	0	0	1				1	-
5408	15.5	2	0.8	1	0	0.1	0.1	4	-
5408	10.5	1.5	0	1			0	2.5	-

Istoric

Alte informatii

[Online Exam manual](#) (pdf, 2.56 MB, en, )

[Exam Simulation \(video\)](#) (mp4, 41.96 MB, en, )

[Important Agilent Application Notes](#) (rar, 2.36 MB, ro, )

Ani anteriori

2020-2021

2019-2020

2018-2019

2017-2018

2016-2017

Mai mult...

Dispozitive si circuite de microunde pentru radiocomunicatii

Disciplina: DCMR (2020-2021)

Coordonator Disciplina: conf. dr. Radu-Florin Damian

Cod: DOS412T

Tip Disciplina: DOS; Disciplina Optionala, Disciplina de Specialitate

Credite: 4

An de Studiu: 4, Sem. 7

Activitati

Curs: Cadru Didactic: conf. dr. Radu-Florin Damian, 2 Ore/Saptamana, Sectie Specializare, Orar:

Laborator: Cadru Didactic: conf. dr. Radu-Florin Damian, 1 Ore/Saptamana, Grupa, Orar:

C 2017

- Extrase din evaluările calitative ale studenților (2017):
 - “70% dintre studenti au platit un student de an mai mare sa le faca proiectul, intre 30 si 50 de lei”
- Calcul

$$50 \text{ stud} \times 70\% \times 40 \text{ lei} = 1400 \text{ lei}$$

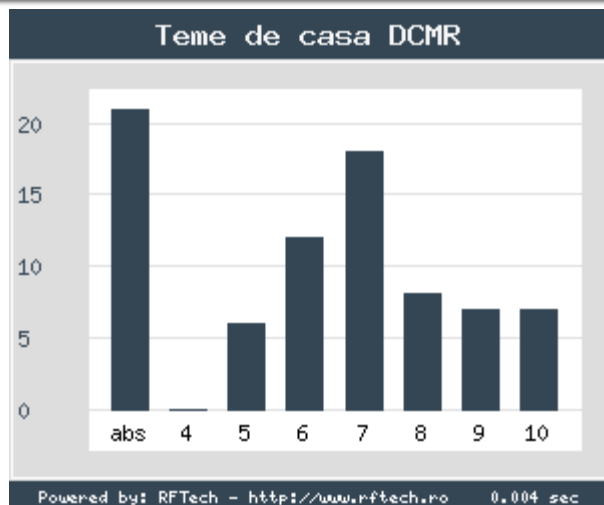
$$50 \text{ stud} \times 70\% \times 30 \text{ min} = 17.5 \text{ h}$$

$$1 \text{ luna} = 4 \text{ sapt} \times 5 \text{ zile} \times 8 \text{ h} = 160 \text{ h}$$

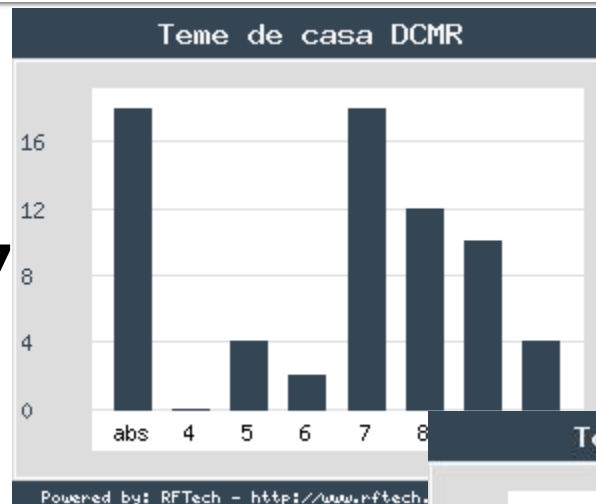
$$\frac{1400 \text{ lei}}{17.5 \text{ h}} = \frac{12800 \text{ lei}}{160 \text{ h}} = \frac{12800 \text{ lei}}{1 \text{ luna}}$$

Efect? – factorul “andrei”

