PHY-5115/5116: MATHEMATICAL METHODS I/II (Dr R Fiebig)

Selected Sections from: G B Arfken and H J Weber, Mathematical Methods for Physicists, 6th Edition, Elsevier Academic Press, ISBN 0-12-059876-0.
In PHY-5115 the selected material through Chapter 7 will be covered, and PHY-5116 shall cover (selected parts of) the remainder.

1 VECTOR ANALYSIS
1.1 Definitions
1.2 Rotation of coordinate axes
1.3 Scalar product
1.4 Vector product
1.5 Triple products
1.6 Gradient
1.7 Divergence
1.8 Curl
1.11 Gauss' theorem
1.12 Stokes' theorem
1.15 Dirac delta function

2 CURVED COORDINATES AND TENSORS
2.1 Orthogonal coordinates
2.2 Differential vector operators
2.5 Spherical polar coordinates
2.6 Tensor analysis
2.7 Contraction, direct product
2.9 Pseudotensors, dual tensors
2.10 Non-cartesian tensors

3 DETERMINANTS AND MATRICES
3.1 Determinants
3.2 Matrices
3.3 Orthogonal matrices
3.4 Hermitean matrices, unitary matrices
3.5 Diagonalization of matrices

6 FUNCTIONS OF A COMPLEX VARIABLE I
6.1 Complex Algebra
6.2 Cauchy-Riemann Conditions
6.3 Cauchy's Integral Theorem
6.4 Cauchy's Integral Formula
6.5 Laurant Expansion
6.6 Singularities
6.7 Mapping

7 FUNCTIONS OF A COMPLEX VARIABLE II
7.1 Calculus of Residues

8 THE GAMMA FUNCTION
8.1 Definitions, Simple Properties
8.2 Digamma and Polygamma Functions
5.9 Bernoulli Numbers, Euler-Maclaurin Formula [376]
8.3 Sterling's Series

EXAMS AND MORE

- Homework will be collected, but not graded. The fractional return on the homework will be assigned a score $H = 0 \ldots 100$. Homework is due two weeks after assignement (not counting spring break). The deadline for homework submission is at the conclusion of the final exam.

- There will be three exams including the final. The length of each exam is the usual class period. Each exam score $E_i = 0 \ldots 100$, $i = 1, 2, 3$, carries equal weight. The class textbook only is allowed, and required. Other materials are a calculator, a ruler, paper and pen(cil).

- The overall score X for the course is determined by combining homework and exams as

$$X = \frac{1}{2}H + \frac{1}{2}\frac{E_1 + E_2 + E_3}{3}\,.$$

- Tentative exam schedule, Fall 2009
  Sep-30 (Wed)
  Nov-04 (Wed)
  Dec-07 (Mon)

- Announcements made in class may supersede syllabus rules!

- An approximate guideline for the grading scale is:

Points X	Grade
95–100	A
90–95	A
85–90	$A-$
80–85	$B+$
75–80	B
70–75	$B-$
65–70	$C+$
60–65	C
55–60	$C-$
50–55	$D+$
45–50	D
40–45	$D-$
0–40	F

HOMEWORK ASSIGNEMENTS

1.2	(13)	1,2
1.3	(17)	3
1.4	(22)	7,9
1.5	(29)	5,7,13
1.6	(37)	1,3
1.7	(42)	3,5
1.8	(47)	7,8,11,14,17
1.11	(62)	2,3
1.12	(67)	1,10
1.15	(91)	1,7,13,23
2.1	(109)	2,3,6
2.2	(113)	3
2.5	(128)	1,6,8,16
2.6	(138)	2
2.7	(140)	2
2.9	(149)	3,4,12
2.10	(158)	2,5,6,8,15
3.1	(174)	1,2,3,6
3.2	(187)	1,4,5,7,11,13,15,36
3.3	(206)	1,6,9,10
3.4	(212)	1,5,12,13,16,18,20,24
3.5	(226)	3,6,8,10,19,30,33
3.6	(236)	1,5,16,17,18
6.1	(409)	8,10,16
6.2	(416)	2,5,7
6.3	(424)	3
6.4	(429)	2,4,8
6.5	(437)	3,8,9
6.6	(442)	2,4
6.7	(450)	1,4,6
7.1	(474)	1,5,11,14,27
8.1	(506)	4,5,11,25,26
8.2	(513)	7,8,13
5.9	(385)	2,7
8.3	(518)	3,4,9
8.4	(523)	14,16
8.5	(530)	7,8,10
9.2	(550)	2,3,6,10,12,16
9.5	(574)	1,5,7,12
9.6	(588)	3,4,10,11,15,21,23
10.1	(631)	3,6,12,13
10.2	(639)	3,7,9
10.3	(647)	3,6

10.4 (659) 4,5,9
10.5 (670) 2,8,11,13

11.1 (686) 2,10
11.2 (697) 2,9,10
11.3 (704) 1,2
11.4 (711) 3,4
11.5 (716) 1,6,10

12.2 (754) 2,5,7
12.3 (762) 2,6,11
12.5 (783) 5,11
12.6 (791) 2,4

13.1 (832) 3,9
13.2 (845) 3,9,12
13.3 (855) 1,3,30
13.4 (862) 1,6
13.5 (867) 12,15

14.1 (886) 2,3
14.2 (891) 1,3
14.3 (898) 1,9,14
14.4 (905) 2,9

15.1 (934) 1,2,4
15.3 (942) 1,5,10,17,18
15.4 (950) 3
15.5 (953) 5

15.8 (970) 1,2,4
15.9 (976) 1,2
15.10 (985) 5,11,13,16
15.11 (993) 1,2
15.12 (1000) 4,13

16.1 (1011) 1,6
16.2 (1015) 6,8
16.3 (1025) 1,2,4,11
16.4 (1034) 1,2,3,5

17.8 (1074) 2,4