

PIEAS

PAKISTAN INSTITUTE OF ENGINEERING
AND APPLIED SCIENCES

RESEARCH and ACADEMIC Achievements

No.1 in Pakistani and
106 in Asian Universities
(QS Asian University Rankings 2014)

No. 1 Engineering University of Pakistan
(HEC Ranking 2006-2013)

A Leader in Research

MESSAGE from RECTOR



Dr. Muhammad Aslam is a physicist, a nuclear engineer and a material scientist. He completed his Master's from Quaid-i-Azam University, Islamabad and PhD from Purdue University, USA. He was a David-Ross Scholar at Purdue. He has been serving as Rector PIEAS since November 2003.

Pakistan Institute of Engineering and Applied Sciences (PIEAS), Islamabad is a highly specialized institution of higher education with its major focus on postgraduate degree programs. Although PIEAS offers BS, MS and PhD degree programs in diverse areas of engineering, physical and life sciences, yet MS and PhD programs are predominant at the institution. Research projects form an important component of the postgraduate programs. MS students constitute the largest entity of students at PIEAS. The work done for research projects by good MS students is presented in national and international conferences and it gets published in reputed international journals. For a PhD student the eligibility for the degree is mainly determined by the quality of thesis project. Each PhD student contributes several research papers to national and international conferences and publishes the research work in reputed journals of the field.

Highly qualified faculty, good research and general infrastructure and excellent quality & quantity of research publications define the academic environment of PIEAS. These factors have been instrumental in No. 1 ranking of PIEAS in the category of "engineering and technology" in all assessments of Higher Education Commission carried out in years 2006, 2010 and 2013. Quacquarelli Symonds (QS) Ranking of Asian Universities in year 2014, declaring PIEAS at No. 1 position in Pakistan and 106th in Asia has further endorsed the high quality of teaching and research at the institution. Supporting facilities like a large computer centre, a good library and on-campus hostels also have a positive impact on the academic environment.

This brochure in the ensuing pages aims at highlighting PIEAS research infrastructure, the most current R&D areas along with faculty profile. This will facilitate the potential research scholars in development of their links to relevant faculty members of PIEAS for useful collaboration aimed at creation of new knowledge.

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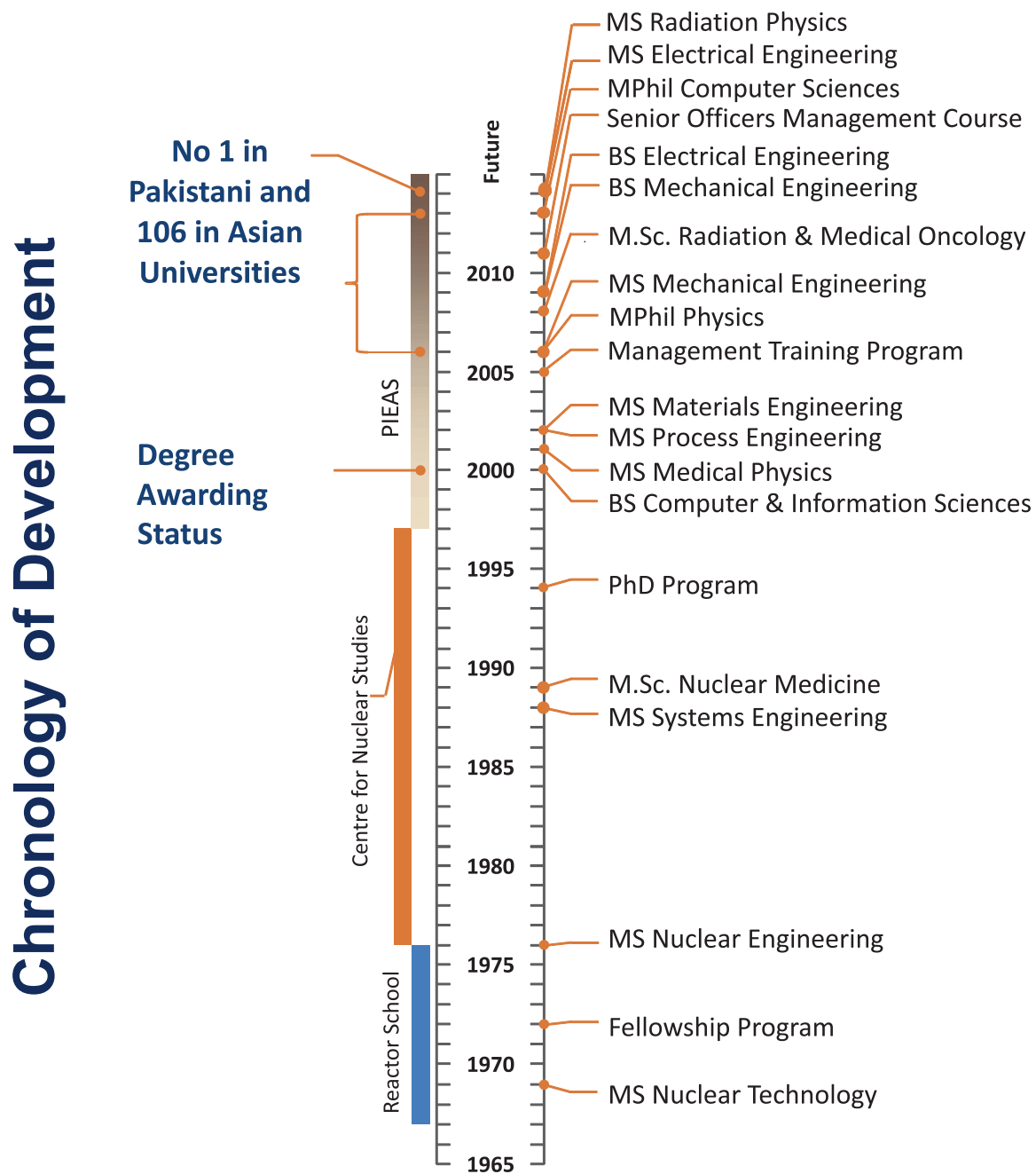
84 Residential Services Division

