University of the Philippines
JAN 2 0 2020 VMgre
Date: JAN 1 5 2020

- JAN 2 0 2020

RECEN

DEFICE OF THE F

UNIVERSITY OF THE PHILIPPINES

MARK 17 2020



UNIVERSITY OF THE PHILIPPINES

3F, Quezon Hall, Diliman, Quezon City Tele/Fax: (632) 9264736; 9818500 local 2528 or 2529 Email: ovpaa@up.edu.ph

OFFICE OF THE VICE PRESIDENT FOR ACADEMIC AFFAIRS

15 January 2020

DANILO L. CONCEPCION President University of the Philippines

Dear President Concepcion:

This is to recommend for approval the following curricular proposals of UP Diliman. These proposals were approved by the UP Diliman University Council (see Annex 1).

TATE

- A. College of Architecture
 - 1. Bachelor in Landscape Architecture
- B. College of Arts and Letters
 - 1. Bachelor of Arts (Speech Communication)
 - 2. Bachelor of Arts (Art Studies: Philippine Arts)
 - 3. Bachelor of Arts (Art Studies: Art History)
 - 4. Bachelor of Arts (Art Studies: Interdisciplinary)
 - 5. Bachelor of Arts (European Languages)
 - 6. Bachelor of Arts (Theater Arts) -
- C. College of Education
 - 1. Bachelor of Elementary Education
 - 2. Bachelor of Secondary Education
- D. College of Engineering
 - 1. Bachelor of Science in Mining Engineering
 - 2. Bachelor of Science in Materials Engineering
 - 3. Bachelor of Science in Metallurgical Engineering
 - 4. Bachelor of Science in Geodetic Engineering
 - 5. Bachelor of Science in Computer Science
 - 6. Bachelor of Science in Electrical Engineering
 - 7. Bachelor of Science in Computer Engineering
 - 8. Bachelor of Science in Electronics and Communications Engineering
 - 9. Bachelor of Science in Industrial Engineering
 - 10. Bachelor of Science in Mechanical Engineering
- E. College of Fine Arts
 - 1. Bachelor of Fine Arts (Art Education)
- F. College of Home Economics
 - 1. Bachelor of Science in Family Life and Child Development
 - 2. Bachelor of Science in Hotel, Restaurant and Institution Management
 - 3. Bachelor of Science in Community Nutrition
- G. College of Mass Communication
 - 1. Bachelor of Arts in Journalism

- 2. Bachelor of Arts in Communication Research
- 3. Bachelor of Arts in Film
- 4. Bachelor of Arts in Broadcast Communication
- H. College of Music
 - 1. Bachelor in Music
- I. College of Science
 - 1. Bachelor of Science in Physics
 - 2. Bachelor of Science in Applied Physics (Instrumentation Physics)
 - 3. Bachelor of Science in Applied Physics (Materials Physics)
 - 4. Bachelor of Science in Molecular Biology and Biotechnology
 - 5. Bachelor of Science in Mathematics
 - 6. Bachelor of Science in Biology
- J. College of Social Sciences and Philosophy
 - 1. Bachelor of Arts (Anthropology)
 - 2. Bachelor of Arts (Linguistics)
 - 3. Bachelor of Science (Geography)
 - 4. Bachelor of Arts (History)
- K. College of Social Work and Community Development 1. Bachelor of Science in Social Work
- L. School of Library and Information Science
 - 1. Bachelor in Library and Information Science
- M. School of Statistics
 - 1. Bachelor of Science (Statistics)

Truly yours,

Maria Cynthia Rose Banzon Bautista Vice President for Academic Affairs,

APPROVED

ECUTIVE

Annex 1. List of curricular proposals and dates of UC endorsement and submission of revised proposals to OVPAA

.

Curricular Proposal	UC Endorsement	1st submission of the revised proposal to OVPAA	UC Endorsement	2 nd submission of the revised proposal to OVPAA	UC Endorsement	3rd submission of the revised proposal to OVPAA
College of Architecture						
Bachelor in Landscape Architecture	18-Apr-18	29-May-18	28-May-18	9-Aug-18		
College of Arts and Letters						
Bachelor of Arts (Speech Communication)	19-Jun-18	30-Aug-18				
Bachelor of Arts (Art Studies: Philippine Arts)	19-Jun-18	20-Aug-18				
Bachelor of Arts (Art Studies: Art History)	19-Jun-18	20-Aug-18				
Bachelor of Arts (Art Studies: Interdisciplinary)	19-Jun-18	20-Aug-18				
Bachelor of Arts (European Languages)	2-Sep-19	19-Sep-19	X.			
Bachelor of Arts (Theater Arts)	19-Jun-18	30-Aug-18				
College of Education						
Bachelor of Elementary Education	15-Jul-19 & 2-Sept-19	21-Nov-19				
Bachelor of Secondary Education	15-Jul-19 & 2-Sept-19	21-Nov-19				
College of Engineering						
Bachelor of Science in Mining Engineering	*CC approved	17-Apr-19	24-Jun-19	28-Aug-19		
Bachelor of Science in Materials Engineering	18-Feb-19	7-May-19				
Bachelor of Science in Metallurgical Engineering	*CC approved	28-Nov-18	26-Nov-18	28-Aug-19	15-Jul-19	28-Aug-19
Bachelor of Science in Geodetic Engineering	*CC approved	17-Apr-19	24-Jun-19	19-Sep-19		
Bachelor of Science in Computer Science	19-Jun-18	6-Sep-18				
Bachelor of Science in Electrical Engineering	19-Jun-18	30-Aug-18				
Bachelor of Science in Computer Engineering	19-Jun-18	30-Aug-18				



Curricular Proposal	UC Endorsement	1st submission of the revised proposal to OVPAA	UC Endorsement	2 nd submission of the revised proposal to OVPAA	UC Endorsement	3rd submission of the revised proposal to OVPAA
Bachelor of Science in Electronics and Communications Engineering	19-Jun-18	30-Aug-18				
Bachelor of Science in Industrial Engineering	19-Jun-18	30-Aug-18				
Bachelor of Science in Mechanical Engineering	28-May-18	15-Aug-18				
College of Fine Arts						
Bachelor of Fine Arts (Art Education)	15-Jul-19	5-Aug-19				
College of Home Economics						
Bachelor of Science in Family Life and Child Development	28-May-18	23-Aug-18	18-Feb-19	9-Sep-19		
Bachelor of Science in Hotel, Restaurant and Institution Management	19-Jun-18	20-Aug-18				
Bachelor of Science in Community Nutrition	*CC approved	23-May-18	28-May-18	30-Aug-18		
College of Mass Communication						
Bachelor of Arts in Journalism	19-Jun-18	24-Jun-19				
Bachelor of Arts in Communication Research	28-May-18	20-Aug-18				
Bachelor of Arts in Film	19-Jun-18	30-Aug-18				
Bachelor of Arts in Broadcast Communication (The previous curriculum proposal (2018) was approved by the President on 8 March 2019. The attached proposal is the revised 2018 curriculum)	15-Jul-19	5-Aug-19				
College of Music						
Bachelor in Music	*CC approved	29-Nov-18	26-Nov-18	17-Oct-19		
College of Science						
Bachelor of Science in Physics	19-Jun-18	20-Aug-18				

1999 - 20 MA

OFFICIAL RELEASE

		1 st submission		2 nd submission		3rd submission
Curricular Proposal	UC Endorsement	of the revised proposal to	UC Endorsement	of the revised proposal to	UC Endorsement	of the revised proposal to
		OVPAA		OVPAA		OVPAA
Bachelor of Science in Applied Physics (Instrumentation Physics)	19-Jun-18	20-Aug-18				
Bachelor of Science in Applied Physics (Materials Physics)	19-Jun-18	20-Aug-18				
Bachelor of Science in Molecular Biology and Biotechnology	28-May-18	20-Aug-18				
Bachelor of Science in Mathematics	19-Jun-18	20-Aug-18				
Bachelor of Science in Biology	19-Jun-18	20-Aug-18				
College of Social Sciences and Philosophy						
Bachelor of Arts (Anthropology)	19-Jun-18	20-Aug-18		1 July 2019 (replacement of proposed & final checklist)		
Bachelor of Arts (Linguistics)	28-May-18	24-Aug-18				
Bachelor of Science (Geography)	19-Jun-18	5-Sep-18				
Bachelor of Arts (History)	28-May-18	24-Jun-19				
College of Social Work and Community Development						
Bachelor of Science in Social Work	19-Jun-18	20-Aug-18				
School of Library and Information Science					2	
Bachelor in Library and Information Science	28-May-18	15-Aug-18				
School of Statistics						
Bachelor of Science (Statistics)	19-Jun-18	23-Aug-18				



20 August2018

Referred to : VP Bautista

For Appropriate Action, please

Ref. No. & Date	Title	Date Received/DTS Nos.
Ref. No. MLT 18-427,	Proposal for the Revision of the Bachelor of Science in	17August2018
dtd 16August2018	Mathematics Program (Appendix ZZ)	2018-0815-0011-8375
Ref. No. MLT 18-428,	Proposal for the Revision of the Bachelor of Arts in	17August2018
dtd 16August2018	Communication Research Program (Appendix JJ)	2018-0815-0011-8376
Ref. No. MLT 18-429,	Proposal for the Revision of the Bachelor of Science in Social	17August2018
dtd 16August2018	Work (Appendix AJ)	2018-0815-0011-8374
Ref. No. MLT 18-430,	Proposal for the Revision of the Bachelor of Arts	17August2018
dtd 16August2018	(Anthropology) (Appendix NN)	2018-0815-0011-8373
Ref. No. MLT 18-431,	Proposal for the Revision of the Bachelor of Science in	17August2018
dtd 16August2018	Molecular Biology Program (Appendix GG)	2018-0815-0011-8372
Ref. No. MLT 18-432,	Proposal for the Revision of the Bachelor of Science in Biology	17August2018
dtd 16August2018	(Appendix YY)	2018-0815-0011-8370
Ref. No. MLT 18-433, dtd 16August2018	Curricular proposals (<i>Appendix OO</i> , Revision of Bachelor of Arts [Art Studies: Philippine Art] program College of Arts and Letters); (<i>Appendix PP</i> , Revision of Bachelor of Arts [Art Studies: Art History] program, CAL); (<i>Appendix QQ</i> , Revision of Bachelor of Arts [Art Studies: Interdisciplinary] program, CAL)	17August2018 2018-0815-0011-8369
Ref. No. MLT 18-434, dtd 16August2018	Curricular Proposal (Appendix AB, Revision of Bachelor of Science in Physics) Program, College of Science; (Appendix AC, Revision of Bachelor of Science in Applied Physics [Instrumental Physics] program, CS); Appendix AD, Revision of Bachelor of Science in Applied Physics [Materials Physics] program, CS)	17August2018 2018-0815-0011-8371
Ref. No. MLT 18-435,	Proposal for the Revision of the Bachelor of Science in Hotel,	20August2018
dtd 17August2018	Bestaurant and Institution Management (Appendix RR)	2018-0815-0011-8379

