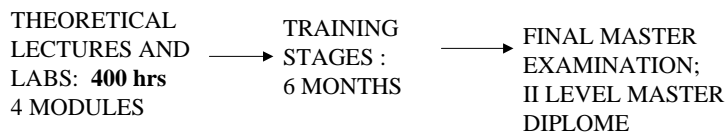


European School of Advanced Studies
on
Nuclear and Ionising Radiation Technology
7th International Master Course
on
**Industrial Applications of the Ionising Radiations
Radioisotopes Techniques and Nuclear Medicine
Environmental Radiochemistry
Radioprotection, Nuclear Decommissioning**
Academic year 2004-2005

*ORGANIZED IN PARTNERSHIP WITH THE
INTERNATIONAL ATOMIC ENERGY AGENCY
(IAEA, VIENNA)*

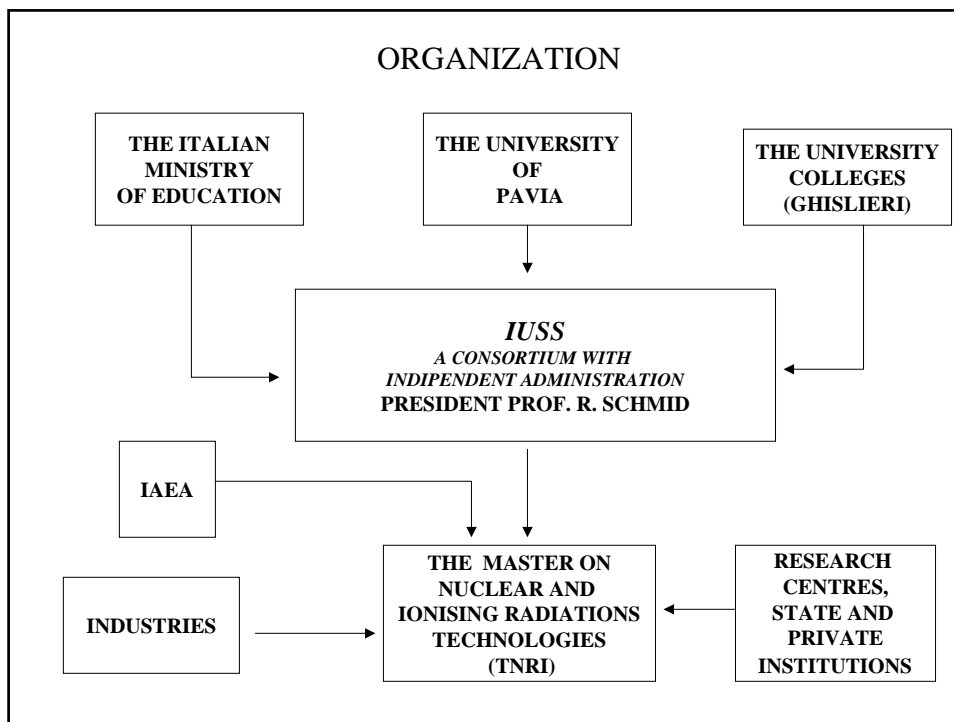
**IUSS-UNIVERSITY OF PAVIA
II LEVEL MASTER**
on
***NUCLEAR AND IONISING RADIATIONS
TECHNOLOGIES***
Academic year 2004-2005

ONE ACADEMIC YEAR



MODULES

- *BASIC NUCLEAR THEORY*
- *INDUSTRIAL APPLICATIONS OF RADIATION TECHNOLOGY*
- *RADIOCHEMISTRY AND RADIOISOTOPES TECHNIQUES*
- *a)RADIOPROTECTION (PROGRAM FOR QUALIFIED EXPERTS)*
b)NUCLEAR DECOMMISSIONING



IUSS-UNIVERSITY OF PAVIA
 EUROPEAN SCHOOL OF ADVANCED STUDIES
 ON
 NUCLEAR AND IONISING RADIATIONS
 TECHNOLOGIES
 Academic year 2004-2005

ADMISSION TO THE COURSE

- *MSc DEGREES ON PHYSICS, CHEMISTRY, ENGINEERING, PHARMACEUTICAL CHEMISTRY, ARE REQUESTED*
- *THE SELECTION IS BASED ON THE CURRICULUM AND A COLLOQUIUM*
- *THE FREQUENCY TO THE COURSE IS MANDATORY*

EXAMINATIONS

- *INTERMEDIATE WRITTEN EXAMINATION AT THE END OF EACH OF THE 4 MODULES*
- *FINAL DIPLOME MASTER EXAMINATION BASED ON THE DISSERTATION OF THE STAGE THESIS. THE STAGE TUTORS ARE INVITED AS MEMBERS OF THE COMMISSION*

FELLOWSHIPS

A LIMITED NUMBER OF FELLOWSHIPS AS TWITION WEAVERS AND REIMBURSEMENT OF LODGING EXPENSES.

BASIC NUCLEAR THEORY: 90 hrs

- *RADIATION PHYSICS*
- *RADIATION CHEMISTRY*
- *RADIOCHEMISTRY AND NUCLEAR CHEMISTRY*
- *RADIOBIOLOGY*
- *RADIATION DOSIMETRY*

2. INDUSTRIAL APPLICATIONS OF RADIATIONS: 110 hrs

- *INDUSTRIAL RADIATION DOSIMETRY*
- *60-Co SOURCES AND E-BEAM ACCELERATORS*
- *APPLICATION OF RADIATIONS TO:*
 - *MATERIAL SCIENCE AND TECHNOLOGY (polymer crosslinking and functional modification, polymer composites, surface curing, curing of semiconductors, e-beam microlithography, e-beam applications in metallurgy)*
 - *ENVIRONMENTAL PROBLEMS (Water remediation, industrial fuel gas treatment, waste sterilization. Recycling of waste materials)*
 - *INDUSTRIAL STERILIZATION (Medical and Pharmaceutical Industries)*
 - *FOOD INDUSTRY AND AGRICULTURE*

3. RADIOCHEMISTRY AND RADIOISOTOPES TECHNIQUES: 90 hr

- *BASIC RADIOCHEMISTRY LABORATORY TECHNIQUES*
- *RADIATIONS SPECTROMETRY AND DETECTION*
- *INAA AND ITS APPLICATIONS (MATERIAL SCIENCE, MEDICAL AND ENVIRONMENTAL RESEARCH, FORENSIC RADIOCHEMISTRY, CULTURAL HERITAGE)*
- *ENVIRONMENTAL RADIOCHEMISTRY AND RADIOECOLOGY*
- *NUCLEAR MEDICINE: A) CYCLOTRON AND RADIONUCLIDES PRODUCTION
B) SYNTHESIS OF RADIOPHARMACEUTICALS*

4-A. RADIOPROTECTION :110 hrs

This part of the course is based on the official program for the 1th, 2th and 3th level Qualified Expert patent examinations.

- *LEGISLATION OF RADIOPROTECTION*
- *RADIATION SOURCES (γ , X, e-beam, neutrons) AND RELATED RADIOPROTECTION AND SAFETY REGULATIONS*
- *RADIATION SHIELD CALCULATION*
- *INSTRUMENTS FOR RADIOPROTECTION*
- *QUALITY CONTROLS*
- *HEALTH CONSEQUENCES UPON EXPOSURE TO RADIATIONS*
- *PERSONNEL DOSIMETRY*
- *RADIOPROTECTION IN RADIOISOTOPES MANIPULATIONS*
- *PLANNING OF RADIOCHEMISTRY LABS*
- *MANAGING NUCLEAR EMERGENCIES*
- *RADIOACTIVE WASTES TREATMENT AND TRANSPORT*

4-B. NUCLEAR DECOMMISSIONING: 24 hrs

- *LEGISLATION*
- *CHARACTERIZATION OF WASTES*
- *PACKAGING OF WASTES*
- *IAEA REGULATIONS FOR TRANSPORTATION OF RADIONUCLIDES*
- *WASTE DISPOSAL*
- *SITE CURING AND SITE RELIESE*

TRAINING STAGES

- **THE TRAINING STAGES ARE REGULATED BY AN OFFICIAL AGREEMENT BETWEEN THE SCHOOL AND THE EXTERNAL INSTITUTIONS**
- **THE TRAINING STAGES HAVE A DURATION OF 6 MONTHS STARTING FROM AUGUST-SEPTEMBER.**
- **THE STAGE ACTIVITY ENDS WITH A FINAL REPORT (STAGE THESIS) AND IT TAKES PLACE UNDER THE SUPERVISION OF A LOCAL TUTOR AND A CO-TUTOR NOMINATED BY THE SCHOOL**
- **THE LOCAL TUTOR AND THE CO-TUTOR ARE INVITED AS MEMBERS OF THE COMMITTEE AT THE FINAL DIPLOME MASTER EXAMINATION.**

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PARTNERS OF THE SCHOOL

INDUSTRIES

- BIOSTER (E-BEAM)
- GAMMARAD (⁶⁰Co CELL)
- GAMMATOM (⁶⁰Co CELL)
- IBA (E-BEAM, X RAY)
- IZOTOP (GAMMA CELLS, Hungary)
- NOVICO (Ascoli Piceno)
- METALLURGICA BRESCIANA
- St-MICROELECTRONICS (Catania)
- MEGARAD (Mignano Montelungo, Caserta)
- So.G.I.N (Roma)
- NUCLECO (Roma)
- PROEL TECNOLOGIES (Firenze)
- TECNOTESSILE (Prato)
- ELSE (Trezzano S/N, Milano)
- COMECER (Ravenna)
- PIRELLI (Advanced Research Labs, Milano)
- ENI (MILANO)

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PARTNERS OF THE SCHOOL

NUCLEAR INSTITUTIONS AND RESEARCH CENTRES

- IAEA (Vienna, Austria)
- RADIOPROTECTION RESEARCH CENTRE (Cadarache, France)
- ENEA (Reseach centres at Casaccia, Bologna and S. Tesresa di Lerici)
- ITALIAN NATIONAL RESEARCH COUNCIL (ISOF-CNR at BOLOGNA; IENI-CNR at Pavia)
- ISTITUTO SUPERIORE DI SANITA' (ISS, ROME)
- ELECTRA (TRIESTE)
- (ICTP , Trieste)
- FEDERAL INSTITUTE FOR FOOD RESEARCH (KARLSRUHE, GERMANY)
- INFN (PAVIA SECTION, AND NATIONAL LABS AT FRASCATI AND LEGNARO)
- AGENCIES FOR THE ENVIRONMENTAL PROTECTION (APAT AND REGIONAL AGENCIES IN MILANO, PAVIA AND PIACENZA)
- HEALTH PHYSICS AND RADIOPROTECTION LABS IN HOSPITALS (MILANO, PAVIA, NOVARA, BOLOGNA)
- PET CENTRES (CNR-Pisa, Milano S.Raffaele, Pavia –LENA)

PARTNERS OF THE SCHOOL

UNIVERSITIES

- THE EMNT NETWORK (Univ of Pavia, Rome, Grenoble, Kaunas, Thursto and CEA-France)
- POLYTECHNIC OF MILAN
- POLYTECHNIC OF TURIN
- UNIVERSITY OF PALERMO
- UNIVERSITY OF BOLOGNA
- UNIVERSITY OF PADOVA
- UNIVERSITY OF URBINO
- TECHNICAL UNIVERSITY OF LODZ (POLAND)
- UNIVERSITY OF STRATHCLYDE (GLASGOW, U.K.)

ACADEMIC YEAR	N° OF MASTER GRADUATED	PHYSICS	CHEMISTRY + CTF + OTHERS	ENGINEERING
1999	15	6	7	2
2000	15	7	2	6
2001	9	4	2	3
2002	13	5	3	5
2003	16 (9 from Italy; 2 from Belarus;1 from Rumenia)	10	3	3
2004	21 (16 from Italy; 2 from Poland;1 Hungary, 1 Jemen, 1 Makedonia)	9	7 Ind. Chem. Chem. Eng Biol. Environmenta l Sci	5
2005	19 (1 graduated in Chemistry from Sudan)	9	7	3

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NUCLEAR FACILITIES AT THE PAVIA'S UNIVERSITY

- TRIGA RESEARCH NUCLEAR REACTOR M II 0.25 Mev
- 16 Mev IBA CYCLOTRON
- 4 kCi 60-Co GAMMA CELL
- 50 kCi 60-Co PANORAMIC GAMMA CELL (to be installed)
- Industrial X -RAY GENERATOR (250 KEV)
- Facilities for high energy physics experiments

PAVIA'S NUCLEAR RESEARCH CENTRES

- THE LABORATORY OF APPLIED NUCLEAR ENERGY (LENA)
- THE NUCLEAR AND THEORETICAL PHYSICS DEPARTMENT
- THE RADIATION CHEMISTRY LAB (CHEMISTRY DEP.)
- THE RADIOCHEMISTRY LAB (CHEMISTRY DEP.)
- THE INFN SECTION of Pavia (HIGH ENERGY PHYSICS INTERNATIONAL PROJECTS)
- *IN THE NEAR FUTURE:* CNAO

