ANNEX 1- Curriculum of the EMJMD- NANOMEDICINE FOR DRUG DELIVERY (NANOMED) NANOMED

Scope : The EMJMD NANOMEDICINE FOR DRUG DELIVERY (NANOMED) aims at filing the gap between basic training currently provided during Master's degree by most Schools of Pharmacy, and advanced knowledge required for post-graduate young scientists in order to understand and be able to integrate the advances in Nanotechnology towards the development of Advanced Particulate Drug Delivery Systems. This project of EMJMD in Nanomedicine has been built following the recommendations of the ETPN (see in B.1.6).

The NANOMED curriculum is supported by the following four European Universities as full partners:
1. University of Paris-Descartes (PD), France (Academic coordinator: Karine Andrieux): coordinator,
2. University of Patras (UPAT), Greece (Academic coordinator: Sophia Antimisiaris),
3. University of Pavia (UPAV), Italy (Academic coordinator: Carla Caramella),
4. University of Angers (UA), France (Academic coordinator: Emilie Roger).

The proposed curriculum will cover 24 academic months (four Semesters) and provide theoretical basis and applied knowledge for 3 Semesters (S1, S2 and S3) combined to two internships: 3 months during S2 and 6 months for another Semester (S4). A brief description of the content/scope of each Semester, follows:

S1:"**Introduction to pharmaceutical formulation: from classical forms to nanoparticles**" takes place in UPAT or in PD. It includes introductory modules designed for non-pharmacists with a background in chemistry or biology, considering that some specific knowledge in both domains is required to efficiently design and develop pharmaceutical forms and in particular nanomedicines. Pharmacists may choose some classes of this introductory module for a knowledge update (video conferencing will be organized between both Universities). They will pair this module with soft skills development and tutoring activities towards other students from the same intake. Subsequent modules (24 ECTS) will provide students with basic knowledge on pharmaceutical technology, biopharmaceutical aspects and regulatory affairs for pharmaceutical forms and cosmetics development. In addition, students will beneficiate from a solid introduction to Nanomedicine for drug delivery (description of the main nano-objects, their preparation, characterization methods as well as some examples of applications) (3 ECTS). Patras' students will join the rest of the intake in Paris in January t**o conclude S1 with common practical courses on classical drug dosage forms.**

S2: "**Basic Nanomedicine and Advanced Biology**" takes place in PD. The "Basic Nanomedicine" module (9 ECTS) is dedicated to the design of nanosystems for various administration routes as well as their subsequent characterization and evaluation. Theoretical and practical courses are combined with visits of university platforms. The "Advanced Biology" module (3 ECTS), concerns the study of biological and biotechnological medicinal products (such as peptides and recombinant proteins including growth factors and therapeutics antibodies). Basic concept in immunology including design and development of vaccines will

also be covered. Finally a 3 month (15 ECTS) internship will be held in full partner Universities, giving students their first opportunity to apply their knowledge in R&D projects in Nanomedicine. S2 ends with a two-week Summer School (3 ECTS) where students will benefit from high quality courses/conferences of an Invited Professor and be also in charge of organizing and participating in a two-day' workshop. S2 aims thus at the acquisition of not only the theoretical but also the practical skills, which are essential for their future career.

S3: "Advanced Nanomedicine" (30 ECTS) takes place in UPAV or UA, and includes modules in regulatory affairs, "Production and Applications of Nanoparticles"and special Nanomedicine issues. The objective of the specialization semester is to provide students with deeper knowledge on promising applications of nanoparticles for diagnosis and therapy. Moreover aspects relevant to industrial production, regulations and quality by design will be developed. The "Strategy of Nanomedicine Development for Clinical Application", will also be included. To be selected in each option, students must present a clear professional project in agreement with the specialized courses chosen. Ultimately, this semester allows students to gain in-depth knowledge of a specific area of Nanomedicine and thus outline their professional profile.

S4: "**6-month internship"** includes the execution of a research project or a professional practice Thesis in the area of Nanomedicine (30 ECTS). This can take place in renowned teams of either full or associated partners such as Universities and private companies (Associated Partners). Students will defend their Master's Thesis in front of a jury composed of nanomedicine experts during the annual workshop gathering students from two consecutive intakes.

"Associated partners" of the EMJMD. Their main roles are to provide with some courses/conferences and internship opportunities. Below is enclosed a non-extensive list of these academic partners: Galien Institute, School of Pharmacy, University of Paris South (France), University of Parma (Italy), University of Athens (Greece), University of Liège (Belgium), University of Nottingham (United Kingdom) and Department of Pharmacy and Pharmaceutical Technology, School of Pharmacy, University of Navarra (Spain).

The Modules composing the four semesters of the curriculum are detailed in the following table:

SEMESTER 1 (PD or UPAT)		
Course	**TYPE**	**ECTS**
Introduction to Pharmaceutical Sciences	Class	3
PreFormulation and Dosage Form Design	Cass	3
Conventional Dosage Forms (including Practical courses taking place in PD)	Class & Practical	9
Special Topics in Pharmaceutical Technology (including Practical courses taking place in PD)-	Class & Practical	6
Practical Applications of Formulations -	Project	6
Innovative Dosage Forms	Class	3
	TOTAL	**30**
SEMESTER 2 (PD & 4 Universities)		
Course	**TYPE**	**ECTS**
INTRODUCTION IN NANOMEDICINES (in PD)	Seminars, Classes &	9

	Practicals & platform visits	
Advanced Biology-Pharmaceutical Biotechnology (in PD)	Class	3
3-month Internship (in one of the 4 Universities)	Practical Project	15
NANOMED Summer School and Workshop	Lectures & Project Presentation	3
	TOTAL	**30**
SEMESTER 3 (U-Pavia or U-Angers)		
Course	**TYPE**	**ECTS**
Nanomedicine Applications and Regulations (including Biotech Drugs)	Class	5
Personal Development	Seminars	2
Specialization in Nanomedicines (broken down in 4 different courses which cover all the aspects of Nanomedicine Development and Special Issues of analysis, targeting, vaccines etc)	Class, Practical, Lectures by Invited Professors	23
	TOTAL	**30**
SEMESTER 4 (all Universities & Associated Partners)		
Internship-Project	**ECTS-TOTAL**	**30**