Teaching program

Génie des Procédés et Bio-Procédés

Academic year 2025-2026

Ecole polytechnique de Nantes Université

January 30, 2026

Contents

Part I

Tables of teaching units

Semester 5 - unit *GPB 3*

Mathematical tools — ECTS : 4

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Worksheets and Databases	5		6			1.25	12.25	*0.25*
• Applied mathematics	15	22.5				2.5	40	*0.75*
TOTAL	20	22.5	6	0	0	3.75	52.25	

Biochemistry — ECTS : 3

Manager : COGNE Guillaume

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Biochemistry	7.5	6.25				1.25	15	*0.5*
• Enzymatic kinetics	6.25	7.5	8			1.25	23	*0.5*
TOTAL	13.75	13.75	8	0	0	2.5	38	

Systemic analysis — ECTS : 3

Manager : COGNE Guillaume

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Methods and concepts in (bio)process engineering	10	15				1.25	26.25	*0.7*
• Systemic analysis	3.75	7.5				1.25	12.5	*0.3*
• Dimensional analysis	2.5	2.5					5	*0*
TOTAL	16.25	25	0	0	0	2.5	43.75	

Humanities 1 — ECTS : 6

Course		Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Business knowledge and entrepreneurship		1.5	13.5					4	*0.15*
• Project management 1		4.5	7.5					2	*0.15*
• Physical education 1			21					2	*0.2*
• Job-hunting strategies and techniques		1.5	9					6	*0.15*
• English grammar for engineers			22.5						*0.175*
• Business communication			21.5						*0.175*
▷ VIP : english and french as a foreign language				15					*0*
TOTAL	min	7.5	95	0	0	0	0	14	
	max	7.5	95	15	0	0	0	14	

Differentiated welcome — ECTS : 2

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Mechanics and physics		10				1	11	*0.5*
1 opt ▷ Cell biology		15				1	16	*0.5*
1 opt ▷ Mathematics		15				1	16	*0.5*
TOTAL	0	25	0	0	0	2	27	

Physics — ECTS : 6

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Hydraulics	10	15	16			2.5	43.5	*0.5*
• Thermodynamics and Energy	11.25	16.25				2.5	30	*0.5*
TOTAL	21.25	31.25	16	0	0	5	73.5	

Chemistry — ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Good laboratory practices 1	2.5		8				11.75	*0.1*
• Chemistry kinetics	5	7.5	8			1.25	21.75	*0.4*
• Thermochemistry	5	7.5	8			1.25	24.25	*0.4*
TOTAL	12.5	15	24	0	0	2.5	57.75	

Common pathway — ECTS : 2

Manager : GADOIN Émilie

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Sustainability issues	10.5	7.5	1.5					*1*
TOTAL	10.5	7.5	1.5	0	0	0	0	

Sum of semester

		Lect	Tut	PW	Proj	WP	Exa	Asst	ECTS
Sum	min	101.75	235	55.5	0	0	18.25	306.25	30
	max	101.75	235	70.5	0	0	18.25	306.25	
Face-to-face sum		410.5 à 425.5							

Semester 6 - unit *GPB 3*

Humanities 2

ECTS : 6

Course		Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Business game			10.5	12				10	*0.2*
• Physical education 2			21					2	*0.2*
• Economy and controversy mapping			27					10	*0.25*
• Preparing the TOEIC			19.5						*0.15*
• Presenting and debating			19.5						*0.15*
• Collaborative speaking practice				2					*0.05*
▷ VIP : english and french as a foreign language				15					*0*
TOTAL	min	0	97.5	14	0	0	0	22	
	max	0	97.5	29	0	0	0	22	

Separation processes

ECTS : 5

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Absorption	7.5	10				1.25	18.75	*0.25*
• Distillation	7.5	10	6	4		1.25	28.75	*0.35*
• Extraction	7.5	10	6			1.25	24.75	*0.3*
• Column process modelling	5						5	*0.1*
TOTAL	27.5	30	12	4	0	3.75	77.25	

Transfer phenomena

ECTS : 4

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Fluid mechanics	7.5	10				2.5	20	*0.3*
• Heat transfert	10	15				2.5	27.5	*0.4*
• Mass transfer	7.5	12.5				1.25	21.25	*0.3*
TOTAL	25	37.5	0	0	0	6.25	68.75	

Reactors

ECTS : 3

Manager : GENTRIC Caroline

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Stirring and mixing	5	5	6			1.25	17.25	*0.4*
• Homogeneous reactors	10	10	6			1.25	27.25	*0.6*
TOTAL	15	15	12	0	0	2.5	44.5	

3A Internship — ECTS : 5

Manager : JAOUEN Pascal

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• 3A Internship								*1*
TOTAL	0	0	0	0	0	0	0	

Biocatalysis and microbiology — ECTS : 3

Manager : COGNE Guillaume

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Biocatalysis	10	5	12			1.25	28.25	*0.45*
• Good laboratory practices 2	2.5						2.5	*0*
• Microbiology	8.75		12			1.25	22	*0.55*
TOTAL	21.25	5	24	0	0	2.5	52.75	

Numerical tools — ECTS : 3

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Computing methods	3	3	12			3	21	*0.5*
• Statistics and probability	10	10				1.25	21.25	*0.5*
TOTAL	13	13	12	0	0	4.25	42.25	

Common pathway — ECTS : 1

Manager : GADOIN Émilie

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Sustainability tools S6	6	9						*1*
TOTAL	6	9	0	0	0	0	0	

Sum of semester

		Lect	Tut	PW	Proj	WP	Exa	Asst	ECT$
Sum	min	107.75	207	74	4	0	19.25	307.5	30
	max	107.75	207	89	4	0	19.25	307.5	
Face-to-face sum		412 à 427							

Semester 6 - unit *GPB3 - DD Pharma*

Separation processes — ECTS : 5

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Absorption	7.5	10				1.25	18.75	*0.25*
• Distillation	7.5	10	6	4		1.25	28.75	*0.35*
• Extraction	7.5	10	6			1.25	24.75	*0.3*
• Column process modelling	5						5	*0.1*
TOTAL	27.5	30	12	4	0	3.75	77.25	

Transfer phenomena — ECTS : 4

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Fluid mechanics	7.5	10				2.5	20	*0.3*
• Heat transfert	10	15				2.5	27.5	*0.4*
• Mass transfer	7.5	12.5				1.25	21.25	*0.3*
TOTAL	25	37.5	0	0	0	6.25	68.75	

Reactors — ECTS : 3

Manager : GENTRIC Caroline

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Stirring and mixing	5	5	6			1.25	17.25	*0.4*
• Homogeneous reactors	10	10	6			1.25	27.25	*0.6*
TOTAL	15	15	12	0	0	2.5	44.5	

3A Internship — ECTS : 5

Manager : JAOUEN Pascal

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• 3A Internship								*1*
TOTAL	0	0	0	0	0	0	0	

Numerical tools — ECTS : 3

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Computing methods	3	3	12			3	21	*0.5*
• Statistics and probability	10	10				1.25	21.25	*0.5*
TOTAL	13	13	12	0	0	4.25	42.25	

Common pathway ECTS : 1

Manager : GADOIN Émilie

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Sustainability tools S6	6	9						*1*
TOTAL	6	9	0	0	0	0	0	

Dual course in Pharmacy and Engineering - Humanities 2 ECTS : 5

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Business game		10.5	12				10	*0.35*
• Physical education 2		21					2	*0.3*
• Preparing the TOEIC		19.5						*0.15*
• Presenting and debating		19.5						*0.15*
• Collaborative speaking practice			2					*0.05*
TOTAL	0	70.5	14	0	0	0	12	

Dual course in Pharmacy and Engineering - S6 ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Prépa pharma								*1*
TOTAL	0	0	0	0	0	0	0	

Sum of semester

	Lect	Tut	PW	Proj	WP	Exa	Asst	ECTS
Sum	86.5	175	50	4	0	16.75	244.75	30
Face-to-face sum	332.25							

Semester 7 - unit *GPB 4*

Data Acquisiton and Analysis — ECTS : 5

Manager : TITICA Mariana

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Sensors and Process Control	7.5	7.5	8			2	25	*0.5*
• Design of Experiment	7.5	10				1.25	18.75	*0.4*
• Sensors project				8			8	*0.1*
TOTAL	15	17.5	8	8	0	3.25	51.75	

Complex flows and systems — ECTS : 6

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Flow in Porous Media	8.75	12.5				2.5	23.75	*0.35*
• Turbulence	6.25	6.25				1.25	13.75	*0.25*
• Numerical analysis	6.25	5	20			1.25	32.5	*0.4*
TOTAL	21.25	23.75	20	0	0	5	70	

Humanities 3 — ECTS : 6

Course		Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Organizational analysis		4.5	6					3	*0.15*
• Physical education 3			21					2	*0.1*
• Negotiation		3	7.5					2	*0.1*
• Communication and Professional Relationships			12					4.5	*0.1*
• Circular economy		4.5	3					6	*0.1*
• Becoming a professional			19						*0.3*
• Collaborative speaking practice				2					*0.05*
• Responsible management 1			4.5					3	*0.1*
0 à 1 ▷ Modern language 2			18						*0.15*
0 à 1 ▷ Preparing the TOEIC			18						*0.15*
0 à 1 ▷ French as a foreign language			18						*0.15*
TOTAL	min	12	73	2	0	0	0	20.5	
	max	12	91	2	0	0	0	20.5	

Purification and thermal processes — ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Industrial chromatography	5	5					10	*0.25*
• Cristallization	2.5	5				1.25	8.75	*0.2*
• Heat Exchangers	5	5				1.25	11.25	*0.25*
• Processes with Phase Change	5	10				1.25	16.25	*0.3*
TOTAL	17.5	25	0	0	0	3.75	46.25	

Processes and Bioprocesses Workshop S7 ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Processes and Bioprocesses Workshop S7			50				50	*1*
TOTAL	0	0	50	0	0	0	50	

Option ECTS : 2

Manager : MARCHAL Luc

Course		Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
1 opt	▷ Entrepreneurship S7				36				*1*
	▷ Research S7				36				*1*
	▷ Low carbon building S7				36				*1*
	▷ Maritime energy S7				36				*1*
	▷ Sustainable brewery S7				36				*1*
TOTAL		0	0	0	36	0	0	0	

Chemical and biological reactor engineering ECTS : 3

Manager : COGNE Guillaume

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Bioreaction Engineering	7	8.75	8			1.25	25	*0.5*
• Non-ideal reactors modeling	8.75	12.5				1.25	22.5	*0.3*
• Fermentation engineering	5	8.75				1.25	15	*0.2*
TOTAL	20.75	30	8	0	0	3.75	62.5	

Sum of semester

		Lect	Tut	PW	Proj	WP	Exa	Asst	ECT$
Sum	min	86.5	169.25	88	44	0	15.75	301	30
	max	86.5	187.25	88	44	0	15.75	301	
Face-to-face sum		403.5 à 421.5							

Semester 7 - unit *GPB4 - DD Pharma*

Complex flows and systems ECTS : 6

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Flow in Porous Media	8.75	12.5				2.5	23.75	*0.35*
• Turbulence	6.25	6.25				1.25	13.75	*0.25*
• Numerical analysis	6.25	5	20			1.25	32.5	*0.4*
TOTAL	21.25	23.75	20	0	0	5	70	

Purification and thermal processes ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Industrial chromatography	5	5					10	*0.25*
• Cristallization	2.5	5				1.25	8.75	*0.2*
• Heat Exchangers	5	5				1.25	11.25	*0.25*
• Processes with Phase Change	5	10				1.25	16.25	*0.3*
TOTAL	17.5	25	0	0	0	3.75	46.25	

Processes and Bioprocesses Workshop S7 ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Processes and Bioprocesses Workshop S7			50				50	*1*
TOTAL	0	0	50	0	0	0	50	

Dual course in Pharmacy and Engineering - Humanities 3 ECTS : 5

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Physical education 3		21					2	*0.15*
• Negotiation	3	7.5					2	*0.15*
• Communication and Professional Relationships		12					4.5	*0.15*
• Circular economy	4.5	3					6	*0.1*
• Becoming a professional		19						*0.3*
• Collaborative speaking practice			2					*0.05*
• Responsible management 1		4.5					3	*0.1*
TOTAL	7.5	67	2	0	0	0	17.5	

Dual course in Pharmacy and Engineering - S7 ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Prépa pharma - S7								*1*
TOTAL	0	0	0	0	0	0	0	

Chemical and biological reactor engineering ECTS : 3

Manager : COGNE Guillaume

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Bioreaction Engineering	7	8.75	8			1.25	25	*0.5*
• Non-ideal reactors modeling	8.75	12.5				1.25	22.5	*0.3*
• Fermentation engineering	5	8.75				1.25	15	*0.2*
TOTAL	20.75	30	8	0	0	3.75	62.5	

Dual course in Pharmacy and Engineering - Data Acquisition and Analysis ECTS : 4

Manager : TITICA Mariana

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Sensors and Process Control	7.5	7.5	8			2	25	*0.5*
• Design of Experiment	7.5	10				1.25	18.75	*0.4*
• Sensors project				8			8	*0.1*
TOTAL	15	17.5	8	8	0	3.25	51.75	

Sum of semester

	Lect	Tut	PW	Proj	WP	Exa	Asst	ECTS
Sum	82	163.25	88	8	0	15.75	298	30
Face-to-face sum	357							

Semester 8 - unit *GPB 4*

Water treatment — ECTS : 3

Manager : MASSE Anthony

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Potable Water Treatment & Design	3.75	6.25				1.25	11.25	*0.3*
• Membrane and Granular Separation	6.25	8.75	8			1.25	24.25	*0.7*
TOTAL	10	15	8	0	0	2.5	35.5	

Technology and industry watch — ECTS : 6

Manager : Djeumegni Julien

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Industrial design	10	12.5				2.5	25	*0.35*
• Bibliography Project	1.25			30		4	35.25	*0.5*
• Process safety	7.5	5				1.25	13.75	*0.15*
TOTAL	18.75	17.5	0	30	0	7.75	74	

Humanities 4 — ECTS : 4

Course		Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• A critical perspective on business			9					3	*0.2*
• Responsible management 2			3					1	*0.05*
• Physical education 4			19.5					2	*0.2*
• Recruitment Pitch			15					5	*0.2*
• Intercultural exploration : understanding differences			18						*0.35*
0 à 1 ▷ Modern language 2			18						*0.15*
0 à 1 ▷ Achieving TOEIC			18						*0.15*
0 à 1 ▷ French as a foreign language			18						*0.15*
TOTAL	min	0	64.5	0	0	0	0	11	
	max	0	82.5	0	0	0	0	11	

4A Internship — ECTS : 10

Manager : RENAUDIE Marie

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• 4A Internship								*1*
TOTAL	0	0	0	0	0	0	0	

Option — ECTS : 1

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Ecological transition for sustainable development 2		9						*0.25*
1 opt ▷ Entrepreneurship S8				28				*0.75*
1 opt ▷ Research S8				28				*0.75*
1 opt ▷ Low carbon building S8				28				*0.75*
1 opt ▷ Maritime energy S8				28				*0.75*
1 opt ▷ Sustainable brewery S8				28				*0.75*
TOTAL	0	9	0	28	0	0	0	

Non-newtonian fluids — ECTS : 2

Manager : Djeumegni Julien

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Complex fluid mechanics	3.75	7.5				1.25	12.5	*0.6*
• Rheology	3.75	3.75				1.25	8.75	*0.4*
TOTAL	7.5	11.25	0	0	0	2.5	21.25	

Processes and Bioprocesses Workshop S8 — ECTS : 4

Manager : RENAUDIE Marie

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Processes and Bioprocesses Workshop S8			50				50	*1*
TOTAL	0	0	50	0	0	0	50	

Sum of semester

		Lect	Tut	PW	Proj	WP	Exa	Asst	ECTS
Sum	min	36.25	117.25	58	58	0	12.75	191.75	30
	max	36.25	135.25	58	58	0	12.75	191.75	
Face-to-face sum		282.25 à 300.25							

Semester 8 - unit *GPB4 - DD Pharma*

Water treatment ECTS : 3

Manager : MASSE Anthony

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Potable Water Treatment & Design	3.75	6.25				1.25	11.25	*0.3*
• Membrane and Granular Separation	6.25	8.75	8			1.25	24.25	*0.7*
TOTAL	10	15	8	0	0	2.5	35.5	

4A Internship ECTS : 10

Manager : RENAUDIE Marie

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• 4A Internship								*1*
TOTAL	0	0	0	0	0	0	0	

Non-newtonian fluids ECTS : 2

Manager : Djeumegni Julien

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Complex fluid mechanics	3.75	7.5				1.25	12.5	*0.6*
• Rheology	3.75	3.75				1.25	8.75	*0.4*
TOTAL	7.5	11.25	0	0	0	2.5	21.25	

Processes and Bioprocesses Workshop S8 ECTS : 4

Manager : RENAUDIE Marie

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Processes and Bioprocesses Workshop S8			50				50	*1*
TOTAL	0	0	50	0	0	0	50	

Dual course in Pharmacy and Engineering - Humanities 4 ECTS : 3

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Responsible management 2		3					1	*0.1*
• Physical education 4		19.5					2	*0.3*
• Recruitment Pitch		15					5	*0.25*
• Intercultural exploration : understanding differences		18						*0.35*
TOTAL	0	55.5	0	0	0	0	8	

Dual course in Pharmacy and Engineering - S8 ECTS : 4

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Prépa pharma - S8								*1*
TOTAL	0	0	0	0	0	0	0	

Dual course in Pharmacy and Engineering - Technology and industry watch ECTS : 4

Manager : SI-AHMED El-Khider

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Industrial design	10	12.5				2.5	25	*1*
• Process safety	7.5	5				1.25	13.75	*1*
TOTAL	17.5	17.5	0	0	0	3.75	38.75	

Sum of semester

	Lect	Tut	PW	Proj	WP	Exa	Asst	ECTS
Sum	35	99.25	58	0	0	8.75	153.5	30
Face-to-face sum	201							

Semester 9 - unit *GPB 5*

Process control and command — ECTS : 5

Manager : TITICA Mariana

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Process control and command	25		21			1.25	47.25	*0.7*
• Sensors project				8			8	*0.3*
TOTAL	25	0	21	8	0	1.25	55.25	

Engineer's project — ECTS : 9

Manager : MARCHAL Luc

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Engineering project	5			95		4	100	*1*
TOTAL	5	0	0	95	0	4	100	

Eco-design — ECTS : 4

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Life cycle analysis	3.75	3.75				1.25	8.75	*0.3*
• Process Energy Management	7.5	8.75				1.25	17.5	*0.7*
• Intensified processes	20						20	*0*
TOTAL	31.25	12.5	0	0	0	2.5	46.25	

Process modeling — ECTS : 9

Manager : SI-AHMED El-Khider

Course		Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Computational fluid dynamics		15	21		15		4	55	*0.6*
1 à 2 ▷ Thermodynamic model - ICET		3.75	3.75	8			2	17.5	*0.2*
1 à 2 ▷ ProSim - ICET		5	5	12				22	*0.2*
1 à 2 ▷ SuperPro Designer - BI		7.5	7.5	4	16		4.5	39.5	*0.4*
TOTAL	min	18.75	24.75	4	31	0	6	72.5	
	max	27.5	33.5	20	31	0	10.5	116.5	

Humanities 5 ECTS : 3

Course		Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Supporting change			13.5					3	*0.35*
• Project management 2		1.5	15					3	*0.3*
• People management			10.5					6	*0.3*
• Skills passport day			8					2	*0.05*
▷ Achieving TOEIC			18						*0*
TOTAL	min	1.5	47	0	0	0	0	14	
	max	1.5	65	0	0	0	0	14	

Sum of semester

		Lect	Tut	PW	Proj	WP	Exa	Asst	ECT$
Sum	min	81.5	84.25	25	134	0	13.75	288	30
	max	90.25	111	41	134	0	18.25	332	
Face-to-face sum		326.5 à 388.5							

Semester 10 - unit *GPB 5*

Stage Ingénieur

ECTS : 30

Manager : COTONNEC Annaig

Course	Lect	Tut	PW	Proj	WP	Exa	Asst	*Coef*
• Final project								*1*
TOTAL	0	0	0	0	0	0	0	

Sum of semester

	Lect	Tut	PW	Proj	WP	Exa	Asst	ECTS
Sum	0	0	0	0	0	0	0	30
Face-to-face sum								

Part II

Sheets of courses

3A Internship

Hours

Lect Tut PW Proj WP Exa Asst

Evaluation

One evaluation : *Autoévaluation*

Manager : Pascal JAOUEN

4A Internship

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst

Evaluation

One evaluation : *Autoévaluation*

Manager : Marie RENAUDIE

A critical perspective on business

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	9					3

Evaluation

One evaluation : *Rapport groupe*

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·

Manager : Gwenael THOREL

Absorption

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	10				1.25	18.75

Evaluation

2 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*

Bibliography

A. P. SINHA, PARAMESWAR DE, Mass Transfer: Principles and Operations. PHI Learning Pvt. Ltd., 2012

Emilian Koller, Aide-mémoire de génie chimique DUNOD, 3ème édition

Morton M. Denn CHEMICAL ENGINEERING, An Introduction (Cambridge Series in Chemical Engineering) Paperback - 2 Feb. 2012

Robert E. Treybal, Mass-Transfer Operations. McGraw-Hill Classic Texbook Reissue Series. Third Edition

Learning outcomes

Learning outcomes	N	A	M	E	O
• · Connaitre les notions relatives à l'équilibre entre phases	✓	·	·	·	·
• · Connaissance des différentes méthodes pour dimensionnement une colonne d'absorption	·	✓	·	·	·
• · Connaitre les différents modes d'adsorption	·	✓	·	·	·

Manager : Walid BLEL

Achieving TOEIC

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *DS*

Bibliography

Newcombe, H. McDonald Bertail, C. Pass the TOEIC® Test. First Press ELT

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	✓	·	·	·	·
• .	✓	·	·	·	·
• .	✓	·	·	·	·
• .	✓	·	·	·	·

Manager : Carole CHAUSSE

Achieving TOEIC

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *DS*

Bibliography

- Grant Trew, Tactics for Toeic , Oxford
- Lin Lougheed,600 essential words, Barron's
- Lin Lougheed, Méthode complète pour le Toeic 6eme edition, Pearson France
- Renald Rilcy, Achieve Toeic, Cengage Learning
- Kaplan Prep Plus 2019-2020 Tests 2 et 3

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Carole CHAUSSE

Applied mathematics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
15	22.5				2.5	40

Evaluation

2 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*

Bibliography

Soum, Jagut, Dubouix, techniques mathématiques pour la physique, travaux dirigés, volumes 1 et 2, Hachette supérieur, 1995.

Kaddour NAJIM, Enso IKONEN, Outils mathématiques pour le génie des procédés, cours et exercices corrigés, Dunod, 1999.

François LIRET, Maths en pratique à l'usage des étudiants, cours et exercices , Dunod, 2006.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Acquire proficiency in the mathematical tools used in Process Engineering	·	·	✓	·	·
• Solve differential equations encountered in process engineering	·	✓	·	·	·
• Be able to interpret and analyze given information, translate it into mathematical models, and verify the validity of the results	·	✓	·	·	·

Manager : Annaig COTONNEC

Becoming a professional

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	19					

Evaluation

2 evaluations :

- *Situation Ind*
- *DS*

Bibliography

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- Rebecca Hughes,2010, Teaching and researching speaking- second edition

- Jo Sudden, teachingenglish.org.uk/professional-development/teachers/planning-lessons-and-courses/articles/role-play

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Carole CHAUSSE

Bibliography Project

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
1.25			30		4	35.25

Evaluation

One evaluation : *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Search for and select relevant scientific/academic sources	·	·	✓	·	·
• Critically analyze and synthesize literature related to a given research question	·	✓	·	·	·
• Structure and write a scientific report in accordance with academic standards	·	·	✓	·	·
• Use references correctly and respect academic integrity	·	·	✓	·	·
• Present their work orally in a clear, structured, and well-argued manner	·	·	✓	·	·

Manager : El-Khider SI-AHMED

Biocatalysis

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10	5	12			1.25	28.25

Evaluation

3 evaluations :

- *Devoir surveillé*
- *Travaux pratiques*
- *Examen écrit*

Presentation

This course provides an introduction to bioprocesses and bioreactors. It covers the basics of microbial stoichiometry and kinetics, followed by the main types of reactors (batch, continuous, fed-batch) and their macroscopic balances. The emphasis is on understanding the links between the microorganism, the culture medium and the operation of the bioreactor.

Outline

1. Role of biocatalysts and the place of bioprocesses in industry.
2. Elemental composition of biomass, C-molar formulas, examples of microorganisms.
3. Stoichiometric equations for growth: biomass only, biomass + metabolites (Gaden's classes), yields Y_{xs}, Y_{xO2}, Y_{ps}, etc.
4. Notion of maintenance (Pirt) and apparent yields.
5. Reminder on macroscopic mass balances: ?Accumulation = In - Out + Reaction?.
6. Ideal reactors: perfectly mixed reactor, plug-flow reactor.
7. Modelling a batch culture (Monod model, influence of µ_{max}, K_s, inoculum).
8. Introduction to continuous (chemostat) and fed-batch cultures: residence time, dilution rate, steady state, process interest.
9. Overview of specific cases: growth as pellets or filamentous colonies.

Goals

? Introduce the concepts of elemental composition and C-molar formula for biomass and substrates.

? Write stoichiometric equations for microbial growth and product formation, and derive the main yield coefficients.

? Present the basics of microbial kinetics (Monod model, maintenance) and their use to describe growth in a bioreactor.

? Introduce the different bioreactor operating modes (batch, continuous, fed-batch) and the associated mass balances.

? Provide students with tools to qualitatively analyse the impact of process parameters (inoculum, dilution rate, limiting substrate, etc.) on culture evolution.

Bibliography

? Supports de cours de Biocatalyse - Chapitre I Cinétique et stoechiométrie et Chapitre II Réacteurs.

? Doran P. M., Bioprocess Engineering Principles.

? Stanbury P. F. et al., Principles of Fermentation Technology (chapitres d'introduction aux bio-procédés).

Prerequisites

Basic knowledge of microbiology (microbial growth, metabolism), chemistry and process engineering (material balances, ideal reactors). Elementary mathematics, including simple differential equations.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Express biomass composition using a C-molar formula and set up the associated elemental balances.	·	·	✓	·	·
• Write stoichiometric equations for microbial growth (with or without product formation) and calculate the main yield coefficients.	·	✓	·	·	·
• Explain the role of maintenance and use a simple model to relate substrate consumption and growth.	·	✓	·	·	·
• Write macroscopic mass balances in an ideal bioreactor (batch, continuous, fed-batch) and interpret each term.	·	·	✓	·	·
• Use a Monod-type kinetic model to qualitatively analyse the evolution of a microbial culture for different operating modes.	·	✓	·	·	·

Manager : Guillaume COGNE

Biochemistry

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	6.25				1.25	15

Evaluation

One evaluation : *Examen QCM*

Presentation

Biochemistry of metabolism course focused on the reactivity and plasticity of biological systems. The course explores how cells convert matter and energy (substrates, redox coenzymes, ATP) depending on their environment. It presents the main carbon and energy metabolism pathways (glycolysis, TCA cycle, pentose phosphate pathway, fermentations, respiration, photosynthetic metabolism) and emphasises metabolic plasticity: shifts in strategy (aerobic/anaerobic, fermentative/respiratory, photoautotrophic/mixotrophic) and reorientation of fluxes in response to bioprocess constraints.

Outline

1. Introduction: the cell as a reactive biochemical system; metabolic networks; overall metabolic balances and fluxes.

2. Reactivity & thermodynamics: ?G and ?G°', redox couples, redox potential, coupled reactions, ?pulling? effects of ATP synthesis or respiration.

3. Central carbon metabolism:

4. Fermentative strategies:

5. Respiration & aerobic metabolism:

6. Metabolism in photosynthetic organisms:

7. Metabolic plasticity

8. Bioprocess-oriented case studies

Goals

? Understand the cell as a reactive system transforming substrates, redox coenzymes and chemical energy.

? Use simple thermodynamic and redox arguments (?G, redox couples, coupled reactions) to reason about the direction and feasibility of metabolic reactions.

? Describe the main metabolic strategies for ATP production and redox cofactor regeneration (fermentation, respiration, photosynthetic metabolism).

? Highlight metabolic plasticity: the ability of a microorganism to switch pathways or strategies depending on conditions (substrate, oxygen, light, stress).

? Relate metabolic scenarios (choice of pathway, ATP yield, end products) to bioprocess engineering issues (yield, selectivity, by-product formation).

Bibliography

M. Larpent-Gourgaud, J.J. Sanglier: Biotechnologie - Principes et méthodes, 1992, Doin Editeurs.

J. Brock, M.T. Madigan, J.M. Martinko and J. Parker: Biology of micro-organisms, 9th edition, 2000.

A.L. Lehninger, D.L. Nelson, M.M. Cox: Principes de Biochimie, 1993, Flammarion.

J. Darnell, H. Lodish, D. Baltimore, De Boeck-Westmael: Biologie moléculaire de la cellule, 1993, 2e éd.

Prerequisites

Cell biology course (or equivalent) covering cell organisation, main biomolecule families (proteins, carbohydrates, lipids, nucleic acids) and the basics of gene expression. Basic general/organic chemistry and thermodynamics (free energy, chemical reactions).

Learning outcomes

Learning outcomes	N	A	M	E	O
• Use simple thermodynamic and redox arguments to discuss the direction and coupling of metabolic reactions.	·	·	✓	·	·
• Describe and compare the main central carbon and energy metabolism pathways (glycolysis, TCA cycle, fermentations, respiration, photosynthetic metabolism).	·	✓	·	·	·
• Establish simplified ATP and redox cofactor balances for different metabolic scenarios (fermentative, respiratory, photosynthetic).	·	✓	·	·	·
• Explain the concept of metabolic plasticity and qualitatively predict the effect of a change in conditions (substrate, oxygen, light) on the orientation of metabolic fluxes.	·	·	✓	·	·
• Interpret a simplified metabolic map to discuss expected yields and products in a bioprocess engineering context.	·	✓	·	·	·
• Relate metabolic plasticity to bioprocess constraints (yield, selectivity, by-products, oxygen or light requirements).	·	✓	·	·	·

Manager : Guillaume COGNE

Bioreaction Engineering

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7	8.75	8			1.25	25

Evaluation

3 evaluations :

- *Devoir surveillé*
- *Examen écrit*
- *Mini-projet*

Presentation

This advanced course in bioreaction engineering builds on the introduction to bioprocesses and bioreactors. It covers the macroscopic theory of open systems, culture balances, advanced kinetic and stoichiometric models (growth, metabolites, maintenance), the impact of physical limitations (gas-liquid mass transfer, oxygen supply) on bioreactor performance, experimental monitoring of cultures and the modelling of multi-species systems.

Outline

1. Introduction to bioreaction engineering: role of models, modelling steps, metabolic vs. physical determinism.

2. Macroscopic theory of open systems: extensive/intensive properties, biochemical state vector, general balance equations.

3. Culture balances in ideal reactors: elemental conservation constraints, redox balance, stoichiometric matrix, measured vs. calculated rates.

4. Advanced kinetics and stoichiometry: extended unstructured models, multiple stoichiometric equations (growth, product, maintenance), yield definitions.

5. Reactors and physical limitations: batch/continuous/fed-batch, gas-liquid mass transfer, kLa, coupling between kinetics and transfer.

6. Culture monitoring and instrumentation: gas balances, liquid and gas-phase measurements, estimation of rO? and rCO?, check of elemental balances.

7. Microbial population interactions: interaction types, competition models in chemostat, prey-predator models in batch.

8. Case studies and a small modelling project (analysis of experimental data, parameter identification, simulations under different operating conditions).

Goals

? Apply the macroscopic balance theory to describe open biological systems.

? Build and analyse culture balances while enforcing elemental conservation constraints.

? Develop kinetic and stoichiometric models combining growth, metabolite formation and maintenance.

? Account for physical limitations (oxygen transfer, hydrodynamics) in bioreactor performance analysis.

? Use experimental monitoring data to identify parameters and validate models, including for multi-species systems.

Bibliography

? G. Cogne, Génie de la réaction biologique, Chapitres I à VII (polycopié de cours).
? Schügerl K., Bellgardt K.H., Bioreaction engineering.

Prerequisites

Biocatalysis - Introduction to bioprocesses and bioreactors (or equivalent): mass balances, ideal reactors, basic kinetics (Monod, global yields). Ability to solve simple ODEs and to use a numerical computing tool (e.g. Matlab, Scilab).

Learning outcomes

Learning outcomes	N	A	M	E	O
• Write and manipulate macroscopic balance equations to describe an open biological system (chemical state vector, culture balances).	·	·	✓	·	·
• Build and use a stoichiometric matrix to relate measured rates, calculated rates and yields in a microbial culture.	·	·	✓	·	·
• Develop a kinetic and stoichiometric model including growth, metabolite formation and maintenance, and analyse its parameters.	·	·	·	✓	·
• Include physical limitations (oxygen transfer, hydrodynamics) in the analysis of bioreactor behaviour and performance.	·	·	✓	·	·
• Use experimental culture monitoring data to estimate parameters, check elemental balances and validate a model.	·	·	·	✓	·

Manager : Guillaume COGNE

Business communication

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	21.5					

Evaluation

2 evaluations :

- *Situation Gpe*
- *DS*

Bibliography

Booklet TD 2 du S6 pour les 3A

Manager : Pascale SIMON LLOBREGAT

Business game

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	10.5	12				10

Evaluation

One evaluation : *Soutenance*

Bibliography

- Pierre Vernimmen, Pascal Quiry et Yann Le Fur, Finance d'entreprise, Dalloz, 2025
- Philippe Thomas, Principes de finance d'entreprise, RBédition
- Anna Shapiro-Niel, Denis Fasse, Marketing & Communication : le mix gagnant, Dunod

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
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• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Chrystèle GONCALVES

Business knowledge and entrepreneurship

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
1.5	13.5					4

Evaluation

One evaluation : *Rapport individuel*

Bibliography

- Les fonctions de l'entreprise / Pierre Baranger (Vuibert)

- Management et économie des entreprises / Gilles Dressy (sirey)

- Structure d'une organisation / xerfi canal https://www.youtube.com/watch?v=twVz2QhRyKw

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Boutique Dalloz-Sirey : https://www.boutique-dalloz.fr/management-et-economie-des-entreprises-p.html

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- Osterwalder, A., & Pigneur, Y. (2010). Business model generation: A handbook for visionaries, game changers, and challengers. John Wiley & Sons.

? Wiley : https://www.wiley.com/en-us/Business+Model+Generation:+A+Handbook+for+Visionaries,+Game+Cha
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? Strategyzer (template BMC) : https://www.strategyzer.com/library/the-business-model-canvas

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- Schumpeter, J. A. (1942). Capitalism, socialism and democracy. Harper & Brothers.

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- Autre PDF/notice : https://ia802305.us.archive.org/19/items/j.-schumpeter-capitalism-socialism-and-democracy/J. Schumpeter - Capitalism, Socialism and Democracy.pdf

- Traduction française récente : Schumpeter, J. A. (2023). Capitalisme, socialisme et démocratie (G. Fain, Trad.; J.-C. Casanova, Préf.). Payot. (?uvre originale publiée en 1942.)

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·

Manager : Gwenael THOREL

Cell biology

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	15				1	16

Evaluation

3 evaluations :

- *Devoir surveillé*
- *Examen final QCM*
- *Mini-projet*

Presentation

Fundamentals of cell biology and physiology, molecular biology and microbiology. The course provides the structural and functional background required for the subsequent metabolism-oriented biochemistry course and for bioprocess engineering.

Outline

1. Cell biology and physiology: structure and function of different cell types (prokaryotes, eukaryotes, animal and plant cells), viruses, organelles and biological membranes; respiration, photosynthesis, transport and exchanges, cell division and cell cycle.

2. Main biomolecule families and molecular biology: proteins, carbohydrates, lipids, nucleic acids; structure-function relationships; DNA organisation, genes and chromosomes; replication, transcription, translation; basic concepts of gene expression regulation.

3. Microbiology: diversity of microorganisms of biotechnological interest (bacteria, yeasts, microalgae), microbial growth, laboratory culture, basic principles of sterility and contamination.

Goals

Provide basic knowledge in cell biology and physiology, molecular biology and microbiology.

Enable students to understand the organisation, functioning and reproduction of prokaryotic and eukaryotic cells.

Prepare the later metabolism-oriented biochemistry and bioprocess engineering courses by placing metabolic pathways in their cellular context.

Bibliography

Alberts et al., Biologie moléculaire de la cellule.

Lodish et al., Biologie cellulaire et moléculaire.

Supports de cours et polycopiés fournis pendant l'UE.

Prerequisites

Second-year undergraduate level in scientific disciplines, with basic knowledge in chemistry, biology and general biochemistry.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Describe the overall organisation of prokaryotic and eukaryotic cells and the role of the main organelles.	·	✓	·	·	·
• Identify the main biomolecule families (proteins, carbohydrates, lipids, nucleic acids) and relate basic structural features to their function.	·	✓	·	·	·
• Explain the main steps of gene expression (replication, transcription, translation) and where they occur in the cell.	·	✓	·	·	·
• Characterise in a simple way the growth of a microorganism (growth phases, basic culture parameters).	·	✓	·	·	·
• Interpret diagrams or observations (microscopy, cell cycle) to identify a cell type or a physiological state.	✓	·	·	·	·

Manager : Guillaume COGNE

Chemistry kinetics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	7.5	8			1.25	21.75

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Presentation

This teaching allows to acquire the fundamentals needed to understand chemical and biochemical reactions in relation to their associated state variables. Chemical kinetics is an important aspect of studying the feasibility of a chemical or biochemical process

Outline

? Introduction: definitions such as reaction rate, reaction progress, complete reaction, balanced reaction, influence of temperature (activation energy) and link with the equilibrium constant.

? Methods for determining the rate law: determination of the overall order (integral method) and partial order (order degeneracy, initial rate). Writing material balances in a closed chemical system.

? Determination and validity of Arrhenius' law.

? Concepts of reaction mechanism and catalysis (with some examples)

Goals

The main two objectives for students is to:

- experimentally characterise the kinetic law of a reaction, the sensitivity of the reaction to temperature and demonstrate the impact of catalysis on the reaction rate, for example.

- determine by calculation, in a closed system, the progress of a reaction or the time required to achieve a given progress, with the aim of optimising an industrial chemical process or a process associated with biotransformations.

Furthermore, the study of reaction kinetics and a thorough understanding of the concept of reaction rate are essential prerequisites for fourth-year reactor engineering courses.

Bibliography

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? Chimie BCPST-VETO 2ème année(nouvelle édition). Tec et Doc(Lavoisier) Grécias et Migeon

? Chimie TOUT EN UN. Cours et exercices corrigés.MPSI-PTSI Dunod(j'intègre). Fosset, Baudin, Prévost...

? Chimie TOUT EN UN. Cours et exercices corrigés. 2ème année.PC-PC* Dunod(j'intègre). Fosset, Baudin, Prévost...

Prerequisites

? Knowledge of general chemistry desirable: amount of substance, concentration, density, unit conversions, etc.

? Knowledge of mathematics: primitive functions of common functions, solving first-order differential equations without a second member.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Rate of reaction	·	·	✓	·	·
• Solving the kinetic equation of a reaction (according to kinetic law)	·	·	✓	·	·
• Experimental methods for determining the rate law of a chemical reaction	·	·	✓	·	·
• Concepts of reaction mechanisms	✓	·	·	·	·

Manager : Agnès MONTILLET

Circular economy

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
4.5	3					6

Evaluation

One evaluation : *Soutenance*

Bibliography

- Thierry Le Moigne, L'économie circulaire, Stratégie pour un monde durable, 2018
- Vincent Aurez, Laurent Georgeault, Economie circulaire : système économique et finitude des ressources, 2019
- Manuel de la grande transition, Collectif FORTES, oct 2020

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Chrystèle GONCALVES

Collaborative speaking practice

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
		2				

Evaluation

One evaluation : *Situation Gpe*

Bibliography

- Booklet TD 1 du S6 pour les 3A et le booklet S7 pour les 4A
- Rebecca Hughes, 2010, Teaching and researching Speaking, Second Edition
- Jo Sudden, teachinenglish.org website : Role Play article : https://www.teachingenglish.org.uk/professional-development/teachers/planning-lessons-and-courses/articles/role-play

Manager : John KINGSTON

Collaborative speaking practice

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
		2				

Evaluation

One evaluation : *Situation Gpe*

Bibliography

- Booklet TD 1 du S6 pour les 3A et le booklet S7 pour les 4A
- Rebecca Hughes, 2010, Teaching and researching Speaking, Second Edition
- Jo Sudden, teachinenglish.org website : Role Play article : https://www.teachingenglish.org.uk/professional-development/teachers/planning-lessons-and-courses/articles/role-play

Manager : John KINGSTON

Column process modelling

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5						5

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·

Manager : Luc MARCHAL

Communication and Professional Relationships

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	12					4.5

Evaluation

One evaluation : *Situation Ind*

Bibliography

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- DE LASSUS René, La communication efficace par la PNL, Marabout (Bien-être - Psy), 2019, 288 p., ISBN 2501089499

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- GOLEMAN Daniel, L'intelligence émotionnelle - Intégrale (Analyser et contrôles ses émotions, et ceux des autres), 2014 , 925 p.,Editions J'ai lu

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Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Sylvaine GAUTIER

Complex fluid mechanics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3.75	7.5				1.25	12.5

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Learning outcomes

Learning outcomes	N	A	M	E	O
• to convert a rheological law into a flow model	·	✓	·	·	·
• To determine the pressure drop in an industrial pipe	·	✓	·	·	·
• To design a system transporting a complex fluid	·	✓	·	·	·

Manager : Annaig COTONNEC

Computational fluid dynamics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
15	21		15		4	55

Evaluation

2 evaluations :

- *Rapport groupe*
- *Soutenance*

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	·	✓	·	·
• *	·	·	✓	·	·
• *	·	✓	·	·	·
• *	·	·	✓	·	·

Manager : Jeremy PRUVOST

Computing methods

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3	3	12			3	21

Evaluation

2 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Analyze a simple problem and translate it into an algorithm	·	·	✓	·	·
• Write a functional Python program	·	·	✓	·	·
• Control program flow	·	·	✓	·	·
• Design a small standalone Python tool	·	·	✓	·	·

Manager : Arnaud SOURISSE

Cristallization

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
2.5	5				1.25	8.75

Evaluation

One evaluation : *Devoir surveillé*

Outline

Introduction and Definitions
- Solubility Diagrams of Binary Solutions
- Crystallization Pathways
- Mass and Heat Balances
- Technological Aspects

Goals

Discover the basics of crystallization process management.
- Use of equilibrium diagrams
- Realize mass and thermal balances

Bibliography

F Puel S Veesler D Mangin, Cristallisation Aspects Théoriques, Techniques de l'ingénieur J 2 710 Éditions TI

J P Klein, R Boistelle J Dugua, Cristallisation industrielle Aspects pratiques, Techniques de l'ingénieur J 2 788 Éditions TI

D Ronze, Introduction au génie des procédés, Éditions Tec Doc, Lavoisier

Learning outcomes

Learning outcomes	N	A	M	E	O
• Explain the fundamental concepts related to crystallization	·	✓	·	·	·
• Establish mass and energy balances associated with a crystallization process	·	·	✓	·	·
• Analyze the different crystallization pathways	·	✓	·	·	·

Manager : Matthieu FRAPPART

Design of Experiment

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	10				1.25	18.75

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

Goupy J., Plans d'expériences - Optimisation du choix des essais et de l'interprétation des résultats, 5? éd., Dunod, Paris, 2019.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Design and implement factorial and fractional experimental designs	·	✓	·	·	·
• Analyze experimental data using statistical tools	·	·	✓	·	·
• Determine optimal operating conditions for a process	·	✓	·	·	·
• properly organize experimental runs	·	✓	·	·	·

Manager : Annaig COTONNEC

Dimensional analysis

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
2.5	2.5					5

Evaluation

One evaluation : *DS*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ****	·	·	✓	·	·
• ***	·	·	✓	·	·
• ***	·	✓	·	·	·

Manager : Luc MARCHAL

Distillation

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	10	6	4		1.25	28.75

Evaluation

3 evaluations :

- *Devoir surveillé*
- *Rapport groupe 1*
- *Rapport groupe 2*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·

Manager : Luc MARCHAL

Ecological transition for sustainable development 2

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	9					

Evaluation

One evaluation : *Rendu collectif*

Presentation

After working on the challenges of the Transition at the very beginning of their program (S5), and then on the tools of the transition (S6), engineering students are challenged through a collaborative mini-project, in which a systemic approach, critical thinking, and a forward-looking perspective are mobilized and developed.

Goals

The objective of the TEDS 2 project is to:

Mobilize a systems approach to analyze complex issues related to the ecological and societal transition.

Develop critical thinking and the ability to exercise sound judgment with regard to technological, scientific, and organizational choices.

Strengthen skills in collaborative work, communication, and team-based project management.

Build a forward-looking perspective that integrates uncertainty, scenarios, and planetary boundaries.

Design integrated, responsible, and sustainable solutions, taking into account technical, economic, social, and environmental dimensions.

Affirm a responsible engineering posture, with awareness of one's role and the impact of one's decisions.

Bibliography

Approche systémique

Meadows, D. (2008). Thinking in Systems: A Primer. Chelsea Green Publishing.

Développement durable et responsabilité

Brundtland, G. H. (1987). Our Common Future. UN.

Rockström, J. et al. (2009). A safe operating space for humanity. Nature.

Coopération et travail en équipe

Tuckman, B. (1965). Developmental Sequence in Small Groups. Psychological Bulletin.

Pensée critique

Paul, R., & Elder, L. (2019). Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life.

Vision prospective

Rob Hopkins (2010). Et si !. Intereditions.

Résolution intégrée de problèmes

Pahl, G., Beitz, W. (2007). Engineering Design: A Systematic Approach. Springer.

Ceschin, F., & Gaziulusoy, I. (2016). Design for Sustainability: A Multi-Level Framework.

Approche transversale

Sachs, J. D. (2015). The Age of Sustainable Development. Columbia University Press.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Analyze and understand complex systems: Identify the components of a socio-technical system and their interactions. Use systems representation tools (mapping) to highlight relationships and feedback loops.	·	✓	·	·	·
• Integrate the challenges of sustainable development and social responsibility: Analyze the environmental, social, and economic impacts of a project or solution. Situate proposals with respect to planetary boundaries and the Sustainable Development Goals (SDGs). Identify concrete levers for action at different scales.	·	✓	·	·	·
• Exercise critical thinking: Evaluate the relevance and limitations of data, hypotheses, and scenarios. Question dominant models and technocentric solutions. Argue and justify choices in a structured manner.	·	✓	·	·	·
• Work in a team and collaborate in a multidisciplinary context: Cooperate effectively within a project group. Integrate diverse perspectives and manage disagreements. Communicate clearly, both orally and in writing, with varied audiences	·	✓	·	·	·
• Project and innovate in transitioning contexts: Develop forward-looking scenarios that incorporate uncertainties and systemic constraints. Propose innovative, realistic, and sustainable solutions. Anticipate the medium- and long-term consequences of decisions made.	·	✓	·	·	·
• Adopt a responsible professional stance: Become aware of one's values, perceptions, and responsibilities. Engage in a reflective approach regarding the role of the engineer in society.	·	✓	·	·	·

Manager : Nicolas VERRE

Economy and controversy mapping

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	27					10

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

- Christine Dollo, Laurent Braquet, Economie, Sirey
- Grégory N. Mankiw, Mark P. Taylor, Principes de l'économie, DeBoeck, 2022.
- Bruno Latour, La science en actions : introduction à la sociologie des sciences, La découverte Poche, 2005.

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Chrystèle GONCALVES

Engineering project

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5			95		4	100

Evaluation

5 evaluations :

- *Autoévaluation*
- *Rapport groupe*
- *Soutenance*
- *Mise en sit. gr.*
- *Évaluation externe*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·
• ***	·	✓	·	·	·
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·
• ***	·	✓	·	·	·

Manager : Luc MARCHAL

English grammar for engineers

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	22.5					

Evaluation

2 evaluations :

- *Situation Gpe*
- *DS*

Bibliography

Polycopié

Manager : John KINGSTON

Entrepreneurship S7

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			36			

Evaluation

One evaluation : *Situation Ind*

Manager : John KINGSTON

Entrepreneurship S8

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			28			

Evaluation

One evaluation : *Situation Ind*

Manager : John KINGSTON

Enzymatic kinetics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
6.25	7.5	8			1.25	23

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport de TP*

Presentation

The structure, the origin, the classification and the catalytic action of enzymes are presented. The principal models describing the mechanisms of homogeneous enzyme kinetics are presented : Michaelis-Menten equation, inhibitions/activations, allostery, pH and temperature effects. Exercices are proposed in order to manipulate those concepts. Systems employing immobilized enzymes are introduced. Theoretical knowledge are applied during practical works, aiming to conceive an experience to collect data in order to propose a model describing kinetics of a model enzyme, the invertase.

Outline

1. Enzymes, biocatalysts
   2. Homogeneous enzyme kinetics
   3. Heterogeneous enzyme kinetics
   4. Enzyme activity assays
   5. Exercises
   6. Practical work

Goals

- Understanding of basic principles of enzyme kinetics
  - Analysis of kinetic parameters (KM, Vmax, inhibitions)
  - Use of equations and mathematical models of enzyme kinetics (graphic representations)
  - General culture of uses of enzymes in industrial (bio)processes
  - Experimental methodology (experimental design, analysis, data collection and interpretation, writing a technical report)

Bibliography

Bioprocess Engineering - Basic Concepts, Second Edition. Michael Shuler et Fikret Kargi. PH PTR
Combes D. et Monsan P., 2009. Biocatalyse ou catalyse enzymatique. Réf : BIO590 v1

Prerequisites

Basic knowledge in biology and chemical kinetics.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Knowledge of the basic principles of enzyme kinetics	·	·	✓	·	·
• Analyse kinetic parameters KM and Vmax	·	·	✓	·	·
• Manipulate equations and mathematical models of enzyme kinetics	·	·	✓	·	·
• General culture of uses of enzymes in industrial (bio)processes	✓	·	·	·	·
• Realisation of an activity assay, data collection and interpretation	·	✓	·	·	·

Manager : Marie RENAUDIE

Extraction

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	10	6			1.25	24.75

Evaluation

3 evaluations :

- *Devoir surveillé*
- *Rapport individuel*
- *Rapport groupe*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·
• ***	✓	·	·	·	·

Manager : Luc MARCHAL

Fermentation engineering

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	8.75				1.25	15

Evaluation

3 evaluations :

- *Devoir surveillé*
- *Études de cas*
- *Examen écrit*

Presentation

This course presents the principles of design and sizing of fermentation processes based on simple kinetic models. Students learn how to relate microbial growth, yields and maintenance requirements to process parameters (residence time, dilution rate, reactor volume, feed concentration). The course is supported by case studies and calculation exercises to compare the performance of batch, continuous, plug-flow and fed-batch operation and to select an appropriate configuration for a given industrial objective.

Outline

? Review of mass balances and basic kinetic models (Monod, maintenance).
? Performance criteria: conversion, productivity, yield, residence time.
? Batch reactor design: process time, productivity, choice of operating profile.
? Continuous stirred tank reactor (CSTR/chemostat): design equations, critical dilution rate, washout, multiple steady states.
? Plug flow reactor (PFR): relation to CSTR, concentration profiles, performance comparison.
? Fed-batch reactors: feeding strategies, process time, advantages regarding substrate limitation.
? Comparison of operating modes for a given microbial kinetics.
? Case studies

Goals

This course focuses on the design and sizing of fermentation processes based on simple kinetic models.

Its aim is to provide students with the tools to link growth kinetics, yields and maintenance requirements to design parameters (residence time, dilution rate, volume, feed concentration), in order to select and design an appropriate bioreactor (batch, continuous, plug-flow, fed-batch) for given conversion and productivity targets.

Bibliography

Doran P. M., Ingénierie des bioprocédés (ou édition anglaise Bioprocess Engineering Principles).
J. Nielsen, J. Villadsen, G. Lidén, Bioreaction Engineering Principles, 2e édition
Autres références et supports de cours fournis pendant l'UE.

Prerequisites

Basic knowledge of microbiology and bioprocess engineering (microbial growth, material balances, ideal reactors).

Ability to handle algebra and solve simple differential equations.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Write design equations for batch, continuous stirred tank, plug-flow and fed-batch bioreactors from a given microbial kinetic model.	·	·	✓	·	·
• Size a bioreactor (volume, residence time, dilution rate, feed concentration) to meet a given conversion or productivity target.	·	·	✓	·	·
• Identify washout and multiple steady states in continuous bioreactors.	·	·	✓	·	·
• Compare the performance of batch, continuous, plug-flow and fed-batch operation for a given microbial kinetics.	·	·	✓	·	·
• Interpret design calculations to propose optimisation strategies for a fermentation process.	·	·	✓	·	·

Manager : Guillaume COGNE

Final project

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst

Evaluation

5 evaluations :

- *Rapport individuel*
- *Soutenance*
- *Évaluation externe*
- *Mise en sit. ind.*
- *Autoévaluation*

Manager : Annaig COTONNEC

Flow in Porous Media

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
8.75	12.5				2.5	23.75

Evaluation

One evaluation : *Devoir surveillé*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Characterize porous media and their physical properties	·	·	✓	·	·
• Model fluid flow and pressure drop in packed beds	·	✓	·	·	·
• Apply these concepts to industrial separation and filtration processes	·	✓	·	·	·

Manager : Nour-Eddine SABIRI

Fluid mechanics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	10				2.5	20

Evaluation

3 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*
- *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Connaissance des approches avancées de type analyse locale (restreinte ici aux écoulements laminaires)	·	✓	·	·	·
• Application de bilans (masse, énergie, quantité de mouvement) aux échelles macroscopiques (obtention de théorèmes intégraux)	·	·	✓	·	·
• Application de bilans (masse, énergie, quantité de mouvement) aux échelles microscopiques (obtention d'équations locales de conservation)	·	·	✓	·	·

Manager : Annaig COTONNEC

French as a foreign language

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *Situation Ind*

Manager : Carole CHAUSSE

French as a foreign language

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *Situation ind.*

Manager : Carole CHAUSSE

Good laboratory practices 1

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
2.5		8				11.75

Evaluation

One evaluation : *Devoir surveillé*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Identify the risks associated with handling chemical substances (toxicity, flammability, corrosiveness, reactivity).	·	·	✓	·	·
• Apply proper procedures for the use and storage of chemical products.	·	·	✓	·	·
• Use common laboratory equipment correctly	·	·	✓	·	·
• Recognize and use collective and personal protective equipment	·	·	✓	·	·
• Follow general safety rules in a chemistry laboratory.	·	·	✓	·	·
• Manage chemical waste according to appropriate sorting, storage, and disposal procedures	·	·	✓	·	·

Manager : Sandrine GRATTIER

Good laboratory practices 2

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
2.5						2.5

Evaluation

One evaluation : *Devoir surveillé*

Prerequisites

None

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	·	✓	·	·
• *	·	·	✓	·	·
• *	·	·	✓	·	·

Manager : Sandrine GRATTIER

Heat Exchangers

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	5				1.25	11.25

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

? Y.A. Cengel, Heat and Mass Transfer, McGraw Hill

? Y. A. Cengel, Heat transfer, a practical approach, McGraw Hill, 2002

? A. BONTEMPS, A. GARRIGUE, C. GOUBIER, J. HUETZ, C. MARVILLET, P. MERCIER et R. VIDIL. Echangeurs de chaleur. Définitions et architecture générale. Techniques de l'ingénieur, traité Génie énergétique. B2340.

? A. BONTEMPS, A. GARRIGUE, C. GOUBIER, J. HUETZ, C. MARVILLET, P. MERCIER et R. VIDIL. Echangeurs de chaleur. Problèmes de fonctionnement. Techniques de l'ingénieur, traité Génie énergétique. 2344.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Explain the operating principle of a heat exchanger and cite common industrial applications	·	·	✓	·	·
• Identify the appropriate type of heat exchanger based on a given problem statement or process flow diagram	·	·	✓	·	·
• Determine the logarithmic mean temperature difference (LMTD) for a given heat exchanger	·	·	✓	·	·
• Calculate the number of transfer units (NTU) and the thermal effectiveness of a heat exchanger	·	·	✓	·	·

Manager : El-Khider SI-AHMED

Heat transfert

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10	15				2.5	27.5

Evaluation

3 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*
- *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Describe the three modes of heat transfer: conduction, convection, and radiation.	·	·	✓	·	·
• Formulate a local energy balance and write the heat equation for an incompressible flowing fluid.	·	·	✓	·	·
• Identify and apply the main boundary conditions used in heat transfer problems	·	·	✓	·	·
• Explain the concept of the thermal boundary layer and its role in convective heat transfer	·	✓	·	·	·
• Calculate heat fluxes due to conduction, convection, or radiation	·	✓	·	·	·

Manager : El-Khider SI-AHMED

Homogeneous reactors

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10	10	6			1.25	27.25

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Bibliography

?Génie de la réaction chimique - Conception et fonctionnement des réacteurs (2e Ed), Jacques Vilermaux, Tec&Doc, 1993

?Chemical Reaction Engineering, Octave Levenspiel, Wiley& Sons, 1998

?Elements of Chemical Reaction Engineering (5th Ed), H.Scott Fogler, Pearson, 2016

?Les réacteurs chimiques : De la conception à la mise en oeuvre, Jean-Paul Euzen et Pierre Trambouze, Editions Technip, 2002

Learning outcomes

Learning outcomes	N	A	M	E	O
• · Savoir formuler des bilans de matière dans des réacteurs idéaux	·	·	·	✓	·
• ? Choisir et dimensionner un réacteur approprié à une transformation chimique homogène donnée	·	·	✓	·	·

Manager : Caroline GENTRIC

Hydraulics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10	15	16			2.5	43.5

Evaluation

2 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Apply the fundamental laws governing fluid statics and flow	·	✓	·	·	·
• Calculate head losses and analyze energy in a hydraulic system	·	·	✓	·	·
• Identify flow regimes and their impact on fluid transport	·	·	✓	·	·
• Size a simple hydraulic network and select an appropriate pump	·	·	✓	·	·

Manager : El-Khider SI-AHMED

Industrial chromatography

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	5					10

Evaluation

One evaluation : *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Identify the different chromatographic processes and select an appropriate separation solution for a given problem.	·	·	✓	·	·
• Characterize the performance of a chromatographic column	·	·	✓	·	·
• Model a chromatographic column using mass balances and transport parameters.	·	✓	·	·	·
• Analyser l'influence des paramètres opératoires sur la performance de séparation	·	✓	·	·	·
• Implement scale-up principles	·	✓	·	·	·

Manager : Sébastien CHOLLET

Industrial design

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10	12.5				2.5	25

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	·	✓	·	·
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·

Manager : Luc MARCHAL

Intensified processes

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
20						20

Evaluation

One evaluation : *Devoir surveillé*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the principles and industrial applications of process intensification	·	✓	·	·	·
• Identify technological, economic, and environmental challenges associated with intensified processes.	·	✓	·	·	·
• Recognize innovation trends and career opportunities in the field of process engineering	·	·	✓	·	·

Manager : Luc MARCHAL

Intercultural exploration : understanding differences

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *Situation collective*

Bibliography

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? Meyer, E. (2014). The culture map: Breaking through the invisible boundaries of global business. PublicAffairs.

? Bourrelle, J. S., Elise H. Kollerud (2015). Cracking the Scandinavian code. Mondå Forlag.

? Stringer, D. M., & Cassiday, P. A. (2006). 52 activities for improving cross-cultural communication. Intercultural Press.

Manager : Anna Tataurova

Job-hunting strategies and techniques

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
1.5	9					6

Evaluation

One evaluation : *Situation ind.*

Bibliography

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- Anderson, Chris (2006). The Long Tail: Why the Future of Business Is Selling Less of More. New York: Hyperion. ISBN 978-1-4013-0237-5
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Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Sylvaine GAUTIER

Life cycle analysis

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3.75	3.75				1.25	8.75

Evaluation

One evaluation : *Devoir surveillé*

Presentation

The Life Cycle Assessment (LCA) course introduces students to the methodology for evaluating the environmental impacts of a product, service, or process across its entire life cycle ? from raw material extraction to end-of-life.

Outline

1 - Introduction and Definitions
2 - Product Function and System
3 - Life Cycle Inventory (LCI)
4 - Impact Assessment
5 - Practical Work on OpenLCA

Goals

At the end of the course, the student will be able to:
Understand the foundations and objectives of Life Cycle Assessment (LCA);
Identify and describe the different phases of an LCA (goal and scope, inventory, impact assessment, interpretation);
Define a product system, a functional unit, and its boundaries;
Carry out a life cycle inventory and build a model using openLCA;
Select and interpret environmental impact indicators (climate change, acidification, eutrophication, etc.);
Apply the LCA method within a normative framework;
Use LCA results to compare, design, or improve products.

Prerequisites

Understanding of industrial operations and material/energy flows;
Basic knowledge of applied mathematics (units, balances, proportions);

Learning outcomes

Learning outcomes	N	A	M	E	O
• n	·	·	✓	·	·
• n	·	·	✓	·	·
• n	·	·	✓	·	·
• n	·	✓	·	·	·
• n	·	✓	·	·	·
• n	·	✓	·	·	·
• n	✓	·	·	·	·

Manager : Annaig COTONNEC

Low carbon building S7

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			36			

Evaluation

2 evaluations :

- *Situation Gpe*
- *Situation Ind*

Manager : Nabil ISSAADI

Low carbon building S8

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			28			

Evaluation

2 evaluations :

- *Situation Gpe*
- *Situtation Ind*

Manager : Nabil ISSAADI

Maritime energy S7

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			36			

Evaluation

2 evaluations :

- *Situation Gpe*
- *Situation Ind*

Manager : Yasser DIAB

Maritime energy S8

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			28			

Evaluation

2 evaluations :

- *Situation Gpe*
- *Situation Ind*

Manager : Yasser DIAB

Mass transfer

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	12.5				1.25	21.25

Evaluation

3 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*
- *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Describe diffusion and convection mechanisms in mass transfer	·	·	✓	·	·
• Formulate a local mass balance and derive the general mass transport equation	·	·	✓	·	·
• Identify the main boundary conditions at gas-liquid and solid-fluid interfaces.	·	✓	·	·	·
• Explain the concept of the mass transfer boundary layer and its role in controlling transfer rates	·	✓	·	·	·
• Calculate the total mass transfer flux accounting for both diffusive and convective contributions	·	✓	·	·	·

Manager : El-Khider SI-AHMED

Mathematics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	15				1	16

Evaluation

One evaluation : *Devoir surveillé*

Presentation

Mathematics is an essential tool for engineers. This is why engineering students are required to use it intensively from the very beginning of their training.

Outline

1. Vector calculus
   2. Matrix operations, solving linear systems, and matrix diagonalization
   3. Functions of one variable
   4. Polynomials and rational functions

Goals

This refresher course aims to develop the engineering student's ability to understand and use the mathematical concepts they will frequently encounter throughout the rest of their training.

Bibliography

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K. Weltner, J. Grosjean, W.-J. Weber, P. Schuster, Mathématiques pour les physiciens et les ingénieurs, De Boeck Supérieur, 2012.

Prerequisites

Have a two-year post-secondary level in scientific disciplines.

Learning outcomes

Learning outcomes	N	A	M	E	O
• n	·	·	✓	·	·
• n	·	·	✓	·	·
• n	·	·	✓	·	·
• n	·	·	✓	·	·

Manager : Annaig COTONNEC

Mechanics and physics

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	10				1	11

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

Alonson / Finn Physique générale

Mick O'Hare « Comment fossiliser son hamster » Editions du Seuil 2008

Yakov Perelman « Oh la Physique ! » Dunod 2000

Learning outcomes

Learning outcomes	N	A	M	E	O
• Identify the physical quantities governing a problem	✓	·	·	·	·
• Be familiar with the dimensions of physical quantities and ensure dimensional homogeneity	·	✓	·	·	·

Manager : Luc MARCHAL

Membrane and Granular Separation

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
6.25	8.75	8			1.25	24.25

Evaluation

One evaluation : *Devoir surveillé*

Presentation

This course covers the fundamental principles of membrane filtration. It begins with a classification of membrane processes: microfiltration, ultrafiltration, nanofiltration, and reverse osmosis, based on the size of the particles being separated. The types of membranes (organic, inorganic), their configurations (flat, tubular, spiral, hollow fiber), and their physicochemical properties are studied. The course also addresses transfer mechanisms, transport laws (flux, transmembrane pressure), and fouling phenomena. Design aspects of membrane units, sizing criteria, as well as industrial applications are also discussed.

Outline

Principles and definitions
- Applications
- Characteristics of membranes and modules
- Process operation
- Transfer mechanisms
- Concentration polarization
- Preventive and corrective processes of fouling
- Operating modes

Goals

1. Understand the basic principles of membrane processes:

Identify and distinguish the different types of membrane filtration (microfiltration, ultrafiltration, nanofiltration, reverse osmosis).

Understand the physical, chemical, and mechanical separation mechanisms associated with membrane processes.

2. Know how to choose the appropriate type of membrane/module based on the properties of the fluid and the particles to be separated.

3. Size and design membrane units.

4. Analyze fouling phenomena: Identify the causes of fouling and understand its impact on the performance of membrane systems + Propose solutions to minimize or manage fouling (cleaning, regeneration, modification of operating conditions).

5. Optimize membrane processes to maximize efficiency and membrane lifespan. Analyze filtration performance

6. Acquire a scientific understanding of membranes: Identify and understand the main industrial applications of membrane filtration (water treatment, food industry, pharmaceuticals, chemistry).

7. Model the transfer phenomena in membrane filtration processes.

8. Know how to operate a membrane filtration system.

9. Know how to size a membrane filtration system.

Prerequisites

Knowing how to make material balances

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the basic principles of membrane processes	·	·	·	✓	·
• Size and design membrane units	·	·	✓	·	·
• Acquire a scientific understanding of membranes	·	·	✓	·	·
• Model the transfer phenomena	·	·	✓	·	·
• Operate and design a membrane filtration system	·	·	✓	·	·

Manager : Anthony MASSE

Methods and concepts in (bio)process engineering

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10	15				1.25	26.25

Evaluation

2 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*

Presentation

Introductory course on concepts and methods in process engineering applied to (bio)processes. The module covers general conservation equations, material and energy balances under steady and unsteady regimes, determination of the number of degrees of freedom, and the analysis of complex process flowsheets (recycle, by-pass, purge). Emphasis is placed on rigorous formulation of balance equations and on the systematic approach to solving process engineering problems.

Outline

1. Conservation equations: general balance, classification of quantities (amounts, rates, fluxes), open/closed systems.

2. Steady-state mass and energy balances: processes with and without reactions, overall and component balances, example of a distillation column.

3. Degrees of freedom analysis: definition, simple units, mixers, splitters, series and parallel arrangements, general expression for complex units.

4. Complex process analysis: mixing/splitting nodes, internal and external loops, recycle, purge, by-pass, case studies (catalytic dehydrogenation, NH? synthesis, air dehumidification).

5. Unsteady-state balances: derivation of dynamic balance equations, simple analytical cases, introduction to dynamic energy balances and numerical integration.

6. Exercises and integrated case studies on process flowsheets.

Goals

? Introduce the general balance formulation (accumulation = in - out + generation) for different conserved quantities.

? Derive mass and energy balances for unit operations and processes at steady state.

? Determine the degrees of freedom of a system and identify the additional data required to fully specify a problem.

? Analyse complex process flowsheets (networks of units, recycle, by-pass, purge) using a modular approach.

? Introduce unsteady-state balances and their simple solution methods.

Bibliography

? G. Cogne, Concepts et méthodes en Génie des (bio)procédés, Parties I à V (polycopiés de cours).

? Felder R. M., Rousseau R. W., Elementary Principles of Chemical Processes.

? Himmelblau D. M., Riggs J. B., Basic Principles and Calculations in Chemical Engineering.

Prerequisites

Basic general chemistry and thermodynamics, introductory knowledge of process engineering (simple unit operations), L2-level mathematics (algebraic equations, derivatives, simple ordinary differential equations).

Learning outcomes

Learning outcomes	N	A	M	E	O
• Maîtrise des connaissances générales nécessaires à la compréhension et à la mise en oeuvre d'un procédé	·	·	✓	·	·
• Etre capable d'appliquer les lois de conservation de la matière à des opérations utiles en chimie et biochimie industrielles	·	✓	·	·	·

Manager : Guillaume COGNE

Microbiology

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
8.75		12			1.25	22

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Presentation

This course presents the fundamental role of microorganisms in biotechnologies applied to the fields of food, agriculture, environment, and health. It addresses microbial biological diversity as well as the principles of classification, relying on the basics of taxonomy to understand the organization of the microbial world.

The main cellular groups used in biotechnology are studied: prokaryotes (eubacteria and archaea), eukaryotes (yeasts, molds, microalgae), with an extension to animal and plant cells, as well as viruses. Reviews of microbial structure and physiology are provided, covering everything from cellular organization to nutritional requirements and culture media.

Mechanisms of reproduction and gene transfer are introduced to illuminate the processes of evolution and adaptation in microbial populations. Fundamental concepts of microbial growth, growth kinetics, and cultivation methods are then studied, in relation to the influence of environmental conditions.

The course also details strategies for controlling microbial growth, including sterilization as well as procedures for prevention, contamination control, and decontamination. Finally, it presents the main laboratory techniques in microbiology, ranging from aseptic maintenance to culture, enumeration, and identification of microorganisms, up to modern analytical ?omics? approaches.

Outline

1. Diversity and classification of microorganisms
   - Main cellular groups: prokaryotes, eukaryotes, viruses
   - Principles of taxonomy
   2. Structure and physiology of microorganisms
   - Cellular organization and nutritional requirements
   - Reproduction and gene transfer
   3. Microbial growth and production
   - Growth kinetics and environmental factors
   - Adaptation and evolution of populations
   4. Laboratory techniques
   - Aseptic handling, culture, enumeration, and isolation
   - Identification and modern analyses (omics approaches)
   5. Applications in biotechnology
   - Health, food, agriculture, and environment
   - Use in bioprocesses

Goals

- Master the fundamental knowledge of microbiology, including classification, physiology, and control of microbial growth.

- Understand the main applications of microorganisms in bioprocesses.

- Be able to work aseptically, perform microbial counts and isolations, understand methods for identifying microorganisms, and study bacterial growth.

- Be able to write a clear and well-structured technical report.

Bibliography

Prescott L., Harley J., Klein D., 2019. Prescott's Microbiology. McGraw-Hill Education.

Madigan M., Martinko J., Bender K., Buckley, D., Stahl, D., 2018. Brock Biology of Microorganisms. Pearson.

Schuler A., Kargi, F., 2017. Bioprocess Engineering: Basic Concepts. McGraw-Hill Education.

Foucaud-Scheunemanne C., Helinck S., 2023. Les micro-organismes au coeur des biotechnologies. Editions Techniques de l'Ingénieur.

Prerequisites

Basic knowledge of cell biology and metabolic biochemistry.

Learning outcomes

Learning outcomes	N	A	M	E	O
• Basic knowledge in microbiology, including classification, physiology and growth control	·	·	✓	·	·
• Knowledge of the principal applications of microorganisms in biotechnologies	·	·	✓	·	·
• Work in aseptic conditions, enumerate, isolate, understand methods conducting to the identification of microorganisms	·	·	✓	·	·
• Write a clear and structured technical report	·	·	✓	·	·

Manager : Marie RENAUDIE

Modern language 2

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *Situation Ind*

Manager : Carole CHAUSSE

Modern language 2

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *Situation ind.*

Manager : Carole CHAUSSE

Negotiation

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3	7.5					2

Evaluation

One evaluation : *Situation Ind*

Bibliography

- Salzer, J. et Stimec, A. (2019). Outil 63. Les qualités d'un bon accord. La boîte à outils de la Gestion des conflits (p. 182-183). Dunod. https://shs.cairn.info/la-boite-a-outils-de-la-gestion-des-conflits–9782100791415-page-182?lang=fr.

- https://web.archive.org/web/20140427011407/http://www.commerciaux.fr/profession/methode_soncas.php

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·

Manager : John KINGSTON

Non-ideal reactors modeling

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
8.75	12.5				1.25	22.5

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

?Génie de la réaction chimique - Conception et fonctionnement des réacteurs (2e Ed), Jacques Vilermaux, Tec&Doc, 1993

?Chemical Reaction Engineering, Octave Levenspiel, Wiley& Sons, 1998

?Elements of Chemical Reaction Engineering (5th Ed), H.Scott Fogler, Pearson, 2016

?Les réacteurs chimiques : De la conception à la mise en oeuvre, Jean-Paul Euzen et Pierre Trambouze, Editions Technip, 2002

Learning outcomes

Learning outcomes	N	A	M	E	O
• Formulating coupled material and energy balances in ideal reactors	·	·	✓	·	·
• Take into account the thermicity of chemical reactions	·	·	✓	·	·
• Modeling and predicting the performance of non-ideal reactors	·	·	✓	·	·
• Optimizing the performance of reactors involving multiple reactions	·	·	✓	·	·

Manager : Caroline GENTRIC

Numerical analysis

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
6.25	5	20			1.25	32.5

Evaluation

2 evaluations :

- *Rapport individuel*
- *Devoir surveillé*

Bibliography

Hoffman, J. D., & Frankel, S. (2018). Numerical methods for engineers and scientists. CRC press.

Learning outcomes

Learning outcomes	N	A	M	E	O
• To model transfer phenomena	·	✓	·	·	·
• To discretize and numerically solve partial differential equations (PDEs	·	✓	·	·	·
• To develop programs and validate results using MATLAB	·	✓	·	·	·

Manager : Florian Huchet

Organizational analysis

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
4.5	6					3

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

Droits et devoirs du salarié :

- la pyramide des normes https://www.youtube.com/watch?v=xpWzj66Lxk0
- la négociation collective https://www.youtube.com/watch?v=giwvtotJjws
- Légifrance ingénieurs https://www.legifrance.gouv.fr/conv_coll/id/KALICONT000005635173

Théorie des organisations :

- Théorie des organisations / j m plane (dunod)
- Théorie des orga et écosystèmes / maclouf https://www.youtube.com/watch?v=fn-4ZxWRjNE

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Gwenael THOREL

People management

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	10.5					6

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

- Freeman, R. E. (1984). Strategic management: A stakeholder approach. Boston, MA: Pitman.

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Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : John KINGSTON

Physical education 1

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	21					2

Evaluation

One evaluation : *Situation ind.*

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Jérôme BEZIER

Physical education 2

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	21					2

Evaluation

One evaluation : *Situation ind.*

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Jérôme BEZIER

Physical education 3

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	21					2

Evaluation

One evaluation : *Situation Ind*

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Jérôme BEZIER

Physical education 4

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	19.5					2

Evaluation

One evaluation : *Situation ind.*

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Jérôme BEZIER

Potable Water Treatment & Design

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3.75	6.25				1.25	11.25

Evaluation

One evaluation : *Devoir surveillé*

Outline

Basics; General Treatment Scheme; Main Pollutants
Water Clarification (Coagulation - Flocculation - Settling - Sizing Approach)
Biological Treatments (Implementation; Sludge Production ; O2 Requirements)
Sewage Sludge Treatment

Goals

Basics of urban effluent and sewage sludge treatment

Bibliography

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- Jean-Claude Boeglin, Traitements physico-chimiques de la pollution insoluble, Techniques de l'ingénieur, G 1 270
- Jean-Claude Boeglin, Traitements physico-chimiques de la pollution soluble, Techniques de l'ingénieur, G 1 271
- Claude Delporte, Traitements biologiques aérobies des effluents, Techniques de l'ingénieur, G 1 300
Traitements des boues d'épuration
- Mémento Technique de l'Eau, 10ème édition, Degrémont Suez.
- Claude Cardot, Les traitements de l'eau, Procédés physico-chimiques et biologiques, Technosup, Ellipses éditions.
- Rémy Gourdon, Traitements biologiques des déchets, Technique de l'ingénieur, G 2 060.
- Éric Guibelin, Lutte contre la pollution des eaux - Traitements des boues d'épuration, Techniques de l'ingénieur, G 1 450
- Éric Guibelin, Lutte contre la pollution des eaux - Élimination finale des boues d'épuration, Techniques de l'ingénieur, G 1 451
- Jean-Claude Boeglin, Traitements biologiques des eaux résiduaires, Techniques de l'ingénieur, J 3 942
- Jean-Claude Boeglin, Lutte contre la pollution des eaux, Techniques de l'ingénieur, G 1 250

Manager : Matthieu FRAPPART

Preparing the TOEIC

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	19.5					

Evaluation

One evaluation : *DS*

Bibliography

Polycopié

Manager : Pascale SIMON LLOBREGAT

Preparing the TOEIC

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	18					

Evaluation

One evaluation : *DS*

Bibliography

Polycopié

Manager : John KINGSTON

Presenting and debating

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	19.5					

Evaluation

One evaluation : *Situation Gpe*

Bibliography

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- Gascoigne, A. (2023). Silicon Valley's huge diversity problem holds tech back. The Los Angeles Tmes.

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	✓	·	·	·	·
• .	✓	·	·	·	·
• .	✓	·	·	·	·

Manager : Pascale SIMON LLOBREGAT

ProSim - ICET

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	5	12				22

Evaluation

One evaluation : *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	·	✓	·	·
• *	·	·	✓	·	·
• *	·	·	✓	·	·

Manager : Walid BLEL

Process Energy Management

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	8.75				1.25	17.5

Evaluation

One evaluation : *Devoir surveillé*

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Learning outcomes

Learning outcomes	N	A	M	E	O
• Identify the main sources of energy losses as well as opportunities for waste heat recovery	·	·	✓	·	·
• Apply the principles of thermal integration and pinch analysis to minimize hot and cold utility requirements.	·	✓	·	·	·
• Design an optimal heat exchanger network based on process data.?	·	✓	·	·	·
• Explain the concept of exergy and perform an exergy analysis of simple process systems	·	·	✓	·	·

Manager : Annaig COTONNEC

Process control and command

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
25		21			1.25	47.25

Evaluation

One evaluation : *Devoir surveillé*

Bibliography

Manuels utilisateur des logiciels Matlab-Simulink

Learning outcomes

Learning outcomes	N	A	M	E	O
• Connaître les différentes méthodes pour le contrôle, la simulation et la commande de procédés biologiques, physiques, ou chimiques	·	·	✓	·	·
• Formation aux outils et méthodes nécessaires à la conduite des procédés : acquisition, automatisme, observateurs, modélisation et optimisation par simulation	·	✓	·	·	·
• Etre capable de mettre en place une simulation de procédé à l'aide du logiciel Matlab®-Simulink®	·	✓	·	·	·

Manager : Mariana TITICA

Process safety

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	5				1.25	13.75

Evaluation

One evaluation : *Devoir surveillé*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·

Manager : Luc MARCHAL

Processes and Bioprocesses Workshop S7

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
		50				50

Evaluation

3 evaluations :

- *Rapport groupe*
- *Mise en situ. gr.*
- *Soutenance*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·
• ***	·	·	✓	·	·
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·
• ***	·	✓	·	·	·
• ***	·	·	✓	·	·

Manager : Luc MARCHAL

Processes and Bioprocesses Workshop S8

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
		50				50

Evaluation

2 evaluations :

- *Rapport groupe*
- *Mise en sit. ind.*

Presentation

Project-based course in process and bioprocess engineering. Students, working in groups, design and operate a complete process, from the upstream step (medium preparation, culture or reaction) to downstream separation, concentration and purification of the product. The focus is on process flowsheet design, selection of unit operations and operating conditions, experimental monitoring and global analysis of process performance.

Outline

1. Presentation of the course and workshop topics: selection of a (bio)chemical process to be studied (reaction or culture + product purification).

2. Targeted literature review on the product and existing processes; definition of project objectives (quantities, purity, main constraints).

3. Design of the process flowsheet.

4. Preparation of the experimental plan and detailed schedule: organisation of upstream/downstream steps, task allocation, safety aspects.

5. Experimental sessions: implementation of the ?upstream? part (reaction or culture, monitoring) and of the ?downstream? part (clarification, separation, concentration, purification).

6. Data processing and analysis: simplified mass balances, yield, productivity and loss calculations, discussion of overall process performance.

7. Writing of deliverables (intermediate and final reports) and preparation of the project oral presentation.

Goals

? Apply process and bioprocess engineering concepts to design and run a complete experimental process (reaction/culture + separation/purification).

? Select appropriate unit operations (mixing, agitation, conditioning, clarification, concentration, chromatography, etc.) according to the target product and lab constraints.

? Define operating conditions (medium, T, pH, residence time, velocities, pressures, etc.) and suitable monitoring protocols.

? Perform simple material balances and calculate yields and productivities at the process scale.

? Keep a structured lab notebook documenting the experiments performed, the results obtained and possible improvements or future perspectives.

? Organise a realistic experimental plan, share tasks within the team and present results and design choices in a structured and well-argued way.

Bibliography

? Supports de cours de (bio)procédés et documents fournis pour chaque projet.

? Articles et chapitres d'ouvrages identifiés par les étudiants dans le cadre de l'état de l'art.

Prerequisites

Basic knowledge in process engineering (mass and energy balances, simple unit operations) and, depending on the chosen topic, introductory bioprocess engineering or chemical reaction engineering.

Previous lab practical experience and familiarity with safety rules (handling of chemicals and/or microorganisms).

Learning outcomes

Learning outcomes	N	A	M	E	O
• Carry out a focused literature review on a product and the associated (bio)chemical processes.	·	✓	·	·	·
• Design a process flowsheet including the reaction or culture step and the separation, concentration and purification unit operations.	·	·	✓	·	·
• Define and implement suitable operating conditions and experimental monitoring procedures for the studied process.	·	·	✓	·	·
• Keep a clear and structured lab notebook documenting the experiments performed, the results obtained and possible improvements.	·	·	✓	·	·
• Analyse experimental results, perform simplified mass balances and discuss overall process performance (yield, productivity, losses).	·	·	✓	·	·
• Present in a structured way, in writing and orally, the studied process, the experimental approach and the main results.	·	✓	·	·	·

Manager : Guillaume COGNE

Processes with Phase Change

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	10				1.25	16.25

Evaluation

One evaluation : *Devoir surveillé*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Understand the fundamentals of humid air and water activity	·	·	✓	·	·
• Analyze freezing and drying mechanisms	·	·	✓	·	·
• Compare and select different drying technologies	·	✓	·	·	·
• Evaluate the impact of operating conditions on process performance and product quality	·	✓	·	·	·

Manager : Marie RENAUDIE

Project management 1

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
4.5	7.5					2

Evaluation

One evaluation : *Situation Gpe*

Bibliography

- Doc Pdf : Conseils pour écrit et oral projet DD
- Doc Word : Note de cadrage Projet DD

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Sylvaine GAUTIER

Project management 2

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
1.5	15					3

Evaluation

One evaluation : *DS*

Bibliography

Références disciplinaires/méthodologiques et/ou ressources documentaires obligatoires :

Finance et pilotage de la performance :

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- Antheaume, Nicolas, and Rima El Sayed. 2024. ?For a Pragmatist Approach to Teaching Accounting for Sustainable Development'. In 34th International Congress on Social and Environmental Accounting Research, https://hal.science/hal-04824073/ (June 2, 2025).

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- Vernimmen, Pierre, Pascal Quiry, Maurizio Dallocchio, Yann Le Fur, and Antonio Salvi. 2014. Corporate Finance: Theory and Practice. John Wiley & Sons.

Références disciplinaires/méthodologiques et/ou ressources documentaires recommandées :

Ethique :

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- Thiétart, R.-A. (2007). Méthodes de recherche en management. Dunod.

- De March, F., Le Goff, J., Noël Lemaître, C., & Reinhold, É. (2025). L'entreprise après #MeToo : Entre romances et violences, que peut le management ? Éditions EMS. ISBN?978 2 38630 286 2

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Sylvaine GAUTIER

Prépa pharma

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst

Evaluation

One evaluation : *Évaluation externe*

Manager : Luc MARCHAL

Prépa pharma - S7

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst

Evaluation

One evaluation : *Évaluation externe*

Manager : Luc MARCHAL

Prépa pharma - S8

Hours

Lect Tut PW Proj WP Exa Asst

Evaluation

One evaluation : *Évaluation externe*

Manager : Luc MARCHAL

Recruitment Pitch

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	15					5

Evaluation

One evaluation : *Situation ind.*

Bibliography

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- MétierScope France Travail - https://candidat.francetravail.fr/metierscope/
- APEC - https://www.apec.fr/

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Sylvaine GAUTIER

Research S7

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			36			

Evaluation

One evaluation : *Situation Ind*

Manager : Antoine GOULLET

Research S8

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			28			

Evaluation

One evaluation : *Situation Ind*

Manager : Antoine GOULLET

Responsible management 1

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	4.5					3

Evaluation

One evaluation : *Rapport groupe*

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Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Dominique BARBELIVIEN

Responsible management 2

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	3					1

Evaluation

One evaluation : *Rapport groupe*

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Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Dominique BARBELIVIEN

Rheology

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3.75	3.75				1.25	8.75

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Explain the fundamental concepts of rheology and the associated quantities	·	·	✓	·	·
• Distinguish between Newtonian and non-Newtonian fluid behavior based on experimental curves.	·	✓	·	·	·
• Identify the appropriate rheological model	·	·	✓	·	·
• Interpret the results of rheological tests	·	✓	·	·	·
• Use mathematical expressions of rheological models to determine the characteristic parameters of a fluid	·	✓	·	·	·

Manager : Annaig COTONNEC

Sensors and Process Control

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	7.5	8			2	25

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Choix de capteurs pour le suivi de réacteurs/bioréacteurs	·	✓	·	·	·
• Acquisition de l'information et traitement du signal	·	·	✓	·	·
• Connaissance des principes des capteurs phyiques-chimiques et biologiques	·	·	✓	·	·

Manager : Mariana TITICA

Sensors project

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			8			8

Evaluation

One evaluation : *Rapport groupe*

Manager : Mariana TITICA

Skills passport day

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	8					2

Evaluation

One evaluation : *AutoévaL*

Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	✓	·	·	·	·
• .	·	✓	·	·	·

Manager : Sylvaine GAUTIER

Statistics and probability

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10	10				1.25	21.25

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Autoévaluation*

Presentation

The course in Statistics and Probability applied to Process and Bioprocess Engineering develops competencies in modelling, analysis, and control of industrial processes by explicitly accounting for the variability and uncertainty inherent in real-world systems.

Drawing on practical contexts of data analysis, performance assessment and process supervision, the course promotes a responsible engineering approach aligned with several Sustainable Development Goals, including clean water and sanitation, responsible consumption, clean energy and climate action.

Finally, by fostering a scientific culture grounded in data-driven reasoning and methodological rigor, the course primarily engages with the domains of research and innovation, while indirectly supporting corporate social responsibility objectives by equipping students with tools for statistical process control, fault diagnosis, and risk and quality management.

Outline

1/ Positioning & Contextualization
. Revisiting the fundamental concepts of statistics and probability
. The role of statistical and probabilistic approaches in engineering sciences
. The value of statistical tools for process control and optimization
2/ Characterizing a statistical population
. Measures of shape, central tendency and dispersion
. Common probability models: binomial, Poisson, exponential, Gaussian (law of large numbers)
3/ Sampling
. Survey sampling theory
. Sample statistics
. Small-sample distributions: Student's t-distribution, chi-square, and Fisher's F-distribution
4/ Estimation & Con_dence Intervals
. Confidence level
. Margin of error, accuracy and reliability
5/ Parametric Hypothesis Testing
. Formulating statistical hypotheses
. Decision rules
. Type I and Type II errors
. Application: chi-square goodness-of-fit test

Goals

This module aims to introduce students to the fundamental statistical tools required for the analysis, modeling, and optimization of processes in chemical engineering and bioprocessing. It emphasizes the rigorous use of experimental and industrial data to support decision-making, validate models, and control process variability.

In this context, the intended teaching objectives of the course are to:

. Prepare students to engage with the non-deterministic reasoning encountered in real-world situations involving signi_cant variability, randomness, and uncertainty.

. Develop the ability to translate a concrete situation expressed in natural language into a formal description using the language of probability.

. Apply statistical and probabilistic tools and methodologies to solve problems in process engineering, particularly in the context of product manufacturing and process control.

. Introduce the general framework of Statistical Process Control (SPC).

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- A. SMOLARZ, Probabilités - Modélisation probabiliste pour l'ingénieur, Technosup, Editions Ellipses, 2010.

- S. MERCIER et F. BERGERET, Systèmes de mesures, estimation, échantillonnage et maîtrise statistique des procédés, Editions Dunod, 2021.

Prerequisites

- Basic knowledge of Statistics and Probability (equiv. to the French Baccalaureat level)

- Fundamentals of mathematical tools such as di_erentiation and integration (equiv. to the French Bac+2 level)

Learning outcomes

Learning outcomes	N	A	M	E	O
• Be able to apply statistical tools and methodological approaches to process and analyze data in engineering contexts	·	·	✓	·	·
• Be proficient in expressing non-deterministic problems using probabilistic language within a given context	·	·	✓	·	·
• Be able to perform analytical problem-solving on real situations modeled with probability theory	·	·	✓	·	·
• Gain insight into selected real-world examples of Statistical Process Control (SPC)	·	✓	·	·	·

Manager : Laurence MIEGEVILLE

Stirring and mixing

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	5	6			1.25	17.25

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Bibliography

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? Handbook of Industrial Mixing: Science and Practice, Edward L. PaulVictor A. Atiemo-ObengSuzanne M. Kresta, John Wiley & Sons, Inc., 2004

Learning outcomes

Learning outcomes	N	A	M	E	O
• · Choisir un mobile d'agitation en fonction des objectifs	·	·	✓	·	·
• · Savoir dimensionnement d'une cuve agitée	·	·	✓	·	·
• · Etre capable d'extrapoler une opération de mélange	·	·	✓	·	·

Manager : Caroline GENTRIC

SuperPro Designer - BI

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
7.5	7.5	4	16		4.5	39.5

Evaluation

2 evaluations :

- *Rapport groupe*
- *Soutenance*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Model and simulate chemical or biotechnological processes	·	✓	·	·	·
• Perform automated mass and energy balances	·	·	✓	·	·
• Analyze the operation of batch and continuous processes	·	✓	·	·	·
• Evaluate the technical, energy, and economic performance of a process	·	✓	·	·	·

Manager : El-Khider SI-AHMED

Supporting change

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
	13.5					3

Evaluation

One evaluation : *DS*

Bibliography

- Autissier D (2024), Néo change
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Learning outcomes

Learning outcomes	N	A	M	E	O
• .	·	✓	·	·	·
• .	·	✓	·	·	·
• .	·	✓	·	·	·

Manager : Anouk GREVIN

Sustainability issues

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
10.5	7.5	1.5				

Evaluation

One evaluation : *DS*

Presentation

Train engineering students on environmental and societal issues by making them aware of the concrete impacts of human activities, and in particular engineering, on various planetary ecosystems, whether at the local or global scale."

Goals

Integrate the fundamental principles and key concepts of a systemic approach. Identify interacting elements in a complex system and trace the links and positive/negative feedback loops at play.

Identify the different complex dimensions of sustainability and make connections between societal, economic, and environmental issues.

Estimate the orders of magnitude related to the state of the world (Earth system and human societies) and the scale of impacts of our lifestyles (energy, food, mobility, consumption including digital), beginning to understand the underlying challenges for a future engineer.

Express emotions in a group setting (e.g., through ?Fresques?) when confronted with the data: biodiversity collapse, pollution, climate change, social inequalities...

Cooperate, collaborate, and think together to challenge habitual ways of living and make them more sustainable.

Identify concrete opportunities to act in a more sustainable and responsible way, impacting the identified issues at one's own scale (link to ?eco? projects).

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- La démence numérique - Manfred Szpizer
- Etudes de Nicolas MEILHAN, conseiller scientifique pour France Stratégie
- L'age des low tech- Philippe BIHOUIX, institut Momentum
- Etudes sur le PETROLE : Matthieu AUZANNEAU, the shift project
- cours de Jean Marc JANCOVICI à Centrale et autres GE sur youtube + BL le monde sans fin), Shift Project & Carbone 4
- SYSTEMIE & RESILIENCE : Arthur KELLER (videos youtube et thinkerview)
- BIODIVERSITE : wwf & reporterre + podcast Presages
- RESILIENCE ALIMENTAIRE : les greniers d'abondance (rapport pdf disponible)
- CLIMAT : résistance climatique / Gildas Veret et son kit « inventons nos vies bas carbone »
- CLIMAT : V Masson Delmotte / J JOUZEL : Thinkerview / Presages
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- Collective Action, Elinor Ostrom, Cambridge University Press, 1990

Learning outcomes

Learning outcomes	N	A	M	E	O
• Incorporate the fundamental principles and core concepts of systems thinking	·	✓	·	·	·
• Recognize the various complex dimensions of sustainability and link societal, economic, and environmental topics	·	✓	·	·	·
• Assess the relative magnitudes concerning the state of the world (Earth system and human societies) and the extent of the impacts of our ways of living	·	✓	·	·	·
• Share and express emotions within a group when confronted with issues such as biodiversity loss, pollution, climate change, and social divides...	·	✓	·	·	·
• Work together, collaborate, and reflect collectively to question our usual lifestyles and make them more sustainable	·	✓	·	·	·
• Recognize practical opportunities to take sustainable and responsible action, making an impact on the identified issues within one's own sphere of influence	·	✓	·	·	·

Manager : Nicolas VERRE

Sustainability tools S6

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
6	9					

Evaluation

One evaluation : *Rapport*

Presentation

After working on the challenges of the Transition at the very beginning of their program (S5), our engineering students will learn to concretely assess the impacts of choices?particularly technological ones?using tools such as Life Cycle Assessment (LCA) and Carbon Footprint analysis. They will also explore ways of designing sustainable options through eco-design.

Goals

To train engineering students in environmental and societal challenges by raising their awareness of the concrete impacts of human activities?particularly engineering activities?on the planet's various ecosystems, at both local and global scales.

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ADEME
Analyse du Cycle de Vie - Comprendre et réaliser une ACV
? Référence pédagogique incontournable en français, claire et concrète.
ISO 14040 / ISO 14044
Management environnemental - Analyse du cycle de vie
? Cadre méthodologique de référence (à utiliser comme norme, pas en lecture exhaustive).
ADEME
Méthode Bilan Carbone®
? Base essentielle pour comprendre la comptabilité carbone et les ordres de grandeur.
Berners-Lee, M. (2020)
How Bad Are Bananas? The Carbon Footprint of Everything
? Excellent ouvrage de sensibilisation, très accessible pour débuter.
ADEME
Écoconception des produits et services
? Introduction claire aux principes et outils de l'écoconception, avec des exemples industriels.

Learning outcomes

Learning outcomes	N	A	M	E	O
• To acquire the methodology for conducting a Life Cycle Assessment (LCA) on a product or a service.	·	·	✓	·	·
• To implement a Life Cycle Assessment (LCA) using an appropriate modeling and simulation tool.	·	✓	·	·	·
• To carry out a critical review of the assumptions and results of a Life Cycle Assessment (LCA).	·	✓	·	·	·
• To acquire the methodology for conducting a greenhouse gas (GHG) inventory / carbon footprint assessment.	·	·	✓	·	·
• To implement a Carbon Footprint assessment using an appropriate spreadsheet tool.	·	✓	·	·	·
• To acquire basic knowledge of the eco-design methodology.	✓	·	·	·	·

Manager : Nicolas VERRE

Sustainable brewery S7

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			36			

Evaluation

2 evaluations :

- *Situation Gpe*
- *Situation Ind*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·

Manager : Luc MARCHAL

Sustainable brewery S8

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
			28			

Evaluation

2 evaluations :

- *Situation Gpe*
- *Situation Ind*

Learning outcomes

Learning outcomes	N	A	M	E	O
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·
• ***	·	·	✓	·	·

Manager : Luc MARCHAL

Systemic analysis

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3.75	7.5				1.25	12.5

Evaluation

One evaluation : *Devoir surveillé*

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	✓	·	·	·

Manager : Luc MARCHAL

Thermochemistry

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5	7.5	8			1.25	24.25

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport groupe*

Bibliography

-GRUGER Alain, Thermodynamique et équilibre chimiques, collection sciences Sup, Dunod, 2004
-DURUPTHY André, Thermodynamique chimique, collection H-Prépa,, Hachette, 1996
-OTURAN/ROBERT, Thermodynamique chimique, collection Grenoble sciences, EDP Sciences, 1997

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	·	✓	·	·
• *	·	·	✓	·	·
• *	·	·	✓	·	·
• *	·	✓	·	·	·

Manager : Stéphane AOUSTIN

Thermodynamic model - ICET

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
3.75	3.75	8			2	17.5

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport individuel*

Bibliography

J.N. Jaubert, R. Privat, (2021) Modèles thermodynamiques pour le génie des procédés. ISTE Editions Ltd.

Vidal J. (1997), Thermodynamique, Application au Génie Chimique et à l'industrie pétrolière, Editions Technip.

McCabe W. ,Smith J., Harriott P. (2004), Unit Operations of Chemical Engineering (7th edition) McGraw Hill, Chemical Engineering Series.

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J. Gmehling, B. Kolbe, M. Kleiber, J. Rarey, (2012) Chemical Thermodynamics for Process Simulation. WILEY- VCH

Olivier Cleynen (2015) Thermodynamique de l'ingénieur. Collection LLB.SCIENCES

Simulis- Thermodynamics. Serveur de calculs de propriétés thermodynamiques et d'équilibres entre phases. Modèles Thermodynamiques, ProSim SA. Version 2.0

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	·	✓	·	·
• *	·	·	✓	·	·

Manager : Walid BLEL

Thermodynamics and Energy

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
11.25	16.25				2.5	30

Evaluation

2 evaluations :

- *Devoir surveillé 1*
- *Devoir surveillé 2*

Bibliography

- CLEYNEN Olivier, thermodynamique de l'ingénieur, https://thermodynamique.fr/framabook-thermodynamique.pdf, 2019.

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- VAN WYLEN Gordon, SONTAG Richard, DESROCHERS Pierre, « Thermodynamique appliquée », 2ème édition, ERPI, Ottawa, Canada, 1992.

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	·	✓	·	·
• *	·	·	✓	·	·
• *	·	✓	·	·	·
• *	·	✓	·	·	·

Manager : Annaig COTONNEC

Turbulence

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
6.25	6.25				1.25	13.75

Evaluation

2 evaluations :

- *Devoir surveillé*
- *Rapport individuel*

Learning outcomes

Learning outcomes	N	A	M	E	O
• *	·	·	✓	·	·
• *	·	✓	·	·	·
• *	·	✓	·	·	·

Manager : El-Khider SI-AHMED

VIP : english and french as a foreign language

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
		15				

Bibliography

? Murphy, R. 2015. Essential Grammar in Use. Elementary. Cambridge
? TOEIC le guide officiel du test, ETS Global
? https://community-courses.memrise.com/community/course/430131/3a-s2-toeic-vocabulary/10/
? https://community-courses.memrise.com/community/course/2233959/3a-s1-polytech-nantes-irregular-verbs-meetings/

Manager : Anna Tataurova

VIP : english and french as a foreign language

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
		15				

Bibliography

? Murphy, R. 2015. Essential Grammar in Use. Elementary. Cambridge
? TOEIC le guide officiel du test, ETS Global
? https://community-courses.memrise.com/community/course/430131/3a-s2-toeic-vocabulary/10/
? https://community-courses.memrise.com/community/course/2233959/3a-s1-polytech-nantes-irregular-verbs-meetings/

Manager : John KINGSTON

Worksheets and Databases

Hours

Lect	Tut	PW	Proj	WP	Exa	Asst
5		6			1.25	12.25

Evaluation

2 evaluations :

- *Rapport individuel*
- *Devoir surveillé*

Learning outcomes

Learning outcomes	N	A	M	E	O
• Import data from external files (e.g., CSV) and organize them in a spreadsheet or database.	·	·	✓	·	·
• Use advanced functions (logical, statistical, and lookup functions) to analyze datasets	·	·	✓	·	·
• Sort, filter, and extract relevant information from data tables	·	·	✓	·	·
• Design a small relational database	·	·	✓	·	·

Manager : Carole CASTAGLIOLA