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ABOUT PIEAS

Pakistan Institute of Engineering and Applied Sciences (PIEAS), a public sector university, working under the auspice of Pakistan Atomic Energy Commission, conducts academic and training programs leading to BS, MS/M Phil and PhD studies in hi-tech areas of science and technology for national and international students. PIEAS is committed to the promotion of academic excellenc and innovation in an environment of diversity and equal opportunity, and shall continue to actively contribute to the creation, application and dissemination of knowledge for national development and enhancement in quality of life.



Faculties & Departments

FACULTY OF ENGINEERING

- DCHE** -Department of Chemical Engineering
- DEE** -Department of Electrical Engineering
- DME** -Department of Mechanical Engineering
- DMME** -Department of Metallurgy & Materials Engineering
- DNE** -Department of Nuclear Engineering

FACULTY OF APPLIED SCIENCES

- DCIS** -Department of Computer & Information Sciences
- DCMS** -Department of Communication & Management Sciences
- DMS** -Department of Medical Sciences
- DPAM** -Department of Physics & Applied Mathematics

Degree Programs

MS/MPhil and PhD Programs

- Nuclear Engineering
- Systems Engineering
- Nuclear Medicine
- Medical Physics
- Process Engineering
- Materials Engineering
- Mechanical Engineering
- Laser, Plasma & Computational Physics
- Radiation and Medical Oncology
- Computer Science
- Electrical Engineering
- Radiation Physics

Undergraduate Programs

- Electrical Engineering
- Mechanical Engineering

Special Features of PhD Program

- High relevance to Research & Development in national and international areas of interest.
- External Examiners from developed countries.
- Publication in reputed international journals.
- Open Final Defense using Video Conferencing Facility.



