**Syllabus for Phys404 (Mathematical Physics III)**

**(1437-2016)**

**Textbook:** Arfken and Weber, Mathematical Methods for Physicists, 6th edition, Elsevier (2006).

**Chapter 1** (p499): **The Gamma Function (Factorial Function)**

Definitions, Simple properties

Stirling’s series

**Chapter 2** (p520): **The Beta Function**

**Chapter 3** (p527): **Incomplete Gamma function**

**Chapter 4** (p675): **Bessel Functions**

Bessel functions of the first kind *J*ν(*x*)

Generating function for integer order

Recurrence relations

Bessel’s differential equation

Integral representation

Bessel functions of nonintegral order

Bessel series

Bessel functions of the second kind *N*ν(*x*)

Modified Bessel functions *I*ν(*x*) and *K*ν(*x*)

**Chapter 5** (p741): **Legendre Functions**

Generating function

Recurrence relations

Orthogonality

Associate Legendre functions

Spherical Harmonics

**Chapter 6** (p817): **Hermite Functions**

Generating function

Recurrence relations

Orthogonality

**Chapter 7** (p837): **Laguerre Functions**

Generating function

Recurrence relations

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**Chapter 8** (p881): **Fourier Series**

General properties

Applications of Fourier series

Properties of Fourier series

**Chapter 9** (p931): **Fourier Transforms**

**Chapter 10** (p965): **Laplace Transforms**