Instrumentation

Atty. Roberto M.J. Lara

Secretary of the University and of the Board of Regents



OFFICE OFFITE CAPACIDEALOR for Austerna Astronomical OR Busice 20 A S 20/V Bypy W

REFERENCE NO. MLT-18-434

Atty. Danilo L. Concepcion President University of the Philippines System Diliman, Quezon City

Dear President Concepcion:

UNIVERSITY OF THE PHILIPPINES DILIMAN QUEZON CITY

VOIP TRUNKLINE: 981-8500 LOCAL: 2558, 2556 DIRECT LINE: (632) 929-5401, (632) 927-1835 FAX: (632) 928-2863 E-MAIL: chancellor.updiliman@up.edu.ph

16 August 2018

on the sucretary of the one of th hoministrative Section RECEIVED BY: mil AUG 2018 17 Date:

I would like to submit for your consideration and approval the curricular proposals endorsed by the University Council at its (special) meeting held on 19 June 2018.

Appendix AB	Revision of Bachelor of Science in Physics Program College of Science
Appendix AC	Revision of Bachelor of Science in Applied Physics (Instrumentation Physics) Program College of Science
Appendix AD	Revision of Bachelor of Science in Applied Physics (Materials Physics) Program College of Science

Very truly yours,

MICHAEL L. TAN, PhD Chancellor



Encl.: 1 copy of the proposal

Thank you.



UNIVERSITY OF THE PHILIPPINES DILIMAN Office of the University Registrar

T.M. Kalaw St. corner Quirino St., U.P. Diliman, Q.C. 1101 • P.O. Box 161, U.P. Diliman, Q.C. 1101 Direct Line 927-6084 • U.P. Diliman Trunk Line No. 981-8500

> OUCAA AUG 14 18 PN4:10 003186

10 August 2018

MICHAEL L. TAN, DVM, PhD Chancellor University of the Philippines Diliman, Quezon City

RECEIVED OFFICE OF THE CHANCELLOR University of the Philippines Diliman Date: AUG 1 5 2016 Time: By: 11.10

THROUGH:

Vice Changellor Evangeline C. Amor, PhD Office of the Vice Chancellor for Academic Affairs

Dear Chancellor Tan:

I would like to submit for your consideration and endorsement to the President the curricular proposals endorsed by the University Council at its (special) meeting held on 19 June 2018.

- Appendix AB Revision of the Bachelor of Science in Physics Program College of Science
- Appendix AC Revision of the Bachelor of Science in Applied Physics (Instrumentation Physics) Program College of Science
- Appendix AD Revision of the Bachelor of Science in Applied Physics (Materials Physics) Program College of Science

Sincerely,

T. PAYONGAYONG, PhD University Registrar and UPD UC CC Member-Secretary

Encl. 1 copy of the proposal



Admission & Registration Section VOIP Nos. 4555, 4556, 4557 / admission.our@upd.edu.ph • CRSRS VOIP Nos. 4560, 4565 / crssupport@list.upd.edu.ph Records Management & Appraisal Section VOIP Nos. 4559, 4563 / records.our@upd.edu.ph • Transcript of Records Section VOIP Nos. 4561, 4562 / transcript@upd.edu.ph Central Administrative Section VOIP Nos. 4551-4553 / admin.our @upd.edu.ph • ID Room VOIP Nos. 4564 Publications & UC Secretariat Section VOIP Nos. 4554, 4558 / puess_our.updiliman@cup.edu.ph

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 1/16

NATIONAL INSTITUTE OF PHYSICS 1 **College of Science** 2 University of the Philippines 3 4 Diliman, Quezon City 5 PROPOSED CURRICULAR REVISION OF THE BACHELOR OF SCIENCE 6 IN APPLIED PHYSICS (INSTRUMENTATION PHYSICS) PROGRAM 7 8 I. Background/Rationale 9 10 Students who have taken the K-12 basic education program are entering the university 11 in AY 2018-2019. Internationally, a 4-year BS Applied Physics program is typical 12 after a basic K-12 education. 13 14 The BS Applied Physics program adopted a 5-year curriculum effective AY 1984-15 1985 to enhance the offering of the Institute, with Applied Physics 199 (Independent 16 Research) and Applied Physics 200 (Undergraduate Thesis) to be taken in the 5th year. 17 Since then, it has become an institutional practice to accept students into the research 18 laboratories in their 3rd or early 4th year in preparation for their thesis. This practice 19 has been validated by the increased enrollment in the graduate Physics program. 20 Graduates of the program have found employment in fields ranging from the 21 semiconductor industry to the more nascent sector of data analytics. Mentoring inside 22 a research lab goes beyond providing a nurturing environment for writing a thesis. 23 Exposure to issues of national development and industry needs are encountered inside 24 labs that require an infusion of grants from the national government and other 25 26 institutions. 27 Without losing the gains of mentoring inside the research laboratories while still 28 maintaining the level of rigor of the courses, this proposal aims to change the length 29 of the BS Applied Physics program, which was last updated in June 2012, from 5 30 years to 4 years. There is a need to streamline the courses to make the program more 31 responsive to the demands of a fast-changing environment both in a national as well 32 as a global context. Enhancing the depth and breadth of courses becomes possible 33 with the increased background preparation and maturity of students entering the 34 35 program, and pedagogical and technological advances. Reflective of these ideas are: (1) institution of new courses without changing the course titles for the fundamental 36 physics series, mathematical physics series, and the classical mechanics series; (2) 37 reconfiguration of the experimental physics laboratories; (3) institution of 38 electives geared towards understanding physics concepts in depth; (4) revision of 39 existing courses to cover the physics of enabling technologies such as photonics and 40 optoelectronics; and (5) merging of existing courses that evolved to have significant 41 overlap. 42 43 Concurrently existing courses may have the same title but different course numbers: 44 and the Unive there is a plan to eventually change the new course numbers back to the old ones (e.g. 45 Physics 106 will be renumbered to Physics 101 after the transitory period). 46 47 OFFICIAL This proposal also reflects the revised GE requirements approved by the BOR in 48 RELEASE October 2017. 49 50

JAN 2 0 2020

The proposed chang			
	ges are:		
A. Institution o	f Courses		
B. Change in P	rogram Requirements		
Institution of course			
1. App Physics	157 Computational Analysis and Modeli	ng in Physics	
3 App Physics	184 Physical Electronics and Instrument	ation	
Change in program	requirements	4000	
Nature	Existing	Proposed	
1. Change in GE	Core – 18 units	Core – 21 units	
requirements	AH-9 units	Program-	
	MST - 3 units	prescribed -3	
	SSP = 6 units	units	
	MST = 3 units	Free $GE = 0$ units	
	Free $GE - 18$ units	10tal = 24 units	
	AH – 6 units		
	SSP – 9 units		
0. 10. 1. 1. 0.	Total = 36 units		
2. Deletion of	1. Math 14 Trigonometry or Math 17 A	lgebra and	
program	2 Math 53 Elementary Analysis I		
program	3. Math 54 Elementary Analysis I		
	4. Math 55 Elementary Analysis III		
	5. Math 121.1 Elementary Differential	Equations	
	6. BIO 11 (old course)		
	7. Chem 16 (old course)		
	9 Physics 101 Fundamental Physics L		
	10. Physics 102 Fundamental Physics I		
	11. Physics 103 Fundamental Physics II	Į.	
	12. Physics 104 Modern Physics I		
	13. Physics 101.1 Fundamental Physics	l Laboratory	
	14. Physics 102.1 Fundamental Physics	Laboratory	
	16 Physics 103.1 Fundamental Physics	III Laboratory	
	17. Physics 111 Mathematical Physics I	oratory	
	18. Physics 112 Mathematical Physics II		
	19. Physics 113 Mathematical Physics II	I	Unive
	20. Physics 121 Theoretical Mechanics I	101 Y	
	21. App Physics 156 Computer Methods	in Physics II 🔗 🙋	FFICI
	22. App Physics 186 Instrumentation Ph	ysics II 👸 🛛 🦉	ELEA
	23. Physics 166 Optical Physics II		U

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 3/16

	MALL I
	Modeling
	27. App Physics 185 Instrumentation Physics I
	28. App Physics 173 Solid State Physics
4. Addition of	1. Math 21 Elementary Analysis I
required courses	2. Math 22 Elementary Analysis II
to the program	3. Math 23 Elementary Analysis III
	4. Math 122 Differential Equations and Applications
	5. Chem 16 General Chemistry I
	6. Chem 16.1 General Chemistry I Laboratory
	7. BIO 11 Fundamentals of Biology I
	8. BIO 11.1 Fundamentals of Biology I Laboratory
	9. Science/Math Elective $(3 u 5 u.)$
	10. Physics 106 Fundamental Physics I
	11. Physics 107 Fundamental Physics II
	12. Physics 108 Fundamental Physics III
	13. Physics 106.1 Fundamental Physics I Laboratory
	14. Physics 107.1 Fundamental Physics II Laboratory
	15. Physics 116 Mathematical Physics I
	16. Physics 117 Mathematical Physics II
	17. Physics 126 Theoretical Mechanics I
	18. Physics 142 Quantum Physics II
	19. Physics 170 Condensed Matter
	20. App Physics 157 Computational Analysis and Modeling in
	Physice
	21 A DI LO LO LO L
	21. App Physics 167 Applied Optics
	22. App Physics 184 Physical Electronics and Instrumentation
6. Addition of	1. BIO 12 Fundamentals of Biology II
elective courses	2. BIO 12.1 Fundamentals of Biology II Laboratory
	3. Chem 17 General Chemistry II
	4. Chem 17.1 General Chemistry II Laboratory
	5. Geol 41 Elementary Mineralogy and Microscopy
	6. Marine Science 101 Oceans
	7. Marine Science 102 The Marine Sciences
	8. Math 109 Fundamental Concepts of Mathematics
	 Math 109 Fundamental Concepts of Mathematics MBB 10 Introduction to Molecular Biology
	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology
7. Change in	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1 Chem 16
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 181
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 181 5. Physics 141
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 155 5. Physics 181 5. Physics 141 6. Physics 161
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 155 4. App Physics 181 5. Physics 181 5. Physics 161 7. Physics 165
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 155 5. Physics 181 5. Physics 161 7. Physics 165 8. Physics 191
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 155 4. App Physics 181 5. Physics 181 5. Physics 161 7. Physics 165 8. Physics 191 9. Physics 192
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 155 4. App Physics 181 5. Physics 141 6. Physics 161 7. Physics 165 8. Physics 191 9. Physics 192 10. Physics 196
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 155 4. App Physics 181 5. Physics 161 7. Physics 165 8. Physics 191 9. Physics 192 10. Physics 196 11. App Physics 100
7. Change in course sequence	 8. Math 109 Fundamental Concepts of Mathematics 9. MBB 10 Introduction to Molecular Biology 10. Meteorology 101 General Meteorology 1. Chem 16 2. BIO 11 3. App Physics 155 4. App Physics 155 4. App Physics 181 5. Physics 141 6. Physics 161 7. Physics 165 8. Physics 191 9. Physics 192 10. Physics 196 11. App Physics 199 12. App Physics 200

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 4/16

	 NSTP 1 NSTP 2 PI 100 	,	
8. Change in total number of units	179	148-150	
9. Change in number of years of the program	5	4	
III. Institution of C	ourses		
1. App Physics Computation stochastic sir	157 Computational A al models in physics; mulation and algorithms	Analysis and Modeling in Physics. umerical simulations of physical system s; image processing; multidimensional	15;
detection tee	hniques; pattern recogn	ition	
Prerequisite	Applied Physics 155		
Meeting Typ	e: Lecture / Laboratory		
Credit:	4 u. (3h lec, 3h lab)		
Justification:	Hands-on experience in	n using numerical/computational	
	techniques for solving j	problems in applied physics is emphasized	zed
	in this course. It covers	the more advanced topics of simulating	3
2	physical systems and m	nultidimensional detection methods. A	
	background in numeric	al computing as covered in App Physic	S
	155 is required in this c	course.	
Programs at	Factad: BS Physics	C.	
i rograms aj	feeled. DS T flysles		
2. App Physics	s 167 Applied Optics.	Microscopy, holography and	
interferomet	ry, Fourier optics, spect	roscopy and nonlinear optics, imaging	
optics, 3D in	naging	1,5	
Prerequisite	: Physics 165	C .	
Meeting Typ	e: Lecture		
Credit:	3 u. (3h)		
Justification	: This course covers es	sential topics in optics and photonics w	ith
	an emphasis in imagin	ng and optical characterization. An	
	adequate background	in optics (covered in Physics 165) is	
1.2	needed in this course.	19 15 18 18	
Programs af	<i>fected</i> : BS Physics		
3. App Physic:	s 184 Physical Electro	nics and Instrumentation. Analog-dig	ital unive
conversion a	nd multiplexing; compu	uter hardware and interfacing;	8
microproces	sors and machine langu	age programming; applications of 👘 🍦	OFFIC
microproces	sors. Sensors, transduce	ers, and measurement techniques for 🚆	RELEA
various phys	acal variables; signal co	onditioning, digitization and sampling;	V
signal proces	ssing and reliability of c	lata.	IAN 20
			JAN (U

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 5/16

1	Prerequisite: App Physics 181
2	Credit: 4 u. (3h lec, 3h lab)
3	Meeting Type: Lecture / Laboratory
4	Justification: This course consolidates the core physical concepts in
5	understanding digital instrumentation. Topics include
6	conversion of analog to digital signals, signal processing,
7	conditioning, analysis and control. A background in elementary
8	electronics as covered in App Physics 181 (Physical Electronics
9	I) is needed in this course.
10	
11	Programs affected: BS Physics, BS Applied Physics (Instrumentation Physics)

13 IV. Change in Program Requirements

14 15

12

A. Change in GE Requirements

From:

To:

- 16 17
- 18 19

AH MST SSP Total Required GE Comm 3 STS KAS 1 Eng 10 Philo 1 Fil 40 9 units 3 units 6 units 18 units Program-Physics 10 prescribed 3 units 3 units Free Choice 0 units 6 units 9 units 15 units TOTAL 15 units 6 units 15 units 36 units

20

21 22

Required GE	ENG 13 / Speech 30 FIL 40 ARTS 1 DRMAPS / STS 1 Soc Sci 1 / Soc Sci 2 KAS 1 Philo 1	21 units	
Program-prescribed	Physics 10	3 units	
GE Elective		0 units	
TOTAL		24 units	

23 24

25

26

27

Justification: The changes reflect the revision of the GE framework approved by the BOR in October 2017. The list of required GE courses is updated.

by the BOR in October 2017. The list of required GE courses is updated. Physics 10 is retained as a program-prescribed GE course, as it covers topics that are not included in the majors courses.

Univ

OFFICIAL

RELEASE

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 6/16

1 /	A. Deletion of Courses
3	1. Math 14 Trigonometry or Math 17 Algebra and Trigonometry
4	2. Math 53 Elementary Analysis I
5	3 Math 54 Elementary Analysis I
5	4 Moth 55 Elementary Analysis II
6	4. Wrath 55 Elementary Analysis III
7	5. Math 121.1 Elementary Differential Equations
8	Justification: The K12 stream for Math, Science and Engineering majors is
9	assumed to adequately prepare the students for the BS Physics program.
0	These Math courses have been abolished by the institute of Math and
1	replaced by Math 21-23, and Math 122.
2	
3	6. Chem 16 General Chemistry I (old course)
4	7. Chem 17 General Chemistry II (old course)
5	8. BIO 11 Fundamentals of Biology I (old course)
6	Justification: Chem 16 (old course) is replaced by the new offering Chem
7	16 / Chem 16.1. BIO 11 (old course) is replaced by the new offering
В	BIO 11/ BIO 11.1. Chem 17 (old course) is deleted, while Chem 17/
9	Chem 17.1 is added to the list of Science / Math electives.
D	
1	9. Physics 101 Fundamental Physics I
2	10. Physics 102 Fundamental Physics II
3	11. Physics 103 Fundamental Physics III
4	12. Physics 104 Modern Physics I
5	
6	Justification: This program is affected by the changes instituted in the BS
7	Physics program, wherein the Physics 101-103 (Fundamental Physics)
8	and Physics 104-105 (Modern Physics) series are replaced by the
9	Physics 106-108 series (Fundamental Physics).
0	
1	13. Physics 101.1 Fundamental Physics I Laboratory
2	14. Physics 102.1 Fundamental Physics II Laboratory
3	15. Physics 103.1 Fundamental Physics III Laboratory
4	<i>Justification</i> : This program is affected by the changes instituted in the
5	BS Physics program, wherein the Physics 101.1-103.1 (Fundamental
7	Physics 1-111 Laboratory) are replaced by Physics 106.1 and Physics 107.1 (Fundamental Physics I & II Laboratory)
0	107.1 (Fundamental Flysics I & II Laboratory).
0	16 Physics 104.1 Modern Physics I.I. above town
0	<i>Instituted</i> in the program is affected by the changes instituted in the
1	BS Physics program, wherein the Physics 104 1 (Modern Physics
2	Laboratory) has been absorbed in Physics 101-102 (Experimental
2	Physics I-II)
4	1 hy 5105 1-11).
5	17. Physics 111 Mathematical Physics I
6	18. Physics 112 Mathematical Physics I
7	19. Physics 113 Mathematical Physics III
Test III	RELEASE

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 7/16

1	
2	Justification: This program is affected by the changes instituted in the BS
3	Physics program, wherein Physics 111-113 (Mathematical Physics I-
4	III. 3 x 3 u.) are replaced by Physics 116-117 (Mathematical Physics I
5	& $\mathbb{I}(2 \times 5 \mathbb{I})$
6	
7	20. Physics 121. Theoretical Mechanics I
9	20. Thysics 121 Theoretical Meenanics 1
0	<i>Instification</i> : This program is affected by the changes instituted in the BS
10	Physics program, wherein Physics 121 (3 u) is replaced by Physics
11	126 (Theoretical Mechanics I, 4 u.)
11	120 (Theoretical Meenames 1, 4 u.).
12	21 Ann Bhusias 156 Computer Matheds in Bhusias U
13	21. App Physics 156 Computer Methods in Physics II
14	22. App Physics 186 Instrumentation Physics II
15	
16	Justification: App Physics 156 (4 u.) covers advanced computer
17	programming methods, numerical modeling and simulatons,
18	discrete models, stochastc methods, and current approaches in
19	numerical modeling. App Physics 186 (4 u.) covers imaging systems
20	and image processing, multdimensional detecton techniques, and
21	pattern recogniton. Due to the computational nature of both courses, all
22	essential topics in these courses are covered more efficiently in the
23	newly instituted App Physics 157 (Computational Analysis and
24	Modeling in Physics, 4 u.).
25	
26	23. Physics 166 Optical Physics II
27	24. App Physics 187 Photonics and Applied Optics
28	
29	Justification: Physics 166 (3 u.) covers coherence theory, Fourier optes
30	and imaging, basic microscopy, spectroscopy, and nonlinear optics.
31	App Physics 187 (4 u.) covers the design of data acquisiton systems
32	(DAQ)/signal processing-based instrumentaton systems, current topics
33	and techniques for engineering and design of optcal instruments, non-
34	destructve testng/measurement using optcal methods, and
35	interferometry. All essential topics in these courses are covered more
36	efficiently in the newly instituted App Physics 167 (Applied Optics, 3
37	u.) and the revised Physics 161 (Introductory Laser Physics and
38	Photonics, 3 u.). Essential lab experiments in App Physics 187 (4 u.)
39	are absorbed in Physics 191-192 (Experimental Physics I-II).
40	
41	25. App Physics 182 Physical Electronics II
42	26. App Physics 183 Control Systems Approach to Physics Modeling
43	27. Ann Physics 185 Instrumentation Physics I
43	27. rep 1 nystes 105 mist differentiation 1 nystes 1
45	Justification: Signal detection conditioning processing analysis and
45	control are the core ideas needed by an undergraduate Applied Physics
47	major to tackle problems in instrumentation. With the recent advances
48	in commodity-pricing of microprocessors, microcontrollers, and
10	sensors (e.g. Arduino, RasPi) and the availability of high laval
50	languages for implementation, the assential topics in these courses and
50	anguages for implementation, the essential topics in these courses are
	Pricial Official
	S PELEASE

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 8/16

 now more efficiently covered in the newly instituted App Physics (Physical Electronics and Instrumentation, 4 u.). 28. App Physics 173 Solid State Physics Justification: The topics in Physics 170 covers all the topics of App Physics 173, tus can appropriately replace the course. App Physics (cleartie, magnetic, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) cover scrystal structure; mechanical, thermal, electric, and magnetic propertes of solids; band theory of solids; insulators, and semiconductors; lattice vibratons; insulators, and semiconductors; distication: Wath 21/21.1 (Elementary Differential Equation		
 (Physical Electronics and Instrumentation, 4 u.). 28. App Physics 173 Solid State Physics <i>Justification:</i> The topics in Physics 170 covers all the topics of App Physics 173 (3 u.) cover crystal structure of solids; lattice vibratons; band theory of solids; metals; semiconductor materials and devices; gieldetrie, magnetie, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magneti propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses 1. Math 21 Elementary Analysis I 2. Math 22 Elementary Analysis II 3. Math 23 Elementary Analysis II 3. Math 23 Elementary Analysis II 4. Math 12 Differential Equations and Applications 21 Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology 1^e 8. BIO 11.1. Fundamentals of Biology 1 Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con unber of the (old course) Chem 16 (General Chemistry 5 u.) to 22 with separate numbering for the lecture and lab components (Chem 3 u. and Chem 16.1, 2u.). The same is true for BIO 11 (BIO 11, 3 u.) and Chem 16.1, 2u.). The same is true for BIO 11 (BIO 11, 3 u.) and Chem 16.1, 2u.). The same is true for BIO 11 (BIO 11, 3 u.) and Chem 17.1, Genl 40, Marine Science 101, Marine Sci 9. Science/Math Elective (3 u. – 5 u.) 1. Justification: With their increased background preparation, students abe allowed, with the consent of their adviser, to select		now more efficiently covered in the newly instituted App Physics 184
 28. App Physics 173 Solid State Physics Justification: The topics in Physics 170 covers all the topics of App Physics 173, thus can appropriately replace the course. App Physic 173 (3 u.) cover crystal structure of solids; lattice vibratons; band theory of solids; metals; semiconductor materials and devices; dielectric, magnetic, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magnetic propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses 1. Math 21 Elementary Analysis II 2. Math 22 Elementary Analysis III 3. Math 23 Elementary Analysis III 3. Math 22 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), w were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology 1* 8. BID 11.1 Fundamentals of Biology 1 Laboratory* *subject to approval Justification: The addition of these courses reflect the updated co number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Cher au. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) 1. Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 41. 102, Math 109, Meteorology 101, or any fundamental science/ 42. course for which he/she has satisfied the pr		(Physical Electronics and Instrumentation, 4 u.).
 28. App Physics 173 Solid State Physics Justification: The topics in Physics 170 covers all the topics of App Physics 173, thus can appropriately replace the course. App Physic 173 (3 u.) cover crystal structure of solids; lattice vibratons; band theory of solids; metals; semiconductor materials and devices; dielectric, magnetic, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magneti propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses 1. Math 21 Elementary Analysis II 3. Math 22 Elementary Analysis II 4. Math 122 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/21.1 (Elementary Differential Equations), w were abolished by the Institute of Math. 5. Chem 16 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated co number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 30. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) 1. Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. <!--</td--><td></td><td></td>		
 Justification: The topics in Physics 170 covers all the topics of App Physics 173, thus can appropriately replace the course. App Physic 173 (3 u.) cover crystal structure of solids; lattice vibratons; band theory of solids; metals; semiconductor materials and devices; dielectric, magnetic, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magneti propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses 1. Math 21 Elementary Analysis I 2. Math 22 Elementary Analysis II 3. Math 23 Elementary Analysis III 4. Math 122 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), w were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I 7. BIO 11 Fundamentals of Biology 1* 8. BIO 11.1 Fundamentals of Biology I Laboratory* * subject to approval Justification: The addition of these courses reflect the updated co number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chen 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) 1. Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 40. 102, Math 109, Meteorology 101, or any fundamental science/ 41. 41.<td></td><td>28. App Physics 173 Solid State Physics</td>		28. App Physics 173 Solid State Physics
 Physics 173, thus can appropriately replace the course. App Physics 173 (3 u.) cover crystal structure of solids; lattice vibratons; band theory of solids; metals; semiconductor materials and devices; dielectric, magnetic, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magnetic propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis III Math 23 Elementary Analysis III Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16 General Chemistry I Laboratory BIO 11.1 Fundamentals of Biology 1* BIO 11.1 Fundamentals of Biology 1 Laboratory* *subject to approval Justification: The addition of these courses reflect the updated co number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3 u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 		Justification: The topics in Physics 170 covers all the topics of App
 173 (3 u.) cover crystal structure of solids; lattice vibratons; band theory of solids; metals; semiconductor materials and devices; dielectric, magnetic, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magneti propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses 1. Math 21 Elementary Analysis I 3. Math 22 Elementary Analysis II 3. Math 23 Elementary Analysis III 4. Math 12.2 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), w were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11.1 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated ect number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3 u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bra range of science fundamental courses, such as BIO 12 and/or range of science fundamental courses, such as BIO 12 and/or range of science fundamental courses for the science 101, Marine Sci 9. Science/Math 109, Meteorology 101, or any fundamental science/42 course for which he/she has satisfied the prerequisite, that would a him/he		Physics 173, thus can appropriately replace the course. App Physics
 theory of solids; metals; semiconductor materials and devices of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magneti propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16 General Chemistry I Laboratory B. BIO 11.1 Fundamentals of Biology I* B. BIO 11.1 Fundamentals of Biology I* Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3 u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brange of science fundamental courses, such as BIO 12 and/or range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/42 course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 		173 (3 u.) cover crystal structure of solids; lattice vibratons; band
 delectric, magnetic, thermal, optical, and mechanical propertes of solids; and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magnetipropertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III Math 23 Elementary Analysis III Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16.1 General Chemistry I Laboratory Chem 16.1 General Chemistry I Laboratory BiO 11.1 Fundamentals of Biology 1* BiO 11.1 Fundamentals of Biology 1* BiO 11.1 Fundamentals of Biology 1 Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u) BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/ 102, Math 109, Meteorology 101, or any fundamental science/ 42 course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 		theory of solids; metals; semiconductor materials and devices;
 solidas, and superconductors. Physics 170 (Condensed Matter, 3 u.) covers crystal structure; mechanical, thermal, electric, and magneti propertes of solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III B. Math 122 Differential Equations and Applications Math 23 Elementary Analysis III Math 23 Elementary Analysis III Math 23 Elementary Analysis III Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16 General Chemistry I Laboratory Chem 16.1 General Chemistry I Laboratory BIO 111 Fundamentals of Biology I* BIO 111 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3, and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/102, Math 109, Meteorology 101, or any fundamental science/102, Math 109, Meteorology 101, or any fundamental science/102, Math 109, Meteorology 101, or any fundamental science/103 their he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 		dielectric, magnetic, thermal, optical, and mechanical properties of
11 body Solids; band theory of solids; metals, insulators, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. 13 semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. 16 B. Addition of Required Courses 17 1. Math 21 Elementary Analysis II 18 2. Math 22 Elementary Analysis II 19 3. Math 23 Elementary Analysis III 20 4. Math 122 Differential Equations and Applications 21 Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. 22 5. Chem 16 General Chemistry I 23 6. Chem 16.1 General Chemistry I Laboratory 24 7. BIO 11 Fundamentals of Biology I* 25 8. BIO 11.1 Fundamentals of Biology I Laboratory* 26 0. Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u 30 Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3 du BIO 11.1, 2u). 36 9. Science/Math Elective (3 u. – 5 u.) 37 Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of		solids; and superconductors. Physics 170 (Condensed Matter, 3 u.)
 propertes of softed needy of softed spinors, includes, instantors, and semiconductors; lattice vibratons; imperfections; superconductivity and superfluidity. B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory BIO 11 Fundamentals of Biology I* BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 30. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 		properties of solids; hand theory of solids; metals, insulators, and
 and superfluidity. B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory Blo 11.1 Fundamentals of Biology I* Blo 11.1 Fundamentals of Biology I * subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 30. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brown and chem 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 		semiconductors: lattice vibratons: imperfections: superconductivity
 B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III Math 122 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory BIO 11.1 Fundamentals of Biology I* BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated connumber of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	43 12	and superfluidity
 B. Addition of Required Courses Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III Math 23 Elementary Analysis III Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory BIO 11.1 Fundamentals of Biology I* BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 		and superinducty.
 Math 21 Elementary Analysis I Math 22 Elementary Analysis II Math 23 Elementary Analysis III Math 122 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory BIO 11.1 Fundamentals of Biology I* BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Cher 30. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ 2102, Math 109, Meteorology 101, or any fundamental science/ 2203 (2013) and deeper understanding of the core concepts of an 16eld. 	. 1	ddition of Required Courses
 2. Math 22 Elementary Analysis II 3. Math 23 Elementary Analysis III 4. Math 122 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), w were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 30. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 		1. Math 21 Elementary Analysis I
 3. Math 23 Elementary Analysis II 3. Math 23 Elementary Analysis III 4. Math 122 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated econ number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 30. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	ł	2. Math 22 Elementary Analysis II
 4. Math 122 Differential Equations and Applications Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated economber of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	, 1	3 Math 23 Elementary Analysis II
 Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), w were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory BIO 11 Fundamentals of Biology I* BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated conumber of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	, ,	4. Math 122 Differential Equations and Applications
 Justification: Math 21-23 replaces the Math 53-55 series, while Math replaces Math 121/121.1 (Elementary Differential Equations), we were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory BIO 11 Fundamentals of Biology 1* BIO 11.1 Fundamentals of Biology 1 Laboratory* *subject to approval Justification: The addition of these courses reflect the updated ec number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chen 30 a. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field.)	4. Wath 122 Differential Equations and Applications
 replaces Math 121/121.1 (Elementary Differential Equations), were abolished by the Institute of Math. Chem 16 General Chemistry I Chem 16.1 General Chemistry I Laboratory Chem 16.1 General Chemistry I Laboratory BIO 11 Fundamentals of Biology I* BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated economber of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of am field. 		Justification: Math 21-23 replaces the Math 53-55 series, while Math 122
 were abolished by the Institute of Math. 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated consumer of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brownange of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of am field. 	2	replaces Math 121/121.1 (Elementary Differential Equations), which
 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated connumber of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brownange of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of am field. 	3	were abolished by the Institute of Math.
 5. Chem 16 General Chemistry I 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated consumer of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 30. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brown range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	1	
 6. Chem 16.1 General Chemistry I Laboratory 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated conumber of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brown ange of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of am field. 	5	5. Chem 16 General Chemistry I
 7. BIO 11 Fundamentals of Biology I* 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brown ange of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	5	6. Chem 16.1 General Chemistry I Laboratory
 8. BIO 11.1 Fundamentals of Biology I Laboratory* *subject to approval Justification: The addition of these courses reflect the updated con number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brown range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/Log Math 109, Meteorology 101, or any fundamental science/Log Course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of amfield. 	7	7. BIO 11 Fundamentals of Biology I*
 subject to approval Justification: The addition of these courses reflect the updated connumber of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brown range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/ Course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	3	8. BIO 11.1 Fundamentals of Biology I Laboratory
 Justification: The addition of these courses reflect the updated construction of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chemistry 3 u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brogrange of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/41 102, Math 109, Meteorology 101, or any fundamental science/42 course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of and field.)	*subject to approval
 Justification: The addition of these courses reflect the updated consumer of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brown range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science/41 102, Math 109, Meteorology 101, or any fundamental science/42 course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of and field. 		
 number of the (old course) Chem 16 (General Chemistry 5 u.) to with separate numbering for the lecture and lab components (Chem 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of am field.)	Justification: The addition of these courses reflect the updated course
 with separate numbering for the lecture and lab components (Chen 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brorange of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of am field. 	1	number of the (old course) Chem 16 (General Chemistry 5 u.) to one
 33 3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u BIO 11.1, 2u). 35 36 9. Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of and field. 	2	with separate numbering for the lecture and lab components (Chem 16,
 BIO 11.1, 20). 9. Science/Math Elective (3 u. – 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a brorange of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of and field. 	3	3u. and Chem 16.1, 2u). The same is true for BIO 11 (BIO 11, 3u. and
 9. Science/Math Elective (3 u 5 u.) Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of and field. 	•	BIO 11.1, 2u).
Justification: With their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field.)	9 Science/Math Elective $(2, \dots, 5, \dots)$
Justification: with their increased background preparation, students be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field.	2	9. Science/Wath Elective (3 u. – 5 u.)
be allowed, with the consent of their adviser, to select from a bro range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field.	/	Justification: with their increased background preparation, students will
 range of science fundamental courses, such as BIO 12 and/or 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	3	be allowed, with the consent of their adviser, to select from a broader
 12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Sci 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of and field. 	Э	range of science fundamental courses, such as BIO 12 and/or BIO
 102, Math 109, Meteorology 101, or any fundamental science/ course for which he/she has satisfied the prerequisite, that would a him/her to gain a deeper understanding of the core concepts of an field. 	C	12.1, Chem 17 and 17.1, Geol 40, Marine Science 101, Marine Science
 42 course for which he/she has satisfied the prerequisite, that would a 43 him/her to gain a deeper understanding of the core concepts of and 44 field. 45 46 	1	102, Math 109, Meteorology 101, or any fundamental science/math
 him/her to gain a deeper understanding of the core concepts of and field. 	2	course for which he/she has satisfied the prerequisite, that would allow
44 field. 45 46	3	him/her to gain a deeper understanding of the core concepts of another there are the standard th
45 46	4	field.
46	5	OFFICIAL
	5	RELEASE
n de la companya de l		

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 9/16

1	10. Physics 106 Fundamentals Physics I
2	11. Physics 107 Fundamental Physics II
3	12. Physics 108 Fundamental Physics III
4	Justification: This program is affected by the changes instituted in the BS
5	Physics program, wherein the Physics 101-103 (Fundamental Physics)
6	and Physics 104-105 (Modern Physics) series are replaced by the
7	Physics 106-108 series (Fundamental Physics) in light of the increased
8	preparedness of students who have gone through the K12 program.
9	
10	13. Physics 106.1 Fundamental Physics I Laboratory
11	14. Physics 107.1 Fundamental Physics II Laboratory
12	Justification: This program is affected by the changes instituted in the BS
13	Physics program, wherein Physics 101.1-103.1 (Fundamental Physics
14	Labs, 3 x 1 u.) are replaced by Physics 106.1 and Physics 107.1
15	(Fundamental Physics I & II Lab, 2 x 1 u.) in light of the increased
16	preparedness of students who have gone through the K12 program.
17	
18	
19	15. Physics 116 Mathematical Physics I
20	16. Physics 117 Mathematical Physics II
21	Justification: This program is affected by the changes instituted in the BS
22	Physics program, wherein Physics 111-113 (Mathematical Physics I-
23	III, 3 x 3 u.) are replaced by Physics 116-117 (Mathematical Physics I
24	& II, 2 x 5 u.)
25	17 Physics 126 Theoretical Machanics I
20	<i>Instituation</i> This program is affected by the changes instituted in the DC
27	Dhysical program, wherein Dhysica 121 is maleged by Dhysica 126
28	(Theoretical Machanica I)
29	(Theoretical Mechanics I).
30	18 Division 142 Quantum Division II
31	In the second se
32	allows students to better appreciate the many advanced taxies is
34	Physics 170 (Condensed Matter)
34	Thysics 170 (Condensed Matter),
35	
36	19. Physics 170 Condensed Matter
37	Justification: Physics 170 covers all the topics of App Physics 173
38	(Solid State Physics, 3 u.), and is an apt replacement for the latter.
39	
40	20. App Physics 157 Computational Analysis and Modeling in Physics
41	Justification: This newly instituted course more efficiently covers the
42	essential topics that are currently in App Physics 156 (Computer Viversity
	OFFICIAL
	5 HELLAGE

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX <u>AC</u> PAGE <u>10</u>/16

1	Methods in Physics II) and App Physics 186 (Instrumentation Physics
2	II).
3	
4	21. App Physics 167 Applied Optics
5	Justification: In conjunction with the revised Physics 161 (Introductory
6	Laser Physics and Photonics, 3 u.) and Physics 192 (Experimental
7	Physics II (4), this newly instituted lecture course replaces Physics
/	166 (Optical Physics II 2 u) and App Physics 187 (Photonics and
8	Applied Optical Physics II, 5 d.) and App Physics 187 (Photomes and
9	Applied Optics, 4 u.).
10	
11	22. App Physics 184 Physical Electronics and Instrumentation
12	Justification: This newly instituted course cover the essential topics of
13	instrumentation more efficiently than the courses it will be replacing.
14	namely: App Physics 182 (Physical Electronics II, 4 u.), App Physics
15	183 (Control Systems Approach to Physics Modeling, 3 u.), App
16	Physics 185 Instrumentation Physics I, 4 u.).
17	
18	C. Change in Course Classification from Required to Elective
19	1. Chem 17 General Chemistry II
20	Justification: The core topics chemistry needed by a BS Applied Physics
21	(Instrumentation Physics) major is adequately covered in Chem 16 and
22	Chem 16.1. Chem 17 and Chem 17.1 are now included as an option in the
23	Science/Math Elective elective.
24	
25	D. Addition of Science/Math Elective Courses
26	1. BIO 12 Fundamentals of Biology II and/or BIO 12.1
27	Fundamentals of Biology II Laboratory
28	2. Chem 17 General Chemistry II and Chem 17.1 General
29	Chemistry II Laboratory
30	3. Geol 40 Elementary Mineralogy
31	4. Marine Science 101 Oceans
32	5. Marine Science 102 The Marine Sciences
33	6. Math 109 Fundamental Concepts of Mathematics
34	7. MBB 10 Introduction to Molecular Biology
35	8. Meteorology 101 General Meteorology
36	9. Any foundational course, with the approval of the adviser, offered
37	by units of the College of Science for which the student has
38	satisfied the prerequisite.
39	Indifferentians Listed and Col. 1. 1. 1.
40	<i>Justification</i> : Listed are some of the introductory courses in the math and
41	sciences that may be taken as the Science/Math Elective, provided that
42	the student satisfies the course prerequisite.
43	F. Change in Course Secure
44	E. Change in Course Sequence
45	Example 1 st year 2 nd some
40	$T_{OV} = 1^{\text{st}} \text{ year } 1^{\text{st}} \text{ som}$
48	OFFI
40	7 REL



05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 11/16

1

1				39
2				
3	2.	BIO 11		
4		<i>From</i> : 2 nd year, 2 nd sem		54 55
5		<i>To</i> : 1^{st} year, 2^{nd} sem		1
6		124 A		
7	3.	App Physics 155		
8		From: 3 rd year, 2 nd sem		3
9		To: 3^{rd} year, 1^{st} sem		
10				1
11	4.	App Physics 181		
12		From: 3 rd year, 2 nd sem		2
13		To: 2^{nd} year, 2^{nd} sem		0.
14				
15	5.	Physics 141		
16		From: 3 rd year 2 nd sem		
17		To: 3^{rd} year 1^{st} sem		4
18		i jein, i bein		
19	6.	Physics 161		
20		From: 5 th year 1 st sem		
21		$To: 4^{\text{th}} \text{ year } 2^{\text{nd}} \text{ sem}$		
22		10. · · · · · · · · · · · · · ·		<i>a</i>
23	7	Physics 165		
24		From: 4 th year 1 st sem	10	
25		To: 3^{rd} year 2^{nd} sem		
26		10. 5 year, 2 sem		
27	8	Physics 191		
28	0.	From: 4 th year 1 st sem		
29		To: 3 rd year 2 nd sem		
30		10. 5 your, 2 sem		
31	9	Physics 192		
32	2.	From: 4 th year 2 nd sem		
33		T_{0} : 4^{th} year 1^{st} sem		
34		10. 4 year, 1 sem		
35	10	Physics 196		
36	10	From: 5 th year 2 nd som		
37		T_0 : 4^{th} year 2^{nd} sem		12
38		10. 4 year, 2 sem		
39	11	App Physics 199		
40	11	From: 5 th year 1 st com		
40		T_{0} , A^{th} year, 1^{st} som		
41		10. 4 year, 1 sem		
42	10	App Physics 200		
43	12	Exome 5 th year 2 nd		10 K
44		To: A^{th} upon 2^{nd}		
45		10. 4 year, 2 sem		
40	Instification	The recognonaire of the		
47	number of you	The resequencing of these	with the section t	account the reduction in the
40		tis of the program, along v	viui the earlier tim	e at which the prerequisite
43	courses are sa	usiled.		



05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 12/16

1	13. PE
2	From: 2 nd year, 1 st sem
3	To: 3^{rd} year, 1^{st} sem
4	
5	14. NSTP 1
6	<i>From</i> : 4^{th} year, 1^{st} sem
7	To: 3^{rd} year, 1^{st} sem
8	
9	15. NSTP 2
10	From: 4 th year, 2 nd sem
11	To: 3^{rd} year, 2^{nd} sem
12	
13	16. PI 100
14	<i>From</i> : 5^{th} year, 2^{nd} sem
15	To: 4^{th} year, 2^{nd} sem
16	
17	Justification: The resequencing of these courses take into account the
18	reduction in the number of years of the program, along with balancing
19	the course load of the students.
20	
21	F. Change in Total Number of Units
22	
23	From: 179 units
24	
25	<i>To</i> : 148-150 units
26	
27	Justification: The change in the number of units reflects the streamlining of
28	required Physics courses (reduced by 11-13 u.), as well as a reduction in the
29	number of required GE courses (reduced by 12 u.), and non-Physics

30 31

	Existing	Proposed	Reduction
GE + PI 100	39	27	12
Sci/Math (sans Physics)	38	32	6
Physics (w/ 3-5u. Physics/App Physics elective)	102	89 91	13
Total	179	148 - 150	31

science/math required courses (reduced by 6 u.).

32 33

G. Change in Number of Years

34 35 36

37 38

39

40

41

42

43

To:4 years

From: 5 years

Justification: The increased preparation of the students coming out of the K12 program, along with the streamlining of Physics and Applied Physics courses and the change in the GE framework permits this reduction. OFFICIAL

RELEASE

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 13/16

	1		
	l		
1	•	•	
	ì		
	ì		

	Existing	Proposed
Fund. Physics (lecture)	16 units in 4 sems	15 units in 3 sems
Fund. Physics (lab) +Exp. Physics (lab)	4 units in 4 sems + 4 units in 2 sems (adv)	2 units in 2 sems +4 units in 2 sems (adv)
Math. Physics (11x)	9 units in 3 sems	10 units in 2 sems
Core to Elective	Chem 17	Sci/Math elective (3-5u)
Merged	AP 156, 186 (8u) AP 182, 183, 185 (11u) Phys 166, AP 187 (7u)	AP 157 (4u) AP 184 (4u) AP 167 (3u) + [P191/192]

3 4

5

V. Checklist of Existing and Proposed Curriculum

BACHELOR OF SCIENCE IN APPLIED PHYSICS

(INSTRUMENTATION PHYSICS)

College of Science

Approval of Existing Curri First Semester, AY Existing (179 units)	culum: 2012-2013	Proposed date of effectivity: First Semester, AY 2017-2018 Proposed (148-150 units)		
		FIRST YEAR		
1st Semester	18 units	Lst Semester	19 units	
Math 14*	3	Math 21	4	
Math 53*	5	Geol 11	3	
Geol 11	з	Geol 11.1	1	
Geol 11.1	1	Chem 16	3	
GE (AH1) English 10	3	Chem 16.1	2	
GE (MST1) Physics 10	3	GE 1 Physics 10	3	
PE	(2)	GE 2 KAS 1	3	
		PE	(2)	
2nd Semester	18 units	2nd Semester	18 units	
Physics 101	4	Physics 106	5	
Physics 101.1	1	Physics 106.1	1	
Math 54	5	Math 22	4	
Chem 16	5	BIO 11	3	
GE (AH2) Comm 3	3	BIO 11.1	2	
PE	(2)	GE 3 Eng 13 / Speech 30	3	
		PE	(2)	
Midvear	0 units	Midyear	3-5 units	
		Science/Math Elective*	01 3-5 Y	
L			OFFICIAL RELEASE	
			JAN 2 0 2020	

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 14/16

1st Semester	19 units
Physics 102	4
Physics 102.1	1
Physics 111	3
Math 55	3
Chem 17	5
GE (SSP1) Philo 1	3
PE	(2)

2nd Semester	19 units
Physics 103	4
Physics 103.1	1
Physics 112	3
Math 121.1	3
Bio 11	5
GE (SSP2) Kas 1	3
PE	(2)

Midyear 0 units

S	-	CO	N	D	YEA	R
			_	_		

Lst Semester	18 units
Physics 107	5
Physics 107.1	1
Physics 116	5
Math 23	4
Math 122	3
-3	

2nd Semester	18 units
Physics 108	5
Physics 117	5
Physics 126	4
App Physics 181	4
PE	(2)

Midyear	6 units
GE 4 ARTS 1	3
GE 5 Philo 1	3

1st Semester	17 units
Physics 104	4
Physics 104.1	1
Physics 113	3
Physics 121	3
Physics 131	З
GE (AH3) Free Choice	З

2nd Semester	20 units
Physics 132	3
Physics 141	3
App Physics 155	4
App Physics 181	4
GE (AH4) Free Choice	3
GE (SSP3) Free Choice	3

THIRD YEAR

lst Semester	16 units	
App Physics 155	4	
Physics 131	3	
Physics 141	3	
GE 6 Fil 40	3	
GE 7 Soc Sci 1 / Soc Sci 2	3	
NSTP	(3)	
PE	(2)	
2nd Semester	17 units	
Physics 132	3	
Physics 142	3	
Physics 165	3	
Physics 191	4	
App Physics 157	4	
NSTP,	(3)e Univer	311
1	dot u	Yer
	P OFFICI	AL S
	RELEAS	SE 7
1		8
	S IAN 2	0 2000
2	SAN Z	0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 15/16



1st Semester 19 units		
Physics 165	3	
Physics 191	5	
App Physics 156	4	
App Physics 173	3	
App Physics 182	4	
NSTP	(3)	

2nd Semester	16 units
Physics 151	3
Physics 166	3
Physics 192	3
App Physics 183	3
App Physics 185	4
NSTP	(3)

FOURTH YEAR

1st Semester	17 units
Physics 170	3
Physics 192	4
App Physics 167	3
App Physics 184	4
App Physics 199	3

2nd Semester	16 units
Physics 151	3
Physics 161	3
Physics 196	1
App Physics 200	3
PI 100	3
GE 8 DRMAPS/ STS 1	3

1st Semester	17 units
Physics 161	3
App Physics 186	4
App Physics 187	4
App Physics 199	3
GE (MST2) STS	3

2nd Semester	16 units	10 11 0
Physics 196	1	
App Physics 200	3	
GE (AH5) Fil 40	3	
GE (SSP4) Free Choice	3	
GE (SSP5) Free Choice	3	
PI 100	3	

FIFTH YEAR

lst S	emester 0 units
2	
1	
3	

i żr	nd Semester 0 units
1	
E.	
3	



05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC PAGE 16/16

1. Math 14 and Math 53 are to be taken together provided the student has passed the APE in Math 11. Otherwise the student must take Math 17 in the 1st year/1st semester (in place of Math 14 and Math 53); Math 53 in the 1st year/2nd semester (in place of Math 54); and Math 54 in the immediately following summer session.

* Kas 1 & Fil 40 satisfy the 6-unit Philippine Studies requirement

1

Note: As a requirement for graduaton, all students must take six (6) units in one of the Natonal Service Training Program (NSTP) components: Civic Welfare Training Service (CWTS), Literacy Training Service (LTS), and Reserved Officer's Training Corps Military Science (ROTC Mil Sci). These are offered by UPD. * May be chosen, upon the consent of the adviser, from courses in natural sciences or mathematics

All students required to take Math 21 must have passed any of the following: (1) Pre-Calculus from the STEM or equivalent strand of K-12; (2) the Validation Examination for Math 20 (Pre-Calculus: Functions and their Graphs) administered by the UPD Institute of Mathematics; or (3) Math 20 as a noncredit course

Notes: As a requirement for graduation, all students must take six (6) units in one of the National Service Training Program (NSTP) components: Civic Welfare Training Service (CWTS), Literacy Training Service (LTS), and Reserved Officer's Training Corps Military Science (ROTC Mil Sci). These are offered by UPD.

The University regularly reviews course curricula and may revise them. Students admitted into this program shall follow the existing curriculum until such time that a new curriculum replacing it has been duly approved for implementation. All courses prescribed and taken under this existing curriculum shall be credited under the new curriculum.



BS APPLIED PHYSICS (INSTRUMENTATION PHYSICS) 1/2

units

3

5

1

4

3

2

(2)

3-5

5

5

4

4

(2)

3

3

3

3

3

4

4

(3)

3

3

3

1

3

3

148-150 units

Physics 161

Physics 196

PI 100

App Physics 200

TOTAL

units

umit

units

in in

units

UNIVERSITY OF THE PHILIPPINES DILIMAN

App Physics 167

App Physics 184

App Physics 199

3

4

3

BACHELOR OF SCIENCE IN APPLIED PHYSICS (INSTRUMENTATION PHYSICS) **College of Science** UC Approval: Date of effectivity: 149th UPD UC : 19 June 2018 1st Semester of AY 2018-2019 Section Street, 19 FIRST YEAR AND DESCRIPTION OF THE OWNER 19 units 1st Semester 2nd Semester 18 GE 1 : Physics 10 3 GE 3 : ENG 13/Speech 30 GE 2 : KAS 1 3 Physics 106 Math 21 4 Physics 106.1 Geol 11 3 Math 22 Geol 11.1 **BIO 11** 1 Chem 16 3 BIO 11.1 Chem 16.1 2 PE (2)PE MIGVERN 23.3 Science/Math Elective* SECOND YEAR 1st Semester 18 units 2nd Semester 12 Physics 107 5 Physics 108 Physics 107.1 1 Physics 117 Physics 116 Physics 126 5 Math 23 4 App Physics 181 Math 122 3 PE MICHERIN GE 4 : ARTS 1 GE 5 : Philo 1 THIRD YEAR 1st Semester 16 units 2nd Semester 172 GE 6 : Fil 40 3 Physics 132 GE 7 : Soc Sci 1/Soc Sci 2 3 Physics 142 App Physics 155 4 Physics 165 Physics 131 3 Physics 191 Physics 141 3 App Physics 157 NSTP (3)NSTP PE (2)FOURTH YEAR 1st Semester 17 units 2nd Semester 16 Physics 170 3 GE 8 : DRMAPS / STS 1 Physics 192 4 Physics 151

> the Unive OFFICIAL RELEASE ſ JAN 2 0 2020

BS APPLIED PHYSICS (INSTRUMENTATION PHYSICS) 2/2 UNIVERSITY OF THE PHILIPPINES DILIMAN



Notes:

*May be chosen, upon the consent of the adviser, from courses in natural sciences or mathematics.

All students required to take Math 21 must have passed any of the following: (1) Pre-Calculus from the STEM or equivalent strand of K-12; (2) the Validation Examination for Math 20 (Pre-Calculus: Functions and their Graphs) administered by the UPD Institute of Mathematics; or (3) Math 20 as a non-credit course.

Notes: As a requirement for graduation, all students must take six (6) units in one of the National Service Training Program (NSTP) components: Civic Welfare Training Service (CWTS), Literacy Training Service (LTS), and Reserved Officer's Training Corps Military Science (ROTC MII. Sci). These are offered by UPD.

The University regularly reviews course curricula and may revise them. Students admitted into this program shall follow the existing curriculum until such time that a new curriculum replacing it has been duly approved for implementation. All courses prescribed and taken under this existing curriculum shall be credited under the new curriculum.



05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 1/10

1			N	ATIONAL INSTITUTE OF PHYSIC	S I	
2				College of Science		
3			Univers	ity of the Philippines, Diliman, Que:	zon City	
4						
5			COMPUTATIC	R THE INSTITUTION OF APPLIE	D PHYSICS 157	
7			COMPUTATIO	MAL ANAL 1515 AND MODELING	S IN PHYSICS	
8	А.	Cc	urse Catalogue Desc	ription		
9		1.	Course number:	App Physics 157		
10		2.	Course Title:	Computational analysis and mode	eling in Physics	
11		3.	Course Description	Computational models in physics	; numerical simulation	s of physical
12			systems; stochastic s	imulation and algorithms; image pr	ocessing; multidimens	ional
13			detection techniques;	pattern recognition	1	(2017) (1977)
14		4.	Prerequisite:	App Physics 155 (or equiv.)		
15		5.	Semester Offered:	2 nd semester		
16		6.	Course Credit:	4.0		
17		7.	Number of Hours:	3h (lec), 3h (lab)	1	
18		8.	Meeting Type:	Lecture / Laboratory	4 1	
19		9.	Course Goals:	To show how Monte Carlo metho	ds. complex network to	ools and
20			image and video proc	essing methods can be used as to	ols for solving applied	nhysics
21			problems.		one for conting applied	priyolog
22					i	
23	В.	Ra	tionale		Ť.	
24		Ha	nds-on experience in	using numerical/computational te	chaiques for solving	problems in
25		ap	olied physics is highlig	in this course. It covers the c	ore tonics of Applied	Physics 156
26		(Co	omputer Methods in Ph	vsics II) and Applied Physics 186 (Instrumentation Physic	n II) both of
27		wh	ich will be removed from	n the 4-year program	instrumentation rhysic	is ii), both of
28				n the 4-year program.		
29	C	Co	urse Outline			
30	0.	1	Course Outcomes ((101		
31			Upon completion of th	e course, students must be able to).	
					8	
32			CO 1. Perform	n calculations involving nonline	ar systems using M	lonte Carlo
33			methods;		s V a a w	
34			CO 2. Use indiv	idual-based methods in modelin	ng physical systems;	
35			CO 3. Use netv	ork-based methods in analyzing	g physical systems;	
36			CO 4. Measure	physical variables from images	and video;	
37			CO 5. Enhance	images and other digitized sign	ials;	
38			CO 6. Extract fo	eatures and recognize patterns i	in images and video.	
39 10		2	Course Content			
Γ	ecture/L	ab T				
1			opics			No. of
						Hours
						(lec + lab)
A	Monte Carl	o me	ethods			
					5	6 + 6
1	ndividual-	bas	ed models: Cellular a	utomata, agent-based models		6 + 6
-						the Univer
C	Graphs and	d net	works in physical mode	ls		9+9
						OF FICIA
						R RELEAS

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 2/10

Space-domain image processing	9 + 9
Fourier-domain image processing	9 + 9
Introduction to machine learning	12 + 12

1 2

3. Course Coverage

Week	со	TOPIC	ESSENTIAL/ KEY QUESTIONS	Suggested Teaching and Learning Activities (Lecture-Lab work on)	Suggested Assessment Tools
1-2	CO 1	Monte Carlo methods	How do you use random numbers to perform numerical simulations? How do you evaluate outputs of Monte Carlo simulations?	Population dynamics, Diffusion-limited aggregation, Ising model	
3-4	CO 2	C 2 Individual-based models: Cellular automata, agent- based models	What is an agent- based model? What are cellular automata models? How do you evaluate outputs of agent-based models?	Agent-based modeling, Probability distributions and ABMS	
5		Graphs and	How do you describe networks?	Erdos-Renyi, Watts- Strogatz, Barabasi-Albert networks	Machine
6	-003	networks in physical models	How do you extract network properties from real-world networks?	Using the SNAP database	Problems, Report, Exam
7	CO 4	Space-domain	What are the different spatial (morphological) transformation techniques?	Edge detection, noise reduction, histogram manipulation	
8-9	CO 5 CO 6	image processing	What is the appropriate scale for applying transformations? How do you pick a suitable technique?	Image segmentation, blob analysis, feature extraction	
10-13	CO 4 CO 5 CO 6	Fourier-domain image processing	What are the properties of the Discrete Fourier	1D & 2D DFT, FT model of image formation, applications of FFT	and the Unive

JAN 2-0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 3/10

			How does one perform phase filtering? When is it appropriate to use FFT on images?		
13			What is principal components analysis? When is it appropriate?	Signal compression, spectral imaging	
14	CO 4 CO 5 CO 6	Introduction to machine learning	What is a Bayes theory-based classifier?	Make a classifier using Bayes theory	
15-16		2	What are neural networks? When are they appropriate?	Make a classifier using neural networks	
3 4 5 6		Machine Problems Integration Activiti Exams	s es		
3 4 5 6 7 1 8 9 9 10 11 12 13 14 15	D. Referen S. The S. Th Press R. Go W. Ki Mathe A. B. O'Reil	Machine Problems Integration Activitie Exams eodoridis and K. Koutro eodoridis (2015). <i>Mac</i> nzalez and R. Woods (nzel, G. Reents (1997 ematica and C. Springe Downey (2012). <i>Thi</i> lly.	s es humbas (2008). Pattern Reco hine Learning: A Bayesian 2017). Digital Image Process 7). Physics by Computer: Pi r. nk Complexity: Complexity	gnition, 4th ed. Academic Pres and Optimization Perspective ing, 4 th ed. Pearson. rogramming of Physical Probl Science and Computational	s. Academic lems Using Modeling.
3 4 5 6 7 8 9 10 11 12 13 14 15 16	D. Referen S. The S. Th Press R. Go W. Ki Mathe A. B. O'Reil C. Bis	Machine Problems Integration Activitie Exams eodoridis and K. Koutro eodoridis (2015). <i>Mac</i> nzalez and R. Woods (nzel, G. Reents (1997 ematica and C. Springe Downey (2012). <i>Thi</i> lly. hop (2011). <i>Pattern Re</i>	s es humbas (2008). Pattern Reco hine Learning: A Bayesian 2017). Digital Image Process 7). Physics by Computer: Pi r. ink Complexity: Complexity prognition and Machine Learn	gnition, 4th ed. Academic Pres and Optimization Perspective ing, 4 th ed. Pearson. rogramming of Physical Prob Science and Computational ning. Springer.	s. Academic lems Using Modeling.



	05.	IUN 2018 CC/ 19 Jun 2018 UC APPENDIX \underline{ACL} PAGE $\underline{4/10}$
1 2 3 4		NATIONAL INSTITUTE OF PHYSICS College of Science University of the Philippines, Diliman, Quezon City
5 6		PROPOSAL FOR THE INSTITUTION OF APPLIED PHYSICS 167 APPLIED OPTICS
7 8 9 10 11 12 13 14 15 16 17 18	I. Cours	 Course number: App Physics 167 Course Title: Applied Optics Course Description: Microscopy, holography and interferometry, Fourier optics, spectroscopy and nonlinear optics, imaging optics, 3D imaging Prerequisite: Physics 165 Semester Offered: 1st semester Course Credit: 3 units Number of Hours: 3 h Meeting Type: Lecture Course Goals: To demonstrate an understanding of the principles of different
19 20 21	COURS	optical systems and methods SE OBJECTIVES
22 23 24	At the e	and of the course, the learner is expected to be able to:
25 26 27 28 29 30 31	system II. COL	 Demonstrate advanced understanding of the principles of different optical s and methods Derive intrinsic and extrinsic parameters of optical systems Design and test optical metrology systems Perform measurements using optical systems IRSE OUTLINE
32	Week	Topics
	1	 Review of diffraction and coherence Fresnel Kirchhoff diffraction formula and Fresnel approximation Temporal and spatial coherence, speckle effect
	2	Wavefront reconstruction via HolographyHologram recording and reconstruction

Hologram recording and reconstruction

 Digital Holography

 Digital holographic Interferometry

 Double-exposure technique
 Fringe Processing and phase unwrapping

 Fourier optics

 Fourier treatment of wave propagation
 4F setup and spatial filtering

 Spectroscopy

 Emission, absorption, detection



05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 5/10

	Fluorescence
	Basic microscopy
	Numerical aperture and resolution
	Nonlinear optics
	 Second harmonic generation and frequency generation Atoms in intense fields
1	Camera Intrinsic and Extrinsic Parameters

8-11	Camera Intrinsic and Extrinsic Parameters		
	Pinhole camera model	ł,	
	Aberrations		
	 Modulation transfer function 		
	Camera response function and high dynamic rail	nge imaging	
12	3D Imaging		
	Shape from shadows		
	 Shape from stereo 		
	 Shape from structured illumination 		
13-16	Colorimetry		
	 Properties of the human visual system 	E.	
	 Color order systems and color matching functions 		
	/. Color appearance phenomena		
	/. Color difference specification	ŕ	
	I. Camera spectral sensitivity		

1 2

3

4

5

6

7

III. COURSE REQUIREMENTS

- 1. Quizzes, seatwork, and problem sets
- 2. Projects
- 3. Exams
- 6 7

8

IV. REFERENCES

- 9 1. Optical Society of America (2010). Handbook of Optics, 3rd ed. Vol. I. OSA 2. P.E. Debevec, and J. Malik (2008). "Recovering high dynamic range radiance maps. 10 from photographs." ACM SIGGRAPH 2008 classes. ACM. 11 12
 - 3. P. Hariharan (2007). Basics of Interferometry 2nd ed., Academic Press
- 4. E. Hecht (2016), Optics 5th ed., Pearson 13
- 5. C. Herrera, J. Kannala, and J. Heikkilä (2012). "Joint depth and color camera 14 calibration with distortion correction." IEEE Transactions on Pattern Analysis and 15 Machine Intelligence 34, pp. 2058-2064. 16
- 6. J. Goodman (2004). Introduction to Fourier Optics 3rd ed., Roberts and Company 17 Publishers. 18
- 7. R. J. Schalkoff (1989). Digital image processing and computer vision. vol 286. New 19 York: Wiley. 20
- 8. T. Zimmermann (2005). "Spectral imaging and linear unmixing in light microscopy." 21 Microscopy techniques. pp. 245-265. Springer Berlin Heidelberg tre 22

OFFICIAL

RELEASE

JAN 2 0 2020

23 24

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 6/10

- 1 V. List of faculty members who can teach the course:
- 2 Prof. Percival Almoro, Ph.D.
- 3 Prof. Wilson Garcia, Ph.D.
- 4 Assoc. Prof. Nathaniel Hermosa, Ph.D.
- 5 Prof. Caesar Saloma, Ph.D.
- 6 Prof. Maricor Soriano, Ph.D.
- 7 Prof. Giovanni Tapang, Ph.D.



05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 7/10

	PROPOSAL FOR THE INSTITUTION OF APPLIED PHY	SICS 184	
	Physical Electronics and Instrumentation	i II	
2	Identifying and Deparintly Information		
	A Course Catalogue Description		
	1 Course number: Ann Physics 184		
	2 Course title: Physical electronics and instrumentat	ion II	
	3. Course description: Analog-digital conversion and multir	oleving: con	nuter
	hardware and interfacing; microprocessors and machine I	anguage pr	ogrammir
	applications of microprocessors. Sensors, transducers, ar	nd measure	ment
	techniques for various physical variables; signal condition	ing, digitiza	tion and
	A processing and reliability of data.		
	5. Semester offered:		
	6 Course credit: 40		
	7. Number of hours: 3h lec: 3h lab		
	8. Meeting type: Lecture Laboratory		
	9. Course goals: To teach students how to understand	digital elect	ronics
	concepts, to design and implement data acquisition for ph	ivsical syste	ems, as w
	as process the acquired signals into usable digital information	ation.	
В.	Rationale		
-	C. Course Outline		
	1. Course outcomes		
	Upon completion of the course, students must be able	to:	
a.	Design and implement data acquisition for physical systems:		
b.	Process various signals into usable digital information for expe	riments.	
	2. Course content		
Lecture	/Lab Topics	Hours	Hours
		Lec	Lab
Basic o	f logic concepts and combined logic, feedback and sequential	15 hrs	15 hrs
logic.		10 110	101110
Counto	The Designation and Chair Marking Archive Division	www.	Transition of the second
Counte	sion	15 hrs	15 hrs
Conver			
Microco	ontrollers: Interfacing and application	15 hrs	15 hrs

29 30

Week	со	TOPIC	ESSENTIAL/ KEY QUESTIONS	Suggested Teaching and Learning Activities (Lecture-Lab work on)	Suggested Assessmen Tools	
1	CO.a	Boolean arithmetic, truth tables, gates,	What are binary systems? What are	Expt.1- Introduction to	Quiz Lab Report	the University

JAN 2 0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 8/10

		logic operations, Combinatorial logic circuits	truth tables? What is the difference between AND, OR, NOT, NAND, and NOR gates?	microcontrollers	
2	CO.a	TTL and CMOS, Truth tables, Karnaugh Maps	What is the difference betweem truth tables and Karnaugh Maps? How do we construct a half- and a full- adder?	Expt.2 : Construction of a half and a full adder	Lab Report
3	CO.a	Number systems: Binary, BCD, Gray codes, binary arithmetics, ring oscillators and debouncers	How do we represent numeric information within digital systems? What are oscillators and debouncers?		Quiz
4	CO.a	Flip flops RS and JK	How does a digital circuit acquire memory?		Quiz
5	CO.a	Edge triggered FF Latches and registers	What are the use of bistables in constructing memory and shift registers?	Expt. 3 Shift registers from flip-flops	Quiz Lab Report
6	CO.a	Counters, shift registers, and state machines, analog to digital conversion	What are asynchronous and synchronous counters? What are the characteristics of analogue-to-digital converters?	Expt. 4: Random number generator	Quiz Lab Report
7-8	CO.a	Parallel encoding successive approximation	What are the similarities and differences between successive approximation ADC and counter ADC?	Expt. 5: Signal generator using A/D converters	Quiz Lab Report
9-10	CO.a	CMOS and TTL interfacing, Addreses and data decoders; Multi-segment LEDs pulse width	What are the characteristics of various members of the TTL and CMOS logic circuit families?	Expt. 6 : LED Matrix addressing and interfacing	Quiz Lab Report

JAN 2.0 2020

05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX ACL PAGE 9/10

		modulation debouncer	How do we provide continuous control of power using pulse width modulation?	2 1	
11-12	CO.a	Microprocessors, machine language, microcontrollers analog-to-digital conversion PLLs psuedo-random noise generation	What are resolution, accuracy, setting time,and sampling rate in the context of data conversion? How do we generate pseudo-random noise?	Expt. 7: Construction of running lights	Quiz Lab Report
13-14	CO.a	Sampling, quantization, coding, aliasing; Interface electronics	What are the major components of a typical data- acquisition system?	Expt. 8 Digital acquisition system	Quiz Lab Report
15	CO.b	Frequency analysis of continuous and discrete time signals; The discrete fourier transform, properties and applications	What is the Fourier transform? What are its real-world applications?	Expt. 9: Signal processing of temporal signals	Quiz Lab Report
16	CO.b	Physical principles of sensings; Calibration,; Calibration techniques	What are the role of sensorDigitts in electronic systems? How are range, resolution, accuracy, linearity and sensitivity affects sensor design?	Expt. 10: Quiz Sensors Lab Report	

- 1. Midterm and final exams
- 2. Quizzes
 - 3. Lab reports
 - 4. Project

6 D. REFERENCES

1 2

3

45

7

8

9

10

11

12

- R. Bracewell (1978). Fourier Transforms and Its Applications. 2nd ed. McGraw Hill
- E.O. Brigham (1988). The Fast Fourier Transform and its Applications. Prentice Hall
- J. Fraden (2016). Handbook of Modern Sensors: Physics, Design and Applications 5th ed. Springer
- P. Horowitz and W. Hill (2015). Art of Electronics 3rd ed. Cambridge Univ. Press
 - J. Proakis & I. Manolakis (2000), Digital Signal Processing 3rd ed. Pearson
- Snoke (2014), Electronics: A Physical Approach Pearson



05 JUN 2018 CC/ 19 Jun 2018 UC APPENDIX AC1 PAGE 10/10

- N. Storey (2017). Electronics: A Systems Approach 6th ed. Pearson
- 2

1

4

J. Weber and H. Eren (editors) (2014). *Measurement, Instrumentation, and Sensors* Handbook 2nd ed. CRC Press

5 E. LIST OF FACULTY MEMBERS WHO CAN TEACH THE COURSE

6 Prof. Percival Almoro, Ph.D.

7 Prof. Elmer Estacio, Ph.D.

- 8 Asst. Prof. Marvin Flores, Ph.D.
- 9 Prof. Wilson Garcia, Ph.D.

10 Prof. Caesar Saloma, Ph.D.

- 11 Prof. Maricor Soriano, Ph.D.
- 12 Prof. Giovanni Tapang, Ph.D.