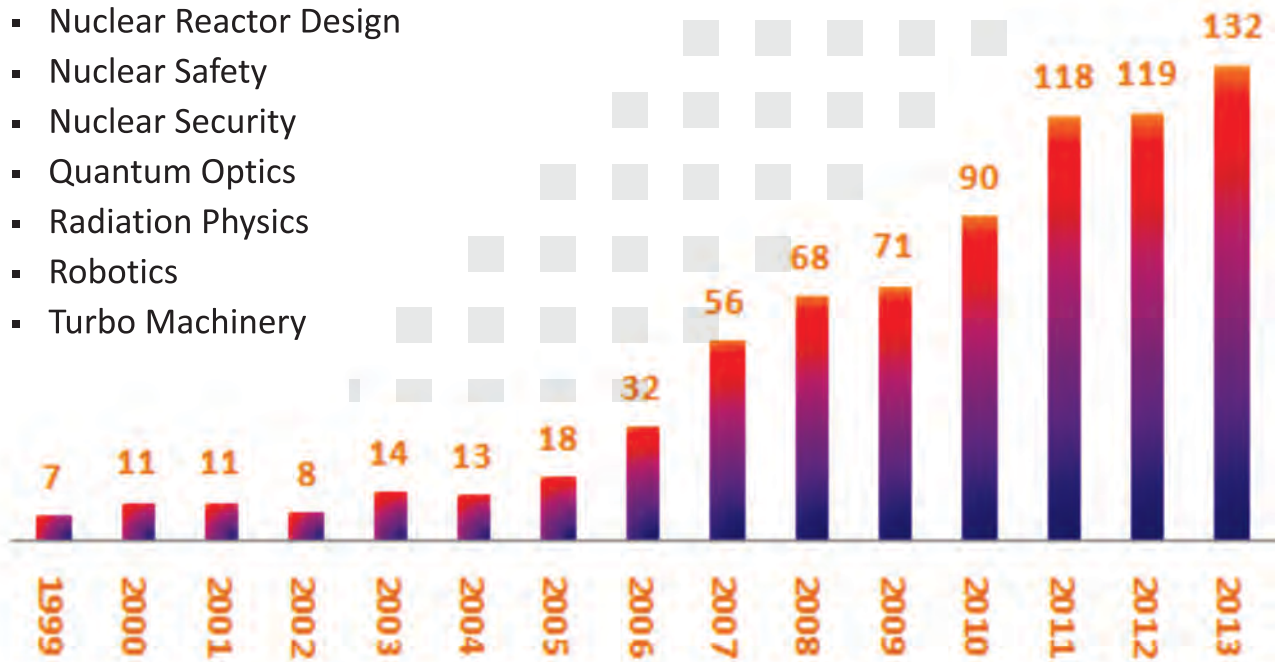
R&D

Major Areas of R&D

- Advanced Polymeric Materials
- Applications of Finite Element Method
- Atmospheric Modeling
- Bio-Photonics
- Combustion
- Computational Fluid Dynamics
- Control and Automation
- Cyber Security
- Image Processing
- Micro and Nano Devices
- Nano Materials
- Nuclear Medicine and Oncology
- Nuclear Reactor Design
- Nuclear Safety
- Nuclear Security
- Quantum Optics
- Radiation Physics
- Robotics
- Turbo Machinery



Students Engaged in Research Work



Yearly Publications in Impact Factor Journals

National Collaborations



- Arid Agriculture University, Rawalpindi
- COMSATS Institute of Information Technology (CIIT), Islamabad
- Engineering Development Board
- Fatima Jinnah Women University, Rawalpindi
- FECTO Cement Factory
- Federal Urdu University, Islamabad
- Gomal University
- Hazara University
- Institute of Space Technology (IST), Islamabad
- International Islamic University, Islamabad
- Islamia College University
- Karachi Institute of Power Engineering (KINPOE), Karachi
- Lahore University of Management Sciences, Lahore
- Mehran University of Engineering and Technology, Jamshoro
- Mirpur University of Science and Technology, Mirpur
- National Center for Physics (NCP), Islamabad
- National Engineering and Scientific Commission (NESCOM)
- National Institute of Health, Islamabad
- National Institute of Laser & Optronics (NILOP)
- National University of Computer and Emerging Sciences, Islamabad
- National University of Science and Technology (NUST), Islamabad
- Pakistan Nuclear Regularity Authority (PNRA)
- Peshawar University, Peshawar
- Punjab University, Lahore
- Quaid-i-Azam University, Islamabad
- Riphah International University Islamabad
- University of Peshawar

International Research Collaboration



Atmospheric Modeling

University of Mexico (UNAM)

Bioinformatics

Catholic University of Daegu, South Korea



Biophotonics

Harvard University, USA
Tufts University, USA
University of Memphis, USA
University of Dundee, UK
University of Sao Paulo, Brazil

Biomedical Engineering

Massachusetts Institute of Technology, USA

Computational Intelligence

University of Stirling, UK

Image Analysis/ Processing

Gwangju Institute of Science & Technology, South Korea
University of Bielefeld, Germany
University of Sussex, UK
University of Warwick, UK

MEMS

University of Southampton, UK
Imperial College, UK

Materials Development

Queensland University, Aus
Zhejiang University, China

Nanoelectronics

Tokyo Institute of Technology

Nuclear Engineering

Atilim University, Turkey

Polymeric Nanocomposites

Cornell University, USA
Pusan National University, South Korea
Kuwait University

Probabilistic Risk Analysis

Kyung Hee University, South Korea

Quantum Optics

Texas A & M University, USA



Growth in Infrastructure

Computer Center



A glimpse of newly developed Computer Center. It is 24/7 facility of 200 state of the art Core i5 Computers. The technical assistance is available round the clock. The Computer Center was developed under Up-Gradation of PIEAS Infrastructure project

Video Conferencing Facility

Video conferencing and interactive lecturing is an initiative of HEC to improve the quality of distance learning education in the country. PIEAS established Teleconference Hall for these services. The facility is supervised by Computational and Internet Services Division



Female Hostel

A view of recently completed female hostel, the project costed around 58 million rupees. The campus now has eight hostel blocks, which can accommodate 180 female and 640 male students.



Advanced Polymer Laboratory



Outside view of advanced polymer lab, the project costed 180 million rupees

Development Projects

Title of the Project	Cost in Million Rs
Strengthening of PIEAS	574
Up-Gradation of PIEAS Infrastructure	495
Development of Advanced Polymer Lab	180
MS and PhD Fellowships from HEC	100
Construction of a Library and a Mosque	135
Establishment of a Center for Nano Technology	61
Building of a Hostel for Female Students	58
Development of Powder Metallurgy Laboratory	44
Hazardous Air Pollutants Lab	44
Travel Grants / Research Fellowships	43
Development of a Bio-Photonics Lab	35
Advanced Computational Reactor Engineering Lab	35
Equipment Maintenance Grants	12
Research Initiation Grants	12
International University Linkage	12
Efficient Watermarking System for DNA	5.7
Electron Transport in Nanostructures	4.4
Laser Tissue Interaction	2.2
Reversible Watermarking System	1.8
Investigation of Local Coal	01

Honors & Distinctions

International Ranking

No.1 Among Pakistani Universities and
106 of Asian Universities by QS Asian University Rankings 2014

National Ranking

No.1 Engineering University by
HEC Ranking 2013
HEC Ranking 2010
HEC Ranking 2006

National Awards for PIEAS Faculty

Sitara-e-Imtiaz (Star of Distinction)	3
President's Pride of Performance	4
Tamgha-e-Imtiaz (Medal of Distinction)	2
President's Medal for Technology	1
Aizaaz-e-Kamal (Honor of Prominence)	1
Aizaaz-e-Fazeelat (Honor of Excellence)	3
Best Teacher Awards (by HEC)	9



Salient Features

Full Time Faculty

PhD	90
Pursing PhD	20
MS/MPhil	22
M.Sc./MA/MBBS/BE	05

Computational and Research Support Infrastructure

- Local Area Network with 1-Gigabit fiber optic backbone
- 20 servers to support a variety of operations
- Around 1500 PCs in a heterogeneous environment
- 24 Mbps Internet Connectivity
- Video conferencing facility for distance learning
- Access of HEC's Digital Library via PERN project

Library

PIEAS library along with PINSTECH library contains
More than 65,000 books

130 current journals

More than 52,000 back issues of journals

1000,000 technical reports

A new state of the art building with full range of library facilities has recently been added to this pool

Digital Library

CISD is executing this program to provide researchers in the university with access to international scholarly literature based on electronic (online) delivery, providing access to high quality, peer-reviewed journals, databases, articles and e-Books across a wide range of disciplines.

Co-curricular Activities

PIEAS students and faculty are involved in various co-curricular activities. For this purpose they have established societies and clubs. Presently there are 9 student societies and 8 sports clubs working under the supervision of Student Affairs Division



Affiliated Institutions

KINPOE

Karachi Institute of Power Engineering

NIBGE

National Institute of Biotechnology
and Genetic Engineering

NIAB

Nuclear Institute of Agriculture and
Biology

NILOP

National Institute of Lasers and
Optronics



A view of newly developed PIEAS
Central Library

DEPARTMENTS

at PIEAS

The background is a solid teal color. A white curved line starts from the top left, curves downwards and to the right, and then curves back towards the bottom left, creating a large, open, teardrop-like shape. The text is centered within this white shape.

**DEPARTMENT OF
CHEMICAL
ENGINEERING**

DCHE

Introduction

The Department of Chemical Engineering offers extensive course work in its postgraduate programs, and has the depth and breadth of expertise to match. The Pakistan Institute of Engineering and Applied Sciences was the first Pakistani University to offer full-time Masters' by course work and PhD programs by research work in engineering. It has continuously updated the contents of courses to ensure relevancy to the needs of government organizations and industry. Currently the postgraduate programs of this department are of 24 months duration with full time enrolment.

Academic Programs

MS Process Engineering
PhD Process Engineering

Specializations

Process Modeling and Control
Chemical and Mineral Processing
Environmental Engineering



Faculty

The Department of Chemical Engineering consists of a strong faculty of scientists and engineers, most of whom possess PhD degrees from renowned overseas universities. The faculty members have academic backgrounds and relevant specializations in the areas of Materials Engineering, Chemical Engineering, Environmental Engineering, Minerals Engineering, and Basic and Applied Chemistry. This rich amalgam of various disciplines is the strength of our department allowing us to pursue R & D and conducting postgraduate academic and research programs.

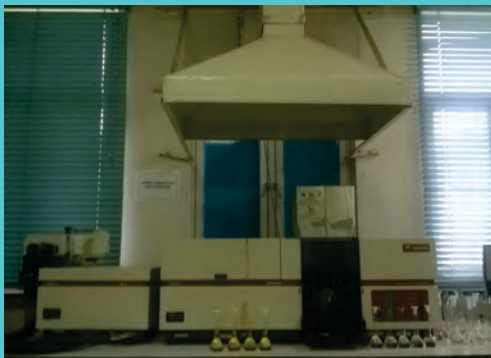
PhD	08
MS	01
Pursuing PhD	06
Total	15

Facilities

DChE has several advanced laboratories to perform basic and advanced level research. Broadly speaking, DChE has a Pilot Scale Laboratory, Process Control Laboratory, Mineral Processing Laboratory, Analytical Chemistry Laboratory and Environmental Analysis Laboratory. A list of some representative equipment from different laboratories within DChE is presented below:



Students working in laboratory



Atomic Absorption Spectrometer

- Distillation Column With Vacuum Facility
- Jaw Crusher
- Flotation Column
- Mozeley Shaking Table
- Denver Flotation Cell
- Gas Chromatograph (gc)
- Flame Photometer
- Rotavapor
- Vacuum Oven
- Conductivity Meter
- Incubator
- Dissolved Oxygen Meter
- Bubble Column Reactor
- Two Bed Ion Exchanger
- Process Control Rig With Single And Cascade Loop Controllers
- Pulse Column Liquid-liquid Extraction Unit
- Combustion Rig (300 Kw)
- Research Setup With The Flue Gas Monitoring Facilities
- High Performance Liquid Chromatograph (hplc)
- Turbulent Contact Absorber Research Setup
- Sieve Plate Distillation Column
- Atomic Absorption Spectrometer
- UV Visible Spectrophotometer
- Rock Cutting Machine
- Lapping and Polishing Machine With Accessories
- Vibratory Disc Mill
- Frantz Isodynamic Magnetic Separator

Research

Current Research Areas

Thermal Hydraulics

Fluid Dynamics
Heat Transfer

Chemical Process Development

Process Analytics
Process Instrumentation and Control
Multiphase Flows
Particle Technology

Mineral Processing

Energy and Fuels

Coal and Biomass
Combustion, Gasification and
Pyrolysis

Computational Fluid Dynamics and its application

Collaborations

Coal Combustion

University of Leeds, UK
MUET, Jamshoro, Sindh
Punjab University, Lahore
NUST, Islamabad
PECTO Cement Factory

Coal Gasification

Engineering Development Board
Computational Fluid Dynamics
PAEC
KINPOE, Karachi
LUMS, Lahore

Recent Publications : 22

Special Achievement

First ever publication on **Thar Coal Combustion Analysis**
in journal of Energy & Fuels

Title: *Combustion of Pakistani Lignite (Thar Coal) in a Pilot-Scale Pulverized Fuel
Down-Fired Combustion Test Facility*



Students during a laboratory session

Workshops

SAPE'13

CFD Workshops at PIEAS and LUMS

Workshops on coal mining and combustion

Planned Workshops

SAPE'14

CFD Modular course



A close view of Rotavapor



**DEPARTMENT OF
COMPUTER AND
INFORMATION
SCIENCES**

DCIS

Introduction

Department of Computer and Information Sciences (DCIS) shares in general PIEAS objective to serve the country with outstanding education through teaching and research. In support of this mission, MPhil and PhD programs in Computer and Information Sciences have been initiated.

The department courses have been designed with the objective to train students in the wide range areas of Computer Science and Information Technology. The broad areas of specializations are Software Development, Networking, Artificial Intelligence, Embedded System Design, Image Processing and Numerical Computing and Computer Security.



Students working in Pattern Recognition Lab

Academic Programs

MPhil (Computer Science)
PhD (Computer Science)

Specializations

Information System Security
Computational Intelligence and Machine Vision
Scientific Computing
Computer Security

Faculty

PhD	12
Pursing PhD	01
M.Sc / MS / MPhil	03

Lab Facilities

Pattern Recognition Lab
Computational Lab
Image Processing Lab
High Performance Computing Lab
Robotics Lab

Research and Collaboration

Research Grants

IT & Telecom Endowment Fund of Rs. 100 Million (Profit of Rs. 13 Million per year)

Grants for various projects (Total 3.2 Million)

- Twas-comstech Joint Research Grants Program, 2011
- HEC National Research Grant Proposal For Universities, 2011
- HEC Upgradation Of Lab, 2012
- HEC Post Doctoral Research Grant

ICT R&D grant of Rs. 3.5 Million is in the final stages of approval

Collaboration

Classification and segmentation of ultrasound liver images (MINAR)

Development of a target tracking and position estimation system for a UAV (SATUMA)

Design and development of pan tilt motion control system for UAV (SATUMA)

Development of a comprehensive cancer patient management system (BINOR)

Information system specialized for cancer centers (INMOL)

Welding defects detection in industrial radiography based digital images using segmentation techniques (SES)

Iris based human identification system (ICCC)

Estimating breast cancer risks using different classifiers (NORI)

Publications

Year 2000-14

International Journals	70
International Conferences	114
Book Chapters	07

Year 2012

International Journals	22
International Conferences	07
Book Chapters	01

Awards

Best Teacher Award (two times)

Research Productivity Awards (five times)

PAS-COMSTECH Prize (one time)

National Youth Award (one time)

Best paper awards (four times)

The logo features a large, stylized orange shape on the right side, resembling a curved arrow or a speech bubble, pointing towards the bottom left. This shape is set against a light blue background. The text is centered within the orange shape.

**DEPARTMENT OF
COMMUNICATION
AND MANAGEMENT
SCIENCES**

DCMS

Introduction



Chairman PAEC Dr. Ansar Parvez Speaking at the Graduation Ceremony of Senior Officers Managements Course

The Department of Communication and Management Sciences (DCMS) furthers the mission of PIEAS to impart academic excellence not only to produce competent engineers and medical doctors, proficient scientists and researchers, but also to produce individuals who can provide effective leadership at all levels, personnel with a groomed intellectual and emotional understanding of the organizational and global challenges.

DCMS Offers courses related to social and management sciences in both undergraduate and graduate degree programs of PIEAS

Offers management training programs for the officers of strategic commissions under the auspices of National Command Authority (NCA).

Faculty

Regular Faculty

Dr. Jamil Ahmed (Head)
Mr. Muhammad Ijaz (Consultant)
Mr. Mazhar Hasnain (SE)
Ms. Mehnaz Zainab (Assistant Professor)
Ms. Rubina Shaheen (Assistant Professor)
Mr. Muhammad Sarwar Khan (Lecturer)
Mr. Nauman Shamim (SS)

Associated Faculty

The diversity and intellectual levels of the senior officers participating in the management courses offered by this department require a faculty that is accomplished in its respective subjects accompanied with vast experience and communication skills. To meet such requirements, senior most persons from various public and strategic organizations such as Strategic Plans Division, Strategic Commissions, Ministry of Foreign Affairs, vice chancellors of universities, eminent personalities from civil society and industry are invited to deliver lectures.

Courses Offered

Courses offered to Undergraduate Programs at PIEAS

CMS-101 Islamic Studies	CMS-102 Ethics (for Non-Muslims)
CMS-103 Pakistan Studies	CMS-104 Composition and Grammar
CMS-105 Communication Skills	CMS-106 Technical Writing
CMS-107 Professional Ethics	CMS-108 Logic and Critical Thinking
CMS-109 Entrepreneurship	CMS-110 Sociology
CMS-201 Principles of Management	CMS-202 Engineering Economics

Courses offered to Graduate Programs at PIEAS

CMS-501 Communication Skills
CMS-505 Project Management

Management Training Program for Officers of Strategic Commissions

Basic Management Courses (BMC)
Senior Officers Management Courses (SOMC)

Collaborations

The nature of collaboration with various strategic organizations under the National Command Authority falls in the realm of seeking professional knowledge and case studies in their areas of working. High ranking officials of strategic commissions are also invited to deliver dedicated lectures on management theories and practices which culminated in the successes of Pakistan's nuclear program, research activities of strategic Commissions and applied knowledge in domains of health, agriculture and nuclear power. As regards collaborations with industry and academia, accomplished leaders from these two sectors are invited for their experiences to enhance professional knowledge of the trainees and various eminent individuals are also invited to supervise industrial projects undertaken by the participants of the senior management courses. This department is poised to launch research projects in collaboration with academia and industry. The successful graduates of the Senior Officers Management Courses also remain engaged with this department for their continued input and enrichment based upon their specific experiences.



Group Photo of the participants of a Senior Officers Management Course with Chairman PAEC

About Management Courses

National Command Authority (NCA) initiated management courses aiming at enhancing the capabilities of senior professionals working in strategic commissions towards innovation, productivity and quality of their work places. These courses were envisaged to be specific and catering for the nature of research and development work related to the programs of Pakistan Atomic Energy Commission (PAEC), National Scientific and Engineering Commission (NESCOM), Pakistan Space and Upper Atmosphere Research



*Major General Ret. Ahmed Bilal
Chairman SUPARCO (extreme left)
awarding certificate to a participant
of Senior Officers Management
Course*

Commission (SUPARCO) and Khan Research Laboratories (KRL). This unique training requirement for the employees of these commissions was not available from other avenues in the country. The National Command Authority (NCA) therefore, assigned this task to PIEAS which was already engaged in conducting middle level management courses since 2005 for the employees of strategic commissions. PIEAS accepted the challenge of designing curriculum for the Senior Officers Management Course (SOMCs) and commence this management program. Thus PIEAS responded quickly by starting the first SOMC in early 2011. So far, around two thousands five hundred employees have graduated in Basic Management Courses (BMC) and Senior Officers Management Courses (SOMCs).

Active Research

The education in management sciences is rather a nascent activity at PIEAS and to start with the department's major focus is to train senior officers of the constituent commissions of the National Command Authority (NCA) in the domain of management sciences which is professional requirement aimed at enabling them to perform as per demands of higher managerial positions. All these graduating employees have produced valuable technical insights related to various topics in the form of project reports. As this forum matures, project reports leading to research in management sciences will also be undertaken.

Workshops and Seminars

The very nature of the proceedings of these higher level management courses falls in the category of seminars/ workshops in their extended form. However short term (3 day / 1 week) seminars in current management themes are planned to be held wherein academia / industry will also be involved. Presently Applied System and Analysis Division of PAEC have organized various workshops on nuclear power and related issues in collaboration with this department.

**DEPARTMENT OF
ELECTRICAL
ENGINEERING**

DEE

Introduction

Objective and Thrust

Department of Electrical Engineering started as a research group called Computer & Control Systems Group (C&CSG), with the main objectives of establishing research activities and training in the areas of Computer Sciences and Control Systems Engineering. The group launched MS Systems Engineering program in 1988. After restructuring of PIEAS, formerly known as Center for Nuclear Studies (CNS), it was separately established as Electrical Engineering Department in 2000.

More than 300 scientists and engineers have graduated and currently 65 students are registered under MS. Systems Engineering program. PhD. in Systems Engineering was started in 1999. Two students have been awarded PhD. degrees in Systems Engineering and 8 are currently pursuing their research leading to PhD. The first batch of BS Electrical Engineering students was inducted in Fall 2009 with specialization in Electronics. Specializations in Power and Computer Engineering will also be offered in the coming years.

Academic Programs

BS Electrical Engineering
MS System Engineering
PhD Electrical Engineering

Faculty Strength

Department has 30 faculty members including 13 foreign qualified PhD and 6 lab engineers

PhD	15
MS	05
Pursuing PhD	04
BS	06
Total	30

Laboratories

There are 8 labs in the Department of Electrical Engineering. State of the art and fully operational equipment are available in these laboratories. The laboratories are continuously upgraded keeping in view the revised curriculum and research projects



Facilities

Control and Automation

Equipment : Servo System setups, Digital Signal and Image processing kits, Induction Motor Drive setups, Inverted pendulum setups, PCB development equipment

Current Projects : Design and Development of DC fan powered by a solar PV system, Fan testing robot, Brain-controlled robot, Design and Development of Induction Furnace

Digital System Design

Equipment : FPGA setups, DSP Development Kits, PIC development boards

Robotics

Equipment : Mobile Robot platforms

Current Projects : Upper humanoid body, Stair climbing robots, Self balancing robots, Exoskeleton for teleportation

Electrical Machines



A view of Electrical Machines Lab

Equipment : Three phase Multifunction Machines, Three phase Asynchronous Machines, DC Machines, Single and Three Phase Transformers, Industrial AC Motors, Electrical Machine Protection

Current Projects :

3 phase-3kW AC induction motor drive

Data Communication Lab

Equipment : TMS Communication Trainers, Universal Software Radio Peripherals, Indigenously developed Waveguide setups

Current Projects : Smart Vehicle Tracking

Measurement and Instrumentation Lab

Equipment : Energy meter with calibrating load, Three phase loads, Single Phase and Three phase watt-meter, Phase meter, Gauss meter, Stroboscope



A view of Control Automation Lab

Electronics Lab

Equipment : Training kits, Oscilloscopes

Current Projects : Inertial sensor based navigation, Active Beacon based localization Motor Drives

Control System Design

Equipment : Siemens PLC kits, Coupled Tank Systems, Magnetic Levitation Setup, Process Trainers, Robotic Arm

Current Projects : Steering Control of Bicycle, Embedded Control of Twin rotor system, Control of Hot air blower system

Research



Recent Publications

Journal 72
Conference 153

Academic Achievements

US Patent

awarded to Dr. Ghulam Mustafa (2013)

Young Associate Award

for Dr. M. Rehan by Pakistan Academy of Sciences

Consecutive Best Paper Awards

at International Conference on Emerging Technologies in 2012 and 2013

1st Position in Quiz Competition

at Digital Innovation Competition, 2013

2nd Position in Programming

at Digital Innovation Competition, 2013

1st Position in Race to Innovation

at GIKI National Electronic Olympiad, 2013

1st Position Speak it Up

at GIKI National Electronic Olympiad, 2013

Current Areas of Active Research

Control Theory and Applications

Non-uniformly sampled Control Systems and Network controlled system
Fault Detection
Diagnosis and Isolation
Chaos Synchronization
Anti-windup compensator Design
Modeling and feedback control of Bio-systems
Visual Servoing

Signal Processing and Computing

Real Time Brain imaging and Brain computer Interfacing for defense and medical applications
Image processing and Machine Vision
Array Signal Processing
Blind source separation and Active Noise control
High Performance Computing

Robotics

Robot Mechanism Design and Control
Robot Programming by Demonstration
Mobile Robot Navigation

Communication Systems

Spectrum Sensing and Cognitive Radio Networks
Cooperative Communication
Wireless Body Area Networks

Collaboration



Collaboration with Academia

National Institute of Laser & Optronics (NILOP)
Applied Electronics

Federal Urdu University
Robotics

Karachi Institute of Power Engineering (KINPOE)
Robotics

Collaboration with Industry

Pakistan Atomic Energy Commission (PAEC)

Robotics and Control applications in Nuclear Power Plants
Embedded Design for complex systems
Machine vision, Industrial Drives

National Engineering and Scientific Commission (NESCOM)

Applied control
Array Signal Processing

Fan industry, Gujrat

DEE is conducting a project to develop energy efficient dc motor

Heavy Electrical Complex (HEC)

Online Tap Changer for Power Transformer

Workshops and Conferences/Seminars

5 day IEEE workshop on MATLAB
GRE-USEP workshop
Insight to IEEE
Talk women in Engineering, December 17, 2013
PI-Electric December 19-20

Planned Workshops/Seminars

PIEAS MEGAFEST
IEEE Symposium on Recent Advances in Control Engineering
Workshop on cognitive radio networks

The logo features a large, stylized letter 'D' on the left side, composed of a light purple outer curve and a white inner curve. The background is a solid dark purple. The text 'DEPARTMENT OF MECHANICAL ENGINEERING' is centered within the dark purple area in a white, serif font.

DEPARTMENT OF
MECHANICAL
ENGINEERING

DME

Introduction

The department of mechanical engineering at PIEAS has its prime objective of producing highly skilled engineers with specialization in three areas, namely Mechanical Engineering Design, Computational Solid Mechanics and Computational Fluid Dynamics. Furthermore active research is going on in the field of Turbo-Machinery.

Academic Programs

B.Sc Mechanical Engineering
M.S Mechanical Engineering
PhD in Mechanical Engineering



Faculty

PhD	07
MS	08
B.Sc	03
Pursing PhD	02

Name

Dr .Muhammad Javed Hyder
Dr. Asad Majid
Dr. Ishtiaq Ahmad
Mr. Muhammad Abid Ilyas
Mr. M. Afzal Hussain Hamdani
Dr. Rizwan Alim Mufti
Mr. Atique Ahmad
Dr. Ajmal Shah
Mr. Muhammad Akmal
Mr. Muhammad Zahid Iqbal
Dr. Kaman Rashid Qureshi
Hafiz Laiq-ur-Rehman
Mr. Muhammad Abdul Basit
Mr. Muhammad Usman
Mr. Imran Khan
Mr. Waqqas Ahmad

Highest Qualification

PhD (ME)
PhD (NE)
PhD (Engineering)
B.Sc. (ME)
MS (Structural Engineering)
PhD (ME)
MS (NE)
PhD (NE)
B.Sc. (ME)
B.Sc. (ME)
PhD (Fluid Mechanics)
MS (Process Engineering)
MS (NE)
MS (ME)
MS (ME)
MS (ME)

Research and Facilities

Current Area of Active Research

Heat transfer analysis of fusion fission based system
Computational Fluid dynamics (CFD)
Quality assurance and industrial safety
Renewable energy and its utilization
Manufacturing process
Turbo machinery R&D and control mechanism development
Automobile Design and Development
CAD/CAM
Modeling and Simulation of manufacturing process
Experimental stress analysis
Mechanical system design and development
Vibration analysis
Computational and Analytical techniques in solid mechanics
Steam Jet Pumps

Total Publications

Total publications during last 5 years are about 30, including journal and conference.



CNC Milling Machine

Equipment / Instruments Available with Department

Subsonic Wind Tunnel
Multi Turbine Test Set
Multi Pump Test Rig
CNC Lathe
CNC Milling

Collaborations

Industry / Academia

DME has linkages industry, which have been developed through internship and Design Projects of the students. Some of the industries are:

- NESCOM
- PAEC
- KRL
- Heavy Mechanical Complex (HMC)
- Starco Fans, Gujrat



Multi Turbine Test Set

Workshops / Seