Nuclear Security Education in Pakistan: Current Status and the Future Plans

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Presentation Layout

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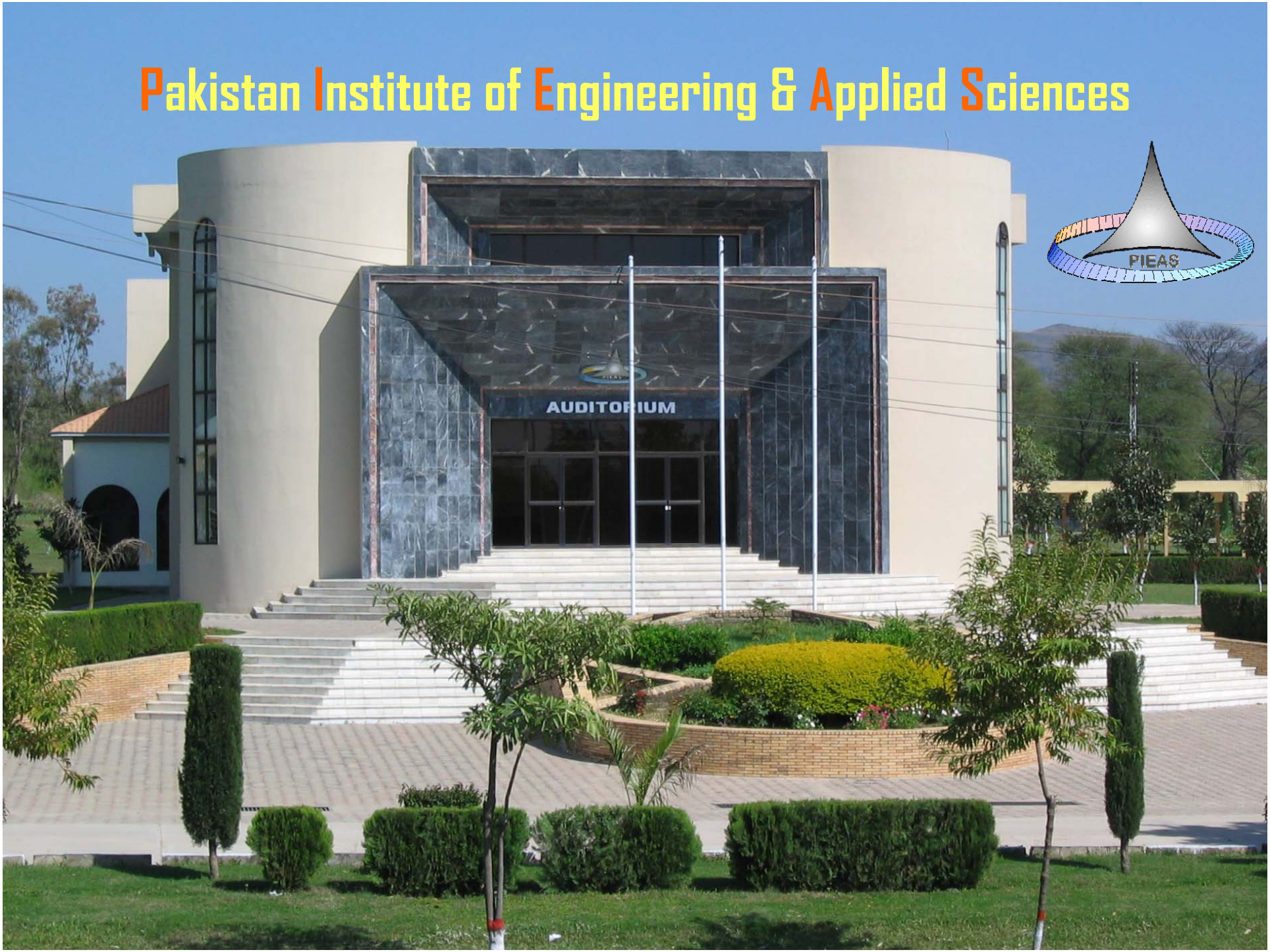
Pakistan Institute of Engineering & Applied Sciences



PIEAS..

- A public sector degree awarding institution
- Offering higher education and training in engineering and applied sciences to:
  - students from all over Pakistan
  - students from other countries of the region

Pakistan Atomic Energy Commission (PAEC) and PIEAS

One of the many educational and training institutes, which provide highly trained manpower

- To PAEC, national industry and hospitals in the areas of:
  - Nuclear Engineering
  - Nuclear Medical Diagnostics and Therapy
  - Process Engineering
  - Materials Engineering
  - Systems Engineering
  - Electrical Engineering
  - Mechanical Engineering

PIEAS Faculties & Departments

- **Faculty of Engineering**
  - Department of Nuclear Engineering (DNE)
  - Department of Electrical Engineering (DEE)
  - Department of Chemical & Materials Engineering (DCME)
  - Department of Mechanical Engineering (DME)
- **Faculty of Applied Sciences**
  - Department of Medical Sciences (DMS)
  - Department of Physics and Applied Mathematics (DPAM)
  - Department of Computer & Information Sciences (DCIS)
  - Department of Communications & Management Sciences (DCMS)

Educational Programs at PIEAS

- PhD program
- MS / M Phil programs in eight (09) fields
  - Nuclear Engineering
  - Systems Engineering
  - Nuclear Medicine
  - Radiation & Medical Oncology (RMO)
  - Medical Physics
  - Process Engineering
  - Materials Engineering
  - Mechanical Engineering
  - Laser / Plasma / Computational Physics
- Undergraduate program
  - BS Electrical & Mechanical Engineering programs
  - BS in Computer & Information Sciences
- Short courses in specialized areas

PNRA and PIEAS Collaboration on Nuclear Security Education

- Pakistan Nuclear Regulatory Authority (PNRA) and Pakistan Institute of Engineering and Applied Sciences (PIEAS) are collaborating in Nuclear Security education
- A two-year degree program of MS (Nuclear Engineering) with specialization in Nuclear Security is in progress

Background Information

- An IAEA meeting at Vienna was held in August 2007 for the development of curriculum guidelines for MS Nuclear Security education program.
- After the meeting, PNRA requested PIEAS for collaboration to initiate Nuclear Security Education program at PIEAS.
- Several Meetings were held between PNRA and PIEAS to discuss possible ways to initiate this program.

Background Information (Contd.)

- After several IAEA meetings, IAEA MS Nuclear Security Education curriculum guidelines were finalized and were sent by IAEA to the member states for further comments.
- Curriculum guidelines at PIEAS were streamlined in the light of IAEA Curriculum guidelines and the possible resource persons were identified at PIEAS, PAEC and PNRA
- The curriculum guidelines were published by IAEA as Nuclear Security Series (NSS)-12 in March 2010.

MS Nuclear Security as Sub-Specialty of MS Nuclear Engineering Program

It was decided that IAEA curriculum for MS Nuclear Security (NSS-12) will be implemented at PIEAS in collaboration with PNRA as following:

- It will be a part of MS Nuclear Engineering program with specialization in Nuclear Security
- The core courses of MS Nuclear Engineering will be offered in first two semesters
- All possible elective courses related to Nuclear Security will be offered in the third and fourth semester, depending upon the availability of faculty.

Main Objectives of MS Nuclear Security Program

- To meet the requirements of professionals having competencies in the field of Nuclear Engineering,
  - With a comprehensive understanding of the requirements for nuclear security matters
- This would mainly cover the broad areas of prevention, detection and response to theft or unauthorized use of nuclear materials.

Advantages of MS Nuclear Security as Sub-specialty of MS Nuclear Engineering Program

- Conducting MS Nuclear Security as sub-specialty of MS Nuclear ENgineering degree program has the added advantages
  - The students specializing with Nuclear Security can also work as Nuclear Engineers, if required
  - This will provide them a broader vision of the technical aspects of both nuclear security and nuclear engineering

MS Nuclear Engineering MS (NE)

- MS Nuclear Engineering programme consists of five (05) semesters
  - 1st Semester (core courses)
  - 2nd Semester (core courses)
  - 3rd Semester (core + elective courses)
  - 4th Semester (core + elective courses + preliminary work on MS thesis)
  - 5th Semester (dedicated for MS Thesis work)
  - Elective courses are offered in the 3rd and 4th semester depending upon
    - the availability of the concerned faculty, and
    - the number of interested students

Comparison with IAEA Curriculum

- A thorough analysis of the IAEA's MS (NS) Curriculum Guidelines (NSS-12) and the existing MS (NE) Curriculum of PIEAS indicated that
  - Several required courses of IAEA's curriculum are almost similar to the core (compulsory) courses in existing MS (NE) curriculum of PIEAS.
  - It was decided to offer two optional courses in 3rd and 4th semesters;
    - Introduction to Nuclear Security in 3rd semester
    - Physical Protection Systems in 4th semester
- The courses were offered by Department of Nuclear Engineering (DNE) at PIEAS in collaboration with PNRA.

Main Challenges faced by DNE

- The introduced courses were to be scrutinized by the following academic bodies at PIEAS
  - Board of Studies (BoS) of Nuclear Engineering Department
  - Board of Faculties (BoF) of PIEAS
  - Academic Committee of PIEAS (the highest academic body at PIEAS)
  - Starting of complete new discipline for award of MS in Nuclear Security will require the approval of Board of Governors (BoG) of PIEAS.

Main Challenges (cont…)

- Some of the tough questions faced were
  - IAEA curriculum guidelines are great but IAEA is not an academic institution??
  - Examples of other academic institutions around the world that are offering these courses in their curriculum at graduate level?
  - What type of textbooks will be used?

Main Challenges (cont…)

- Is the faculty available for conducting nuclear security courses?
- If not, from where the faculty will come?
- How and where will it be trained?
- Which laboratories will be used for experimental work?
- Coordination with other universities for syllabus comparison is required

Acceptance of the Challenges

- Indigenous faculty will be developed and further trained through PIEAS-PNRA-IAEA assistance program
- Labs for academic demonstration will be developed in PIEAS. In the mean time, PNRA labs will be used for practical demonstration
- IAEA will be requested for coordination with other universities offering such courses for comparison of syllabus and training of the faculty members.

Current Status of Nuclear Security Education at PIEAS

- After all processes of scrutiny, MS Nuclear Engineering with Specialization in Nuclear Security (NS) was initiated in November 2009

- Core courses of MS Nuclear Engineering offered in first two semesters
- All possible elective courses related to Nuclear Security offered in the 3rd and 4th semester
- Seminar thesis research project related to Nuclear Security topics

Current Status of Nuclear Security Education (cont…)

- ***Introduction to Nuclear Security (NE-581)*** **is 3 credit hours course. It is offered in 3rd semester. It has been conducted twice and successfully completed**
- ***Physical Protection Systems (NE-582)*** **is 3 credit hours course offered in 4th semester. It has been offered second time and is currently in progress**
- **Existing manpower of PAEC, PNRA and PIEAS is being used as resource persons for these courses**

Teaching Materials Used

- IAEA nuclear security guidelines (nuclear security series, TECDOCS, Information circulars etc.)
- Material from IAEA training courses, provided by PNRA
- Several video documentaries related to nuclear security topics
- Some short videos available on IAEA website related to nuclear security topics

Teaching Methods

- Lectures related to the topics were delivered by the faculty members
- Hands on demonstration of related equipment available at PNRA was carried out by PNRA experts
- Reading assignments
- Term project topics were selected and assigned to the students on individual basis
- Every student was supposed to
  - search for the material related to the assigned topic on internet, and
  - prepare a 20-30 page report, and
  - present it in the class
- Relevant videos were shared with students via intranet for the purpose of watch-at-home assignments before coming to class

Evaluation of Students

- All the students are evaluated as following
- 70% of the grade is awarded through
  - Two one-hour sessional tests, and
  - One 3-hour terminal test (includes all course material)
- 30% grade is awarded on the
  - Term-project report and presentation
  - Assignment on different international instruments
  - Reading assignments (tested as quizzes)

Lessons Learnt

- Nuclear security education is need of the day
- Induction of new courses in the existing discipline is the easiest way to move forward
- Sharing of experiences among different educational institutions and strategic organizations is necessary to enhance the quality of nuclear security education

Future Plans

- New courses related to nuclear security will be gradually introduced in the coming years
- Development of relevant laboratories (under supervision of IAEA) at PIEAS/PNRA to facilitate practical implementation of nuclear security concepts
- Development of nuclear security culture at organizational level
- Training of the manpower in this area to fulfill the national needs

Future Needs

- Development of textbook material
  - Complete textbooks
  - Individual modules
- Development of effective collaboration with international universities
- Sharing of experience and knowledge
- International university experts visits to PIEAS
- Supervision of projects by international experts
- Development of video lectures of experts
- Development of relevant laboratories at PIEAS to supplement the course work.

INSEN

- The INSEN is defined as a partnership between the IAEA and educational and research institutions, and other stakeholders**.
- The mission of INSEN is to enhance global nuclear security by developing, sharing and promoting excellence in nuclear security education.

- **Other stakeholders: governmental entities, such as regulatory authorities, the Ministry of Justice, Finance, Health, Environment, Science, Transport; law enforcement agencies, such as Customs, Police, the intelligence services; the nuclear industry; companies with security expertise in other fields and other related organizations.

Mission of INSEN

- The mission of INSEN is to enhance global nuclear security by developing, sharing and promoting excellence in nuclear security education.

Main Objectives of INSEN

- Development of peer-reviewed textbooks, computer based teaching tools and instructional material, including exercises and materials for laboratory work;
- Faculty assignment and development in the different areas of nuclear security
- through mutual faculty exchanges and/or joint development and implementation of in-depth nuclear security training programmes or schools;
- Joint research and development activities to share scientific knowledge and infrastructure;

Main Objectives of INSEN (Contd.)

- Student exchange programmes to foster international cooperation and exchange of information;
- Quality assurance: consistency with IAEA defined terminology described in the IAEA Nuclear Security Glossary, the Fundamentals and the Recommendation documents;
- Theses evaluation, coordination and improvement;
- Performance of surveys on the effectiveness of nuclear security education among students and faculty;

INSEN Management Structure

- The management structure of INSEN was formulated by a group of experts from different universities and IAEA staff.
- The proposed management structure of INSEN was then sent to all the March 2010 Meeting Participants for their comments.
- It was adopted with very minor changes in August 2010 Meeting
- The working agendas of August 2010 meeting was based on the INSEN management structure

Management Structure of INSEN

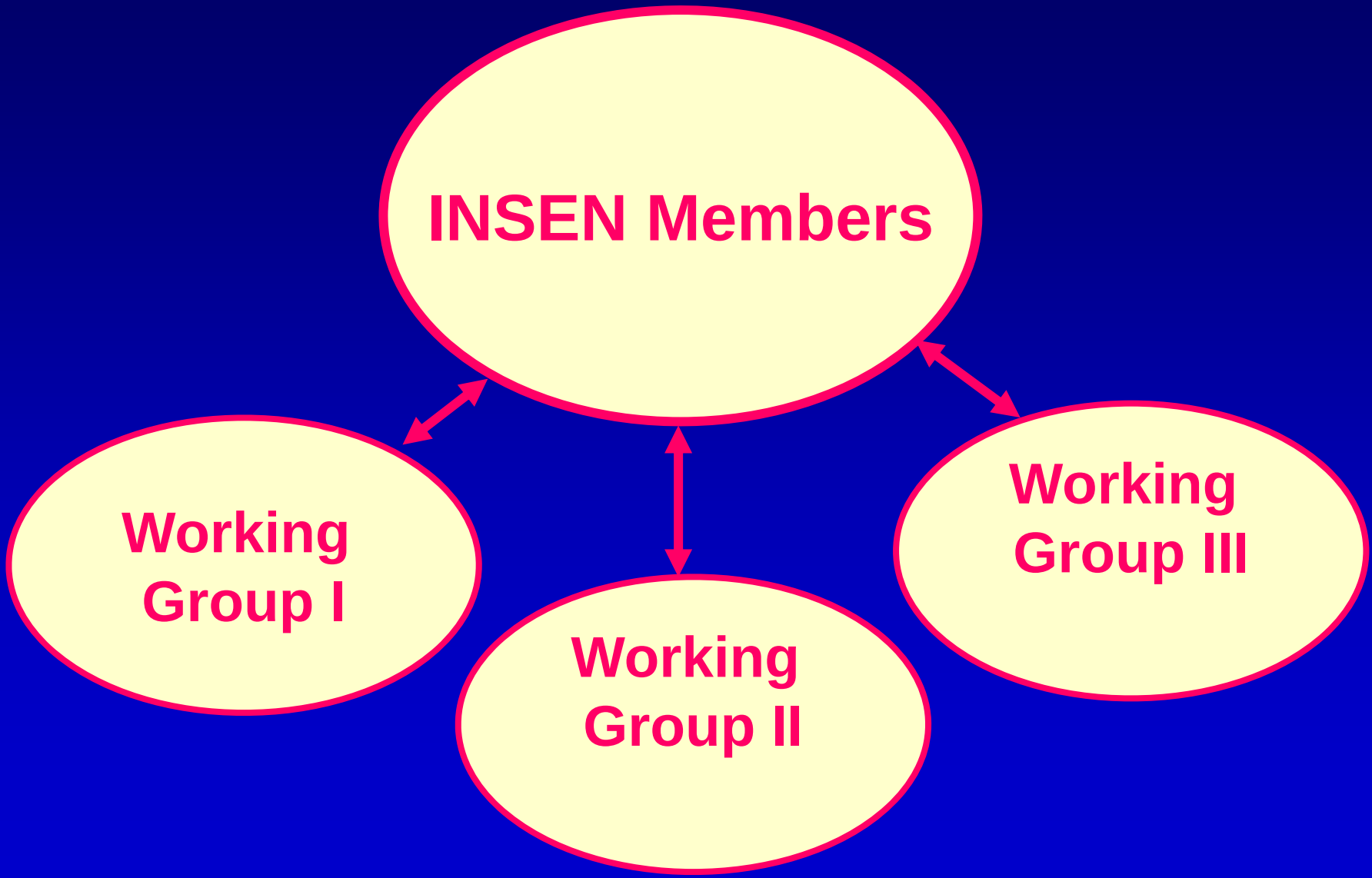
- INSEN is guided by all its members.
- INSEN has three main working groups
  - Working Group-I (WG-I)
    - This group deal with exchange of information and development of materials for nuclear security education
  - Working Group-II (WG-II)
    - This group deals with faculty development and cooperation among educational institutions
  - Working Group-III (WG-III)
    - This group deals with promotion of nuclear security education
- All INSEN members are highly encouraged to participate in all three Working Groups

INSEN Membership

INSEN membership is informal and open to:

- **Any educational and research institution already involved or, that plans to be involved in nuclear security education in the future.**
- **Any other nuclear security stakeholder that is interested or involved in nuclear security education.**

Management Structure of INSEN



Management Structure of INSEN

- Each working group has its members (by option) along with some IAEA Staff
- Each working group selects its own Chairperson, by mutual agreement.
- The Chairpersons of the individual working groups
  - Conduct the meeting of the group,
  - Discuss the main objectives, and
  - Determine actions taken in the future
- There is a formal position of Chairman INSEN.
  - The main function of the Chairman INSEN is to facilitate the Chairpersons of all three working groups during the meetings.

Operational Mode of INSEN

- All working group members will collaborate with each other to achieve the main objectives,
- Every year, there will be an annual meeting of all INSEN members,
- The yearly achievements, lessons learnt and the future action plans to resolve (any) problems will be mutually discussed and decided at this meeting
- Every year, the working group Chairpersons will be rotated so that all INSEN members can play a leading role to achieve the main objectives of INSEN.

Nuclear Security Information Portal

- Nuclear security information web-portal has a special section for INSEN
- This provides infrastructure for promoting, managing, sharing and preserving nuclear security knowledge and facilitating INSEN activities
- Each working group has an area on the INSEN portal and will be responsible for the provision and regular update of information/material

Summary and Conclusions

- Nuclear Security Education has been initiated at PIEAS as a sub-specialty of MS Nuclear Engineering
- Currently two elective courses have been offered.
- More elective courses related to Nuclear Security will be introduced gradually in the future leading to a full fledged MS in Nuclear Security at PIEAS in close collaboration with PNRA and IAEA

Summary and Conclusions

- The quality of the offered courses will be enhanced with the development of
  - Relevant laboratories
  - Development of the expertise by qualification improvement courses and different training courses
- INSEN platform will play a vital role in the development of nuclear security education at national and international level.
  - PIEAS and PNRA are members of INSEN
- Nuclear Security education at PIEAS will be able to meet the national / international need for the human resource development in this area in collaboration with PNRA and IAEA.

Thank you for your kind attention!