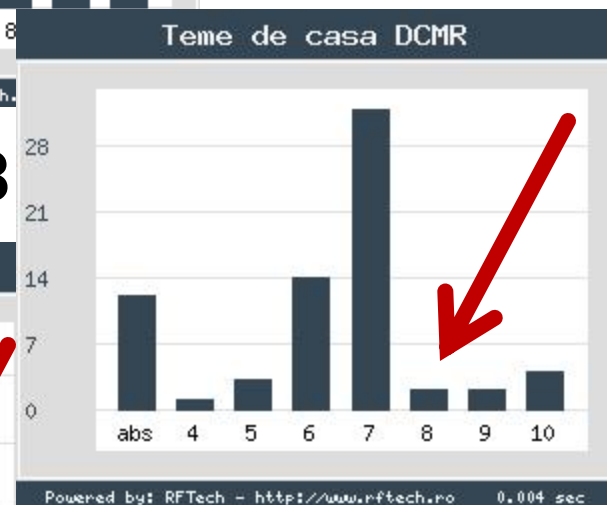
15/6



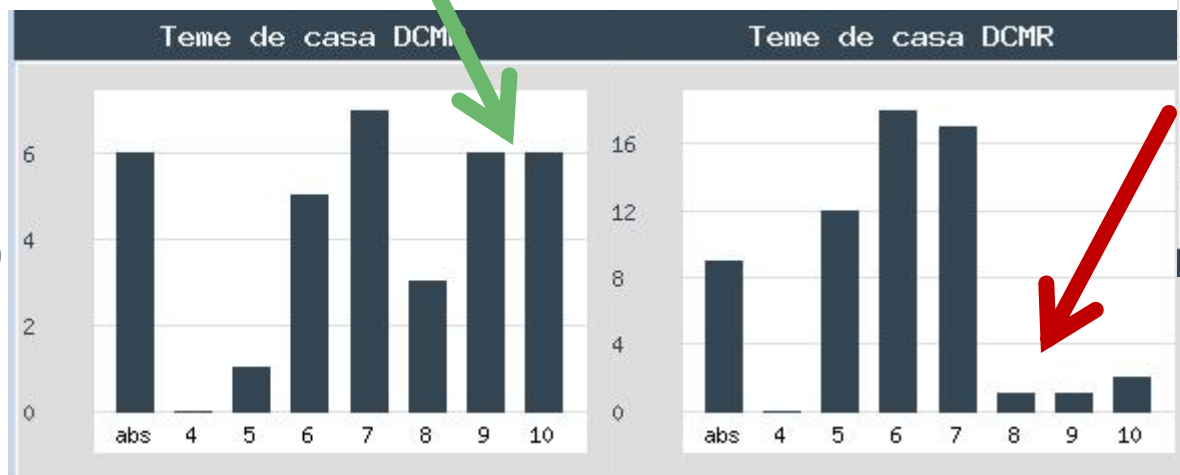
16/7



17/8

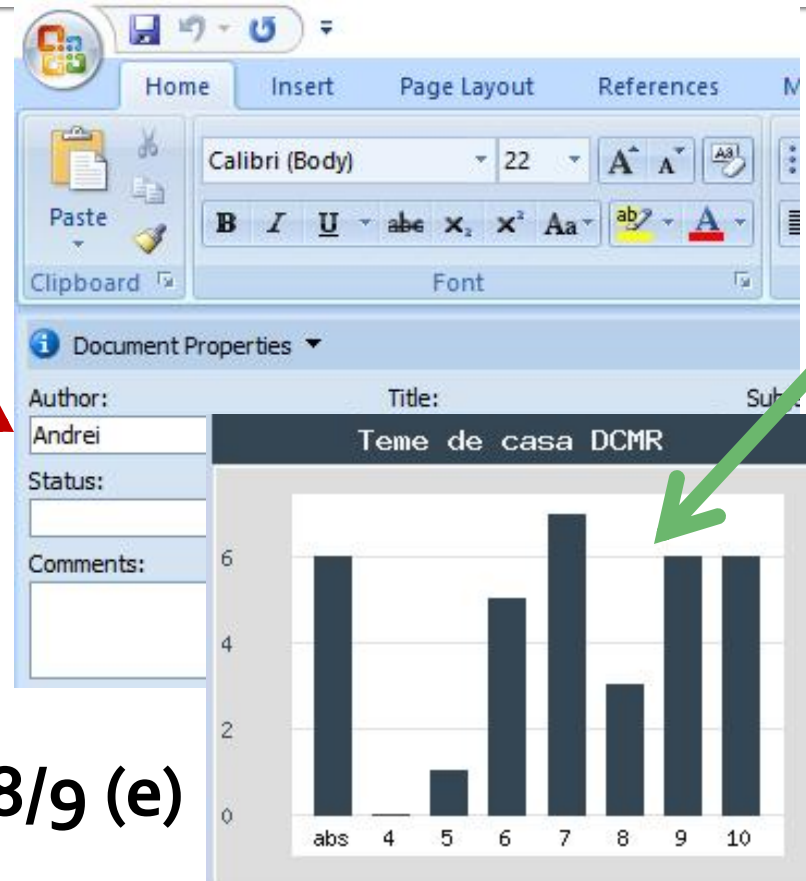
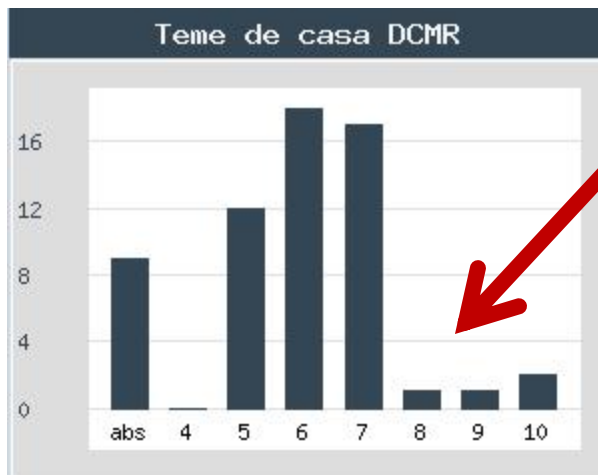


18/9



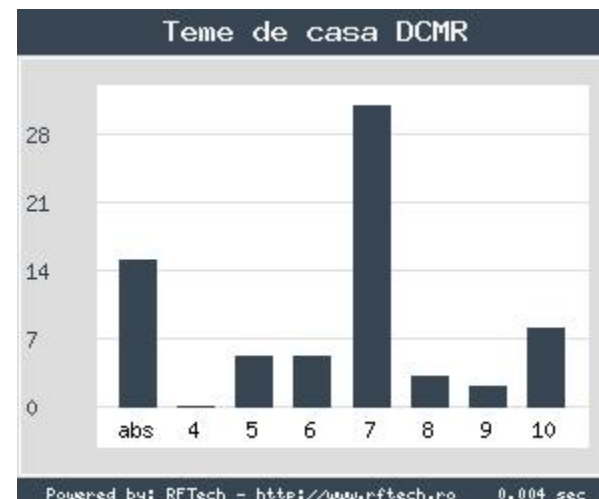
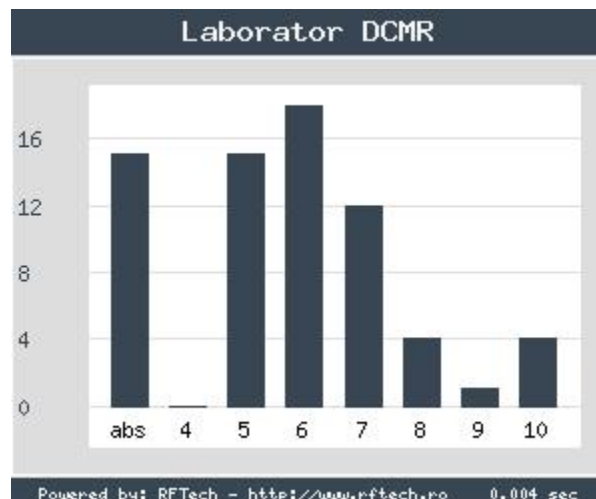
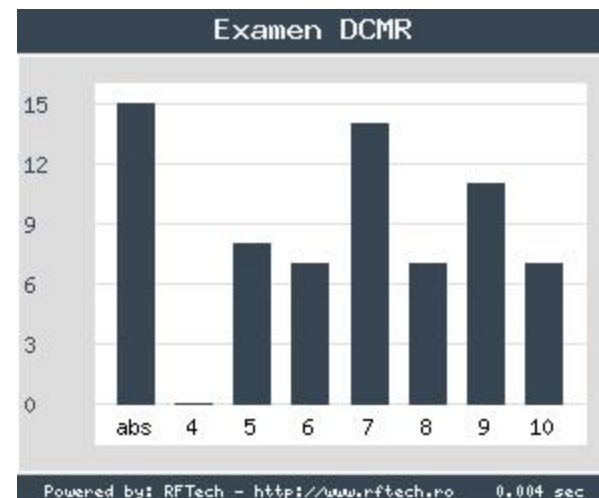
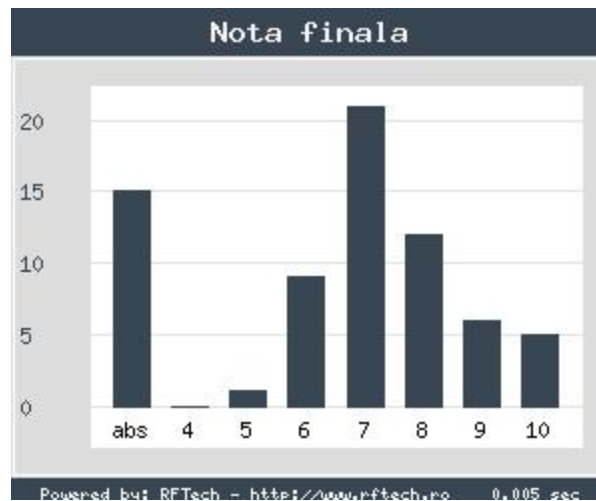
Proiect 2019/2020

- factorul "andrei" = -2p



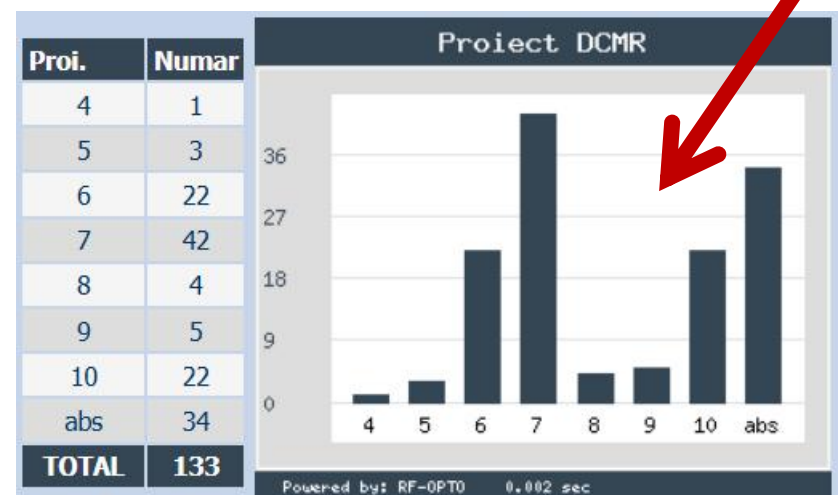
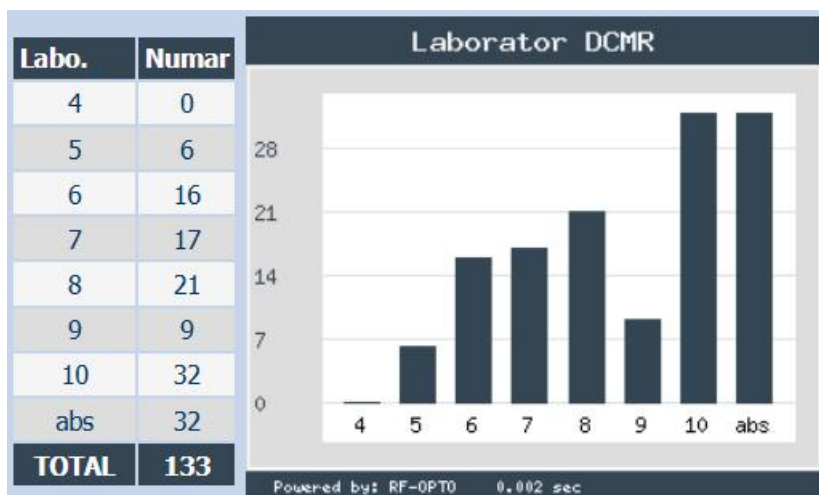
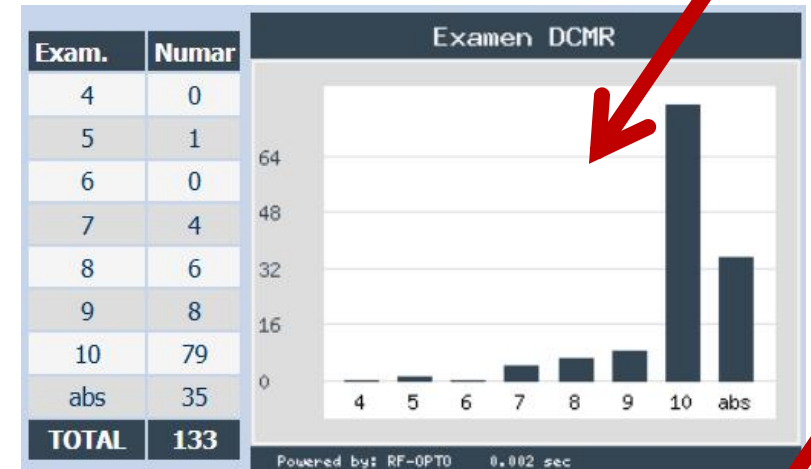
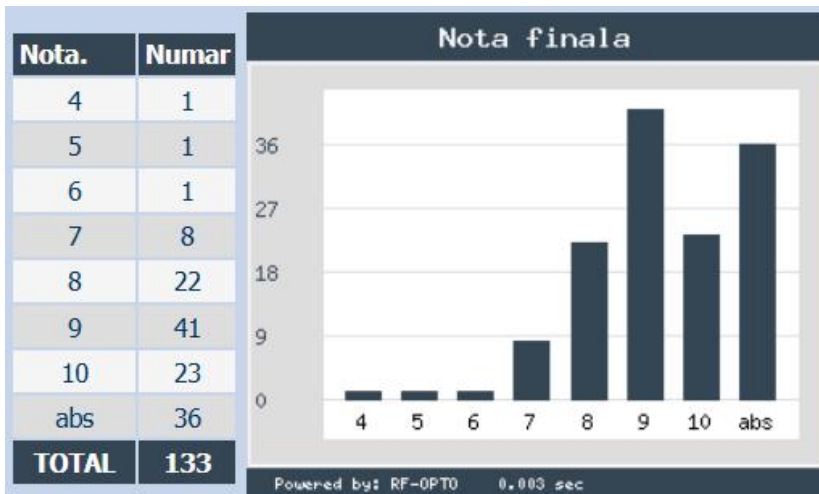
Note

■ 2019/2020

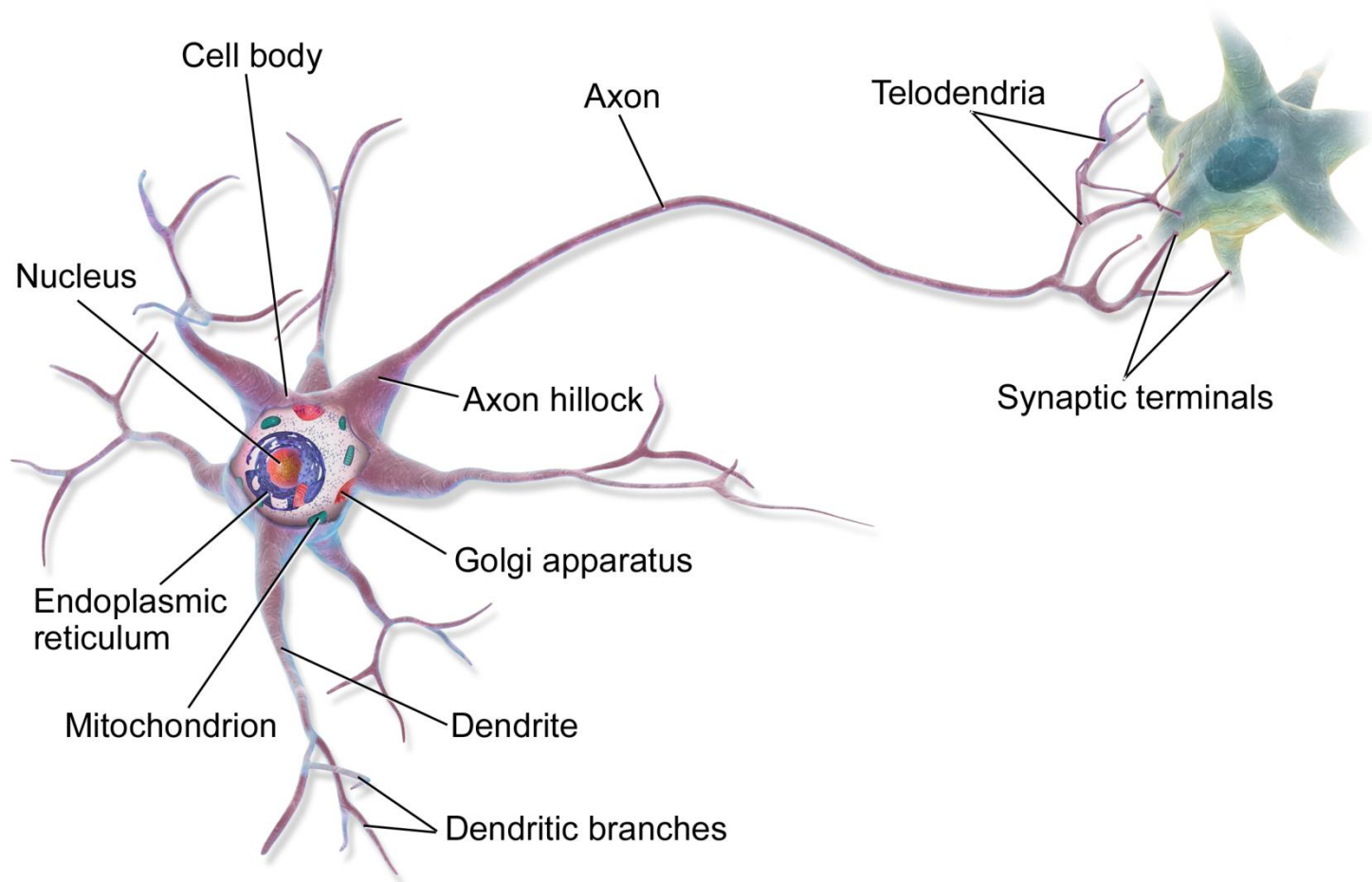


Note

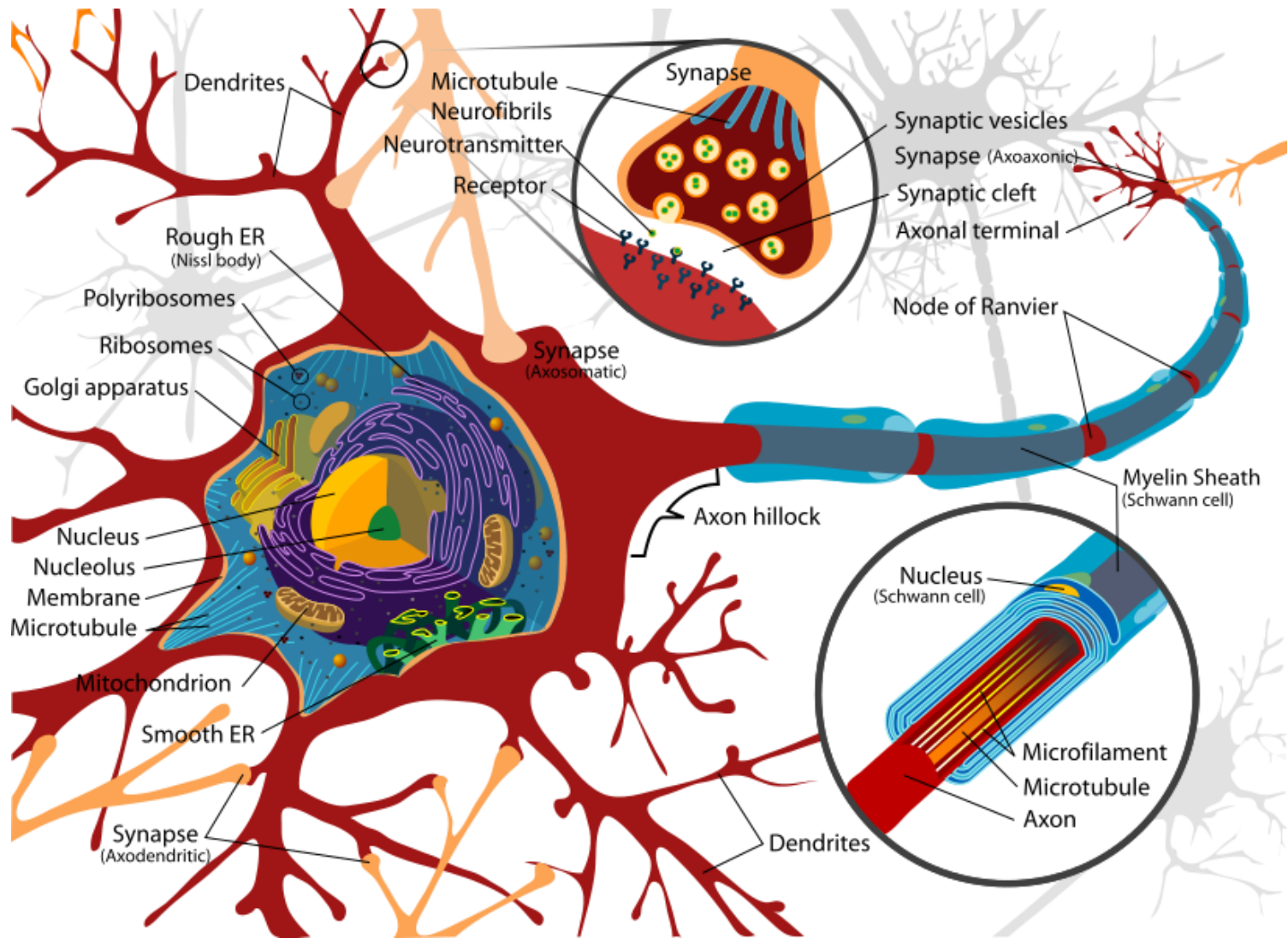
■ 2025/2026



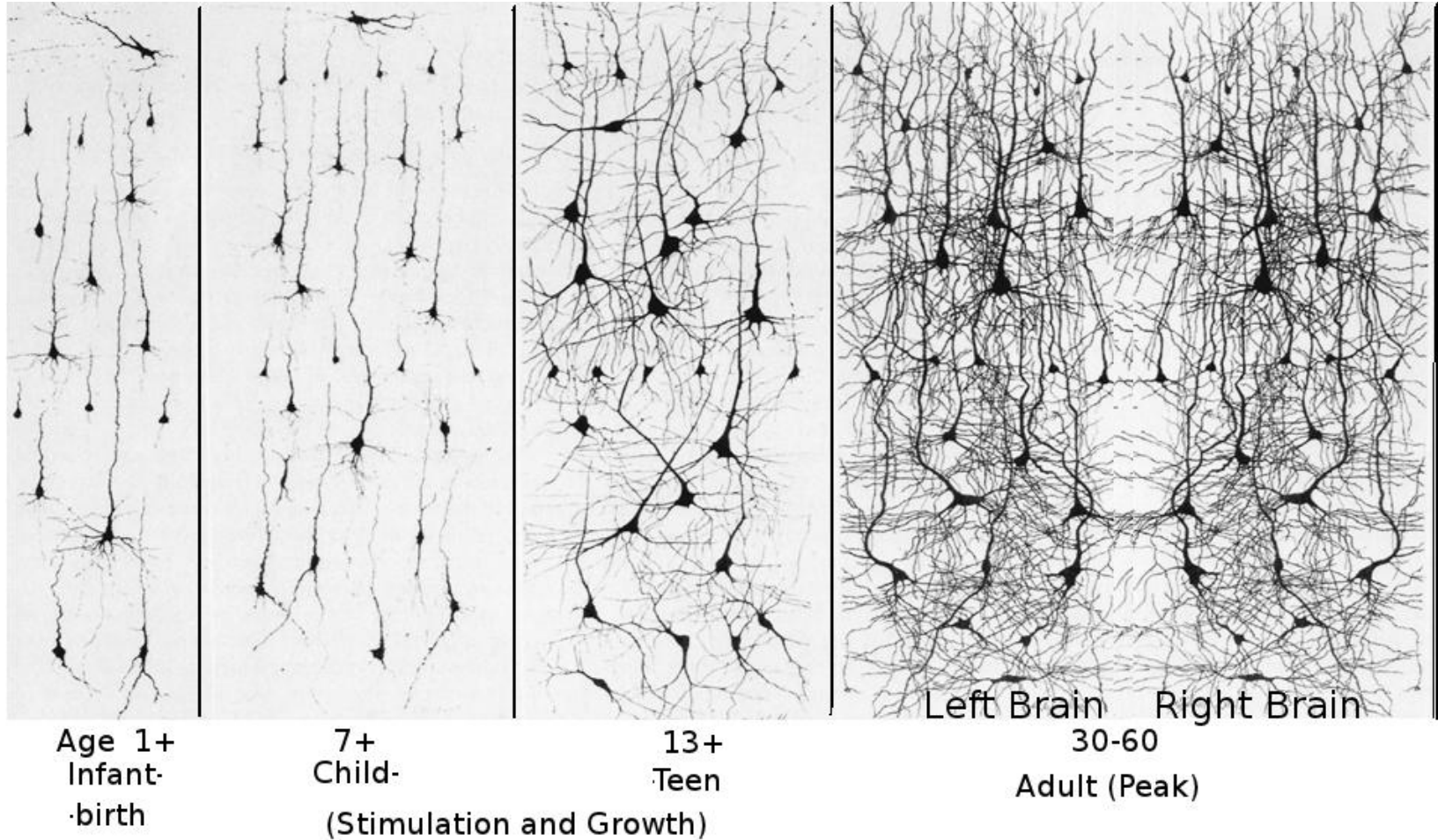
Scop curs 1



Scop curs 2



Scop curs 3



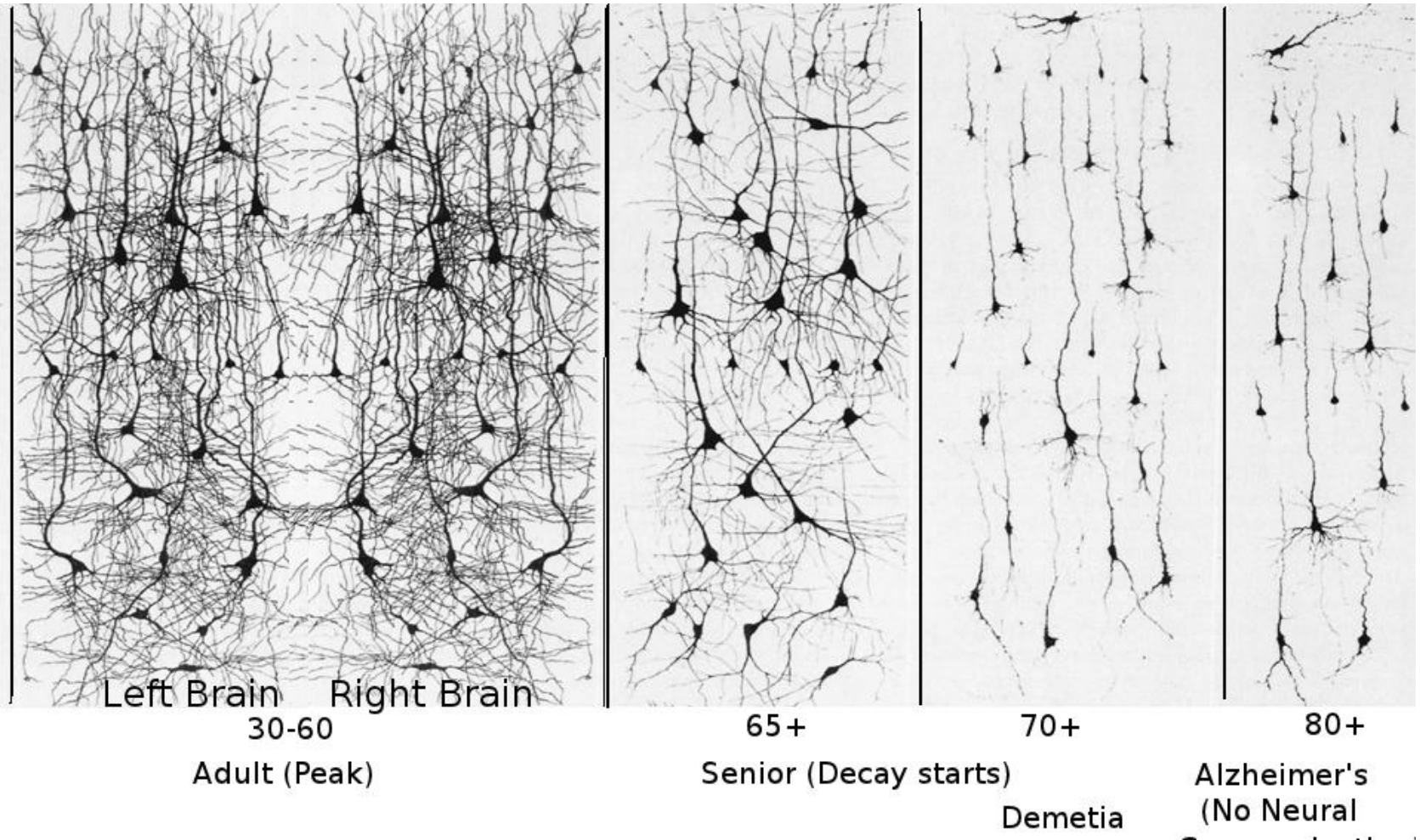
Scop curs 4



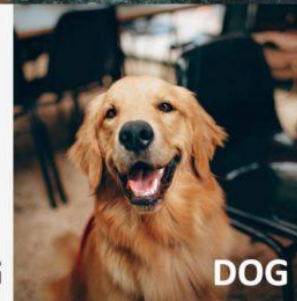
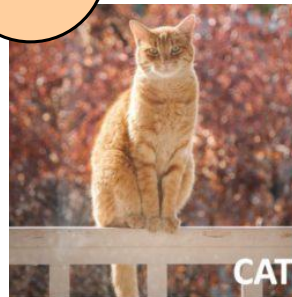
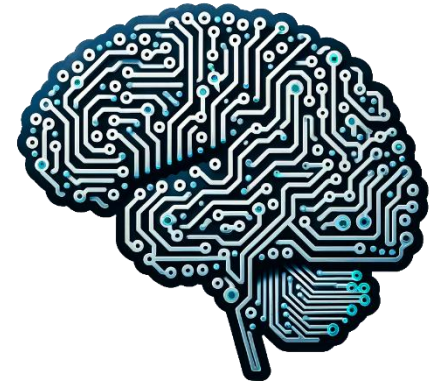
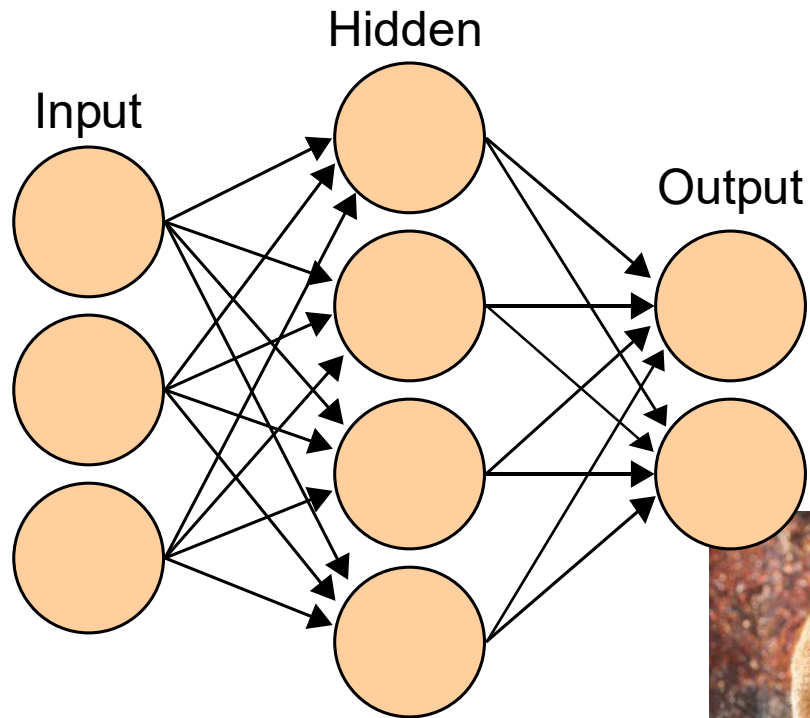
**Sinapse
“înginerești”**



Termen



IA/AI



IA/AI+ IN/NI

**SUPERVISED
LEARNING**

**UNSUPERVISED
LEARNING**

**REINFORCEMENT
LEARNING**



Cuprins

- Linii de transmisie
- Adaptarea de impedanță
- Cuploare direcționale
- Divizoare de putere
- Amplificatoare de microunde
- Filtre de microunde
- Oscilatoare de microunde ?

Bibliografie

- <https://rf-opto.etti.tuiasi.ro>
- Irinel Casian-Botez: "Microunde vol. 1: Proiectarea de circuit", Ed. TEHNOPRES, 2008
- David Pozar, Microwave Engineering, Wiley; 4th edition , 2011, ISBN : 978-1-118-29813-8 (E), ISBN : 978-0-470-63155-3 (P)

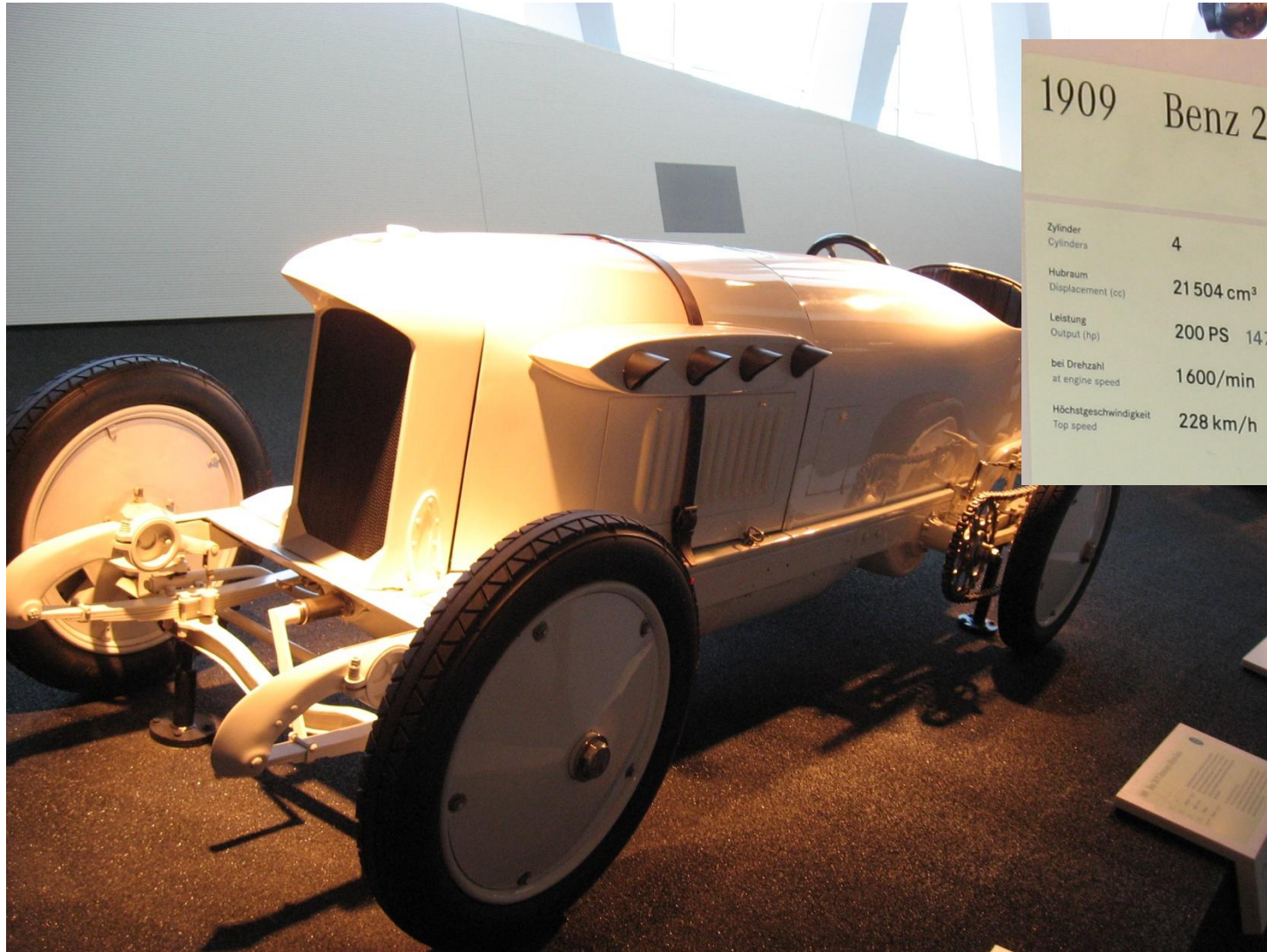
~1930



~1930



1909



1909 Benz 200 PS Rennwagen »Blitzen«		
Zylinder Cylinders	4	
Hubraum Displacement (cc)	21 504 cm ³ 1 312 cu in	
Leistung Output (hp)	200 PS 147 kW	
bei Drehzahl at engine speed	1 600/min	
Höchstgeschwindigkeit Top speed	228 km/h 142 mph	

Der »Blitzen-Benz« ist 1909 der erste 200 km/h fährt. Seine größten Erfolge erzielt er mit dem 4-Zylinder-Motor ausgestattet. Rekordhalter Burman mit 228 km/h über die Saratoga-Race-Track. Ist damit das schnellste Fahrzeug der Welt.

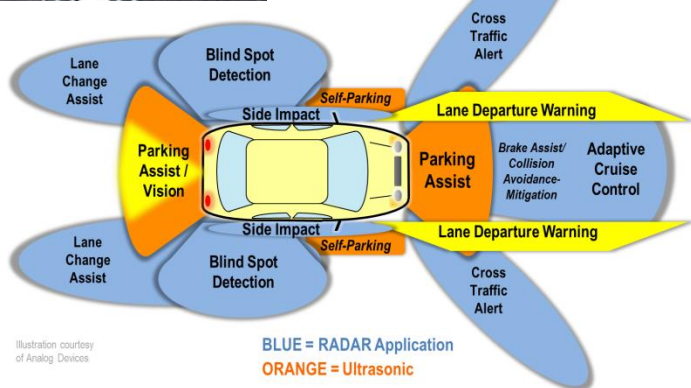
Benz »Lightning Benz« 200 hp racing car. In 1909 the Lightning Benz was the fastest car in the world.

1930-1950



Tehnologie

> 2010



< 1950



Tehnologie

1x1 = 1	2x1 = 2	3x1 = 3	4x1 = 4	5x1 = 5
1x2 = 2	2x2 = 4	3x2 = 6	4x2 = 8	5x2 = 10
1x3 = 3	2x3 = 6	3x3 = 9	4x3 = 12	5x3 = 15
1x4 = 4	2x4 = 8	3x4 = 12	4x4 = 16	5x4 = 20
1x5 = 5	2x5 = 10	3x5 = 15	4x5 = 20	5x5 = 25
1x6 = 6	2x6 = 12	3x6 = 18	4x6 = 24	5x6 = 30
1x7 = 7	2x7 = 14	3x7 = 21	4x7 = 28	5x7 = 35
1x8 = 8	2x8 = 16	3x8 = 24	4x8 = 32	5x8 = 40
1x9 = 9	2x9 = 18	3x9 = 27	4x9 = 36	5x9 = 45
1x10 = 10	2x10 = 20	3x10 = 30	4x10 = 40	5x10 = 50
6x1 = 6	7x1 = 7	8x1 = 8	9x1 = 9	10x1 = 10
6x2 = 12	7x2 = 14	8x2 = 16	9x2 = 18	10x2 = 20
6x3 = 18	7x3 = 21	8x3 = 24	9x3 = 27	10x3 = 30
6x4 = 24	7x4 = 28	8x4 = 32	9x4 = 36	10x4 = 40
6x5 = 30	7x5 = 35	8x5 = 40	9x5 = 45	10x5 = 50
6x6 = 36	7x6 = 42	8x6 = 48	9x6 = 54	10x6 = 60
6x7 = 42	7x7 = 49	8x7 = 56	9x7 = 63	10x7 = 70
6x8 = 48	7x8 = 56	8x8 = 64	9x8 = 72	10x8 = 80
6x9 = 54	7x9 = 63	8x9 = 72	9x9 = 81	10x9 = 90
6x10 = 60	7x10 = 70	8x10 = 80	9x10 = 90	10x10 = 100

$$2 \times 1 = 2$$

$$2 \times 2 = 4$$

$$2 \times 3 = 6$$

$$2 \times 4 = 8$$

$$2 \times 5 = 10$$

$$2 \times 6 = 12$$

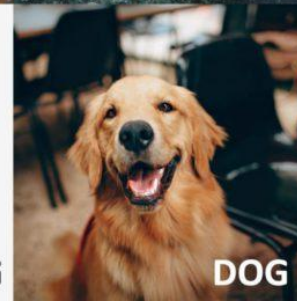
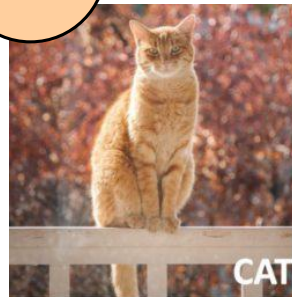
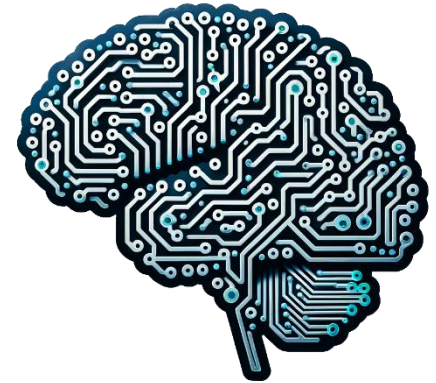
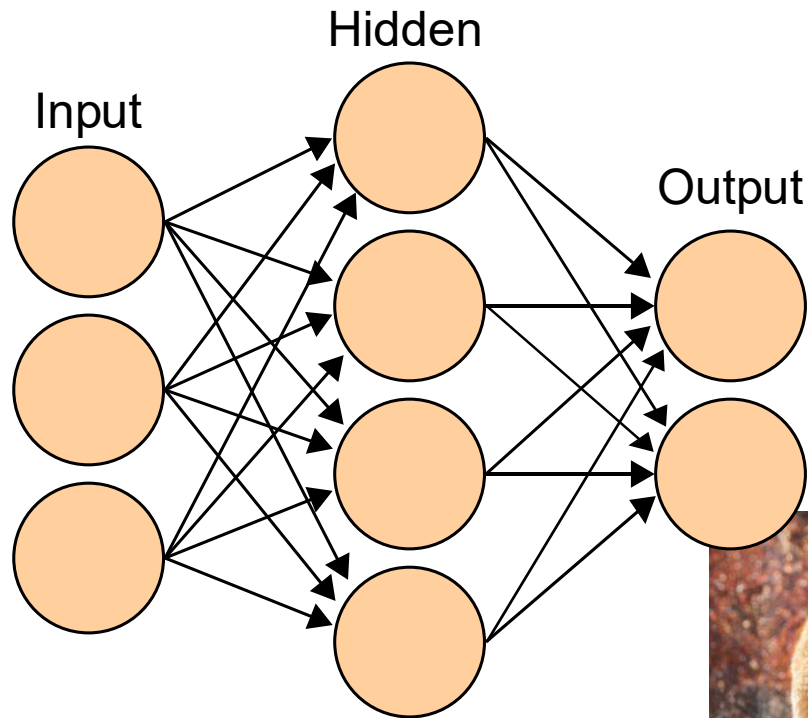
$$2 \times 7 = 14$$

$$2 \times 8 = 16$$

$$2 \times 9 = 18$$

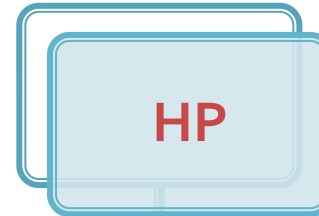
$$2 \times 10 = 20$$

IA/AI

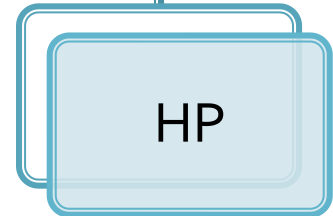




HEWLETT
PACKARD



1999



Agilent

HP

2005

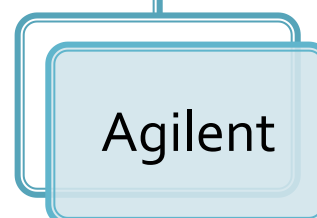


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KEYSIGHT
TECHNOLOGIES

NPL, Londra



NPL, Londra



Examen: Reprezentare logaritmică

- $X[dB] = 10 \cdot \log_{10}(X[lin])$
- $X[B] = \log_{10}(X[lin])$
- $X[lin]$ – adimensional
- $\log(A \cdot B) = \log(A) + \log(B)$

- $X[lin] = 10^{X[dB]/10}$

Examen: Reprezentare logaritmică

$$\text{dB} = 10 \cdot \log_{10} (P_2 / P_1)$$

$$0 \text{ dB} = 1$$

$$+ 0.1 \text{ dB} = 1.023 (+2.3\%)$$

$$+ 3 \text{ dB} = 2$$

$$+ 5 \text{ dB} = 3$$

$$+ 10 \text{ dB} = 10$$

$$-3 \text{ dB} = 0.5$$

$$-10 \text{ dB} = 0.1$$

$$-20 \text{ dB} = 0.01$$

$$-30 \text{ dB} = 0.001$$

$$\text{dBm} = 10 \cdot \log_{10} (P / 1 \text{ mW})$$

$$0 \text{ dBm} = 1 \text{ mW}$$

$$3 \text{ dBm} = 2 \text{ mW}$$

$$5 \text{ dBm} = 3 \text{ mW}$$

$$10 \text{ dBm} = 10 \text{ mW}$$

$$20 \text{ dBm} = 100 \text{ mW}$$

$$-3 \text{ dBm} = 0.5 \text{ mW}$$

$$-10 \text{ dBm} = 100 \mu\text{W}$$

$$-30 \text{ dBm} = 1 \mu\text{W}$$

$$-60 \text{ dBm} = 1 \text{ nW}$$

$$[\text{dBm}] + [\text{dB}] = [\text{dBm}]$$

$$[\text{dBm/Hz}] + [\text{dB}] = [\text{dBm/Hz}]$$

$$[x] + [\text{dB}] = [x]$$

Calculul atenuarii/amplificarii

$$\text{Pierderi/Castig} = \frac{P_{out}}{P_{in}}$$

$$\text{Pierderi[dB]} = [-] 10 \cdot \log_{10} \left(\frac{P_{out}}{P_{in}} \right)$$

$$\text{Pierderi[dB]} = [-] 10 \cdot \log_{10} \left(\frac{P_{out}}{P_0} \cdot \frac{P_0}{P_{in}} \right) = [-] 10 \cdot \left[\log_{10} \left(\frac{P_{out}}{P_0} \right) - \log_{10} \left(\frac{P_{in}}{P_0} \right) \right]$$

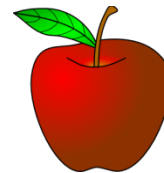
$$\text{Pierderi[dB]} = [-] (P_{out} [\text{dBm}] - P_{in} [\text{dBm}])$$



=



-



Calculul atenuarii/amplificarii

$$\text{Atenuare} = \frac{P_{out}}{P_{in}} < 1 \quad \text{Pierderi[dB]} = 10 \cdot \log_{10} \left(\frac{P_{out}}{P_{in}} \right) < 0$$


$$\text{Pierderi/Atenuare[dB]} = [-] 10 \cdot \log_{10} \left(\frac{P_{out}}{P_{in}} \right)$$

$$\text{Castig} = \frac{P_{out}}{P_{in}} > 1$$

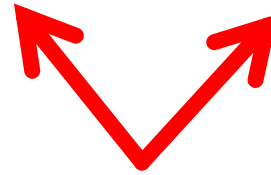
$$\text{Castig/Amplificare[dB]} = 10 \cdot \log_{10} \left(\frac{P_{out}}{P_{in}} \right) > 0$$

$$\text{Atenuare[dB/km]} = \frac{\text{Pierderi[dB]}}{\text{Lungime[km]}}$$

Calculul atenuarii/amplificarii

Pierderi/Atenuare $\rightarrow P_{out} < P_{in} \rightarrow P_{out}[\text{dBm}] < P_{in}[\text{dBm}]$

$$P_{out}[\text{dBm}] = P_{in}[\text{dBm}] - \text{Pierderi/Atenuare}[\text{dB}]$$



Castig/Amplificare $\rightarrow P_{out} > P_{in} \rightarrow P_{out}[\text{dBm}] > P_{in}[\text{dBm}]$

$$P_{out}[\text{dBm}] = P_{in}[\text{dBm}] + \text{Castig/Amplificare}[\text{dB}]$$



Contact

- Laboratorul de microunde si optoelectronica
- <https://rf-opto.etti.tuiasi.ro>
- rdamian@etti.tuiasi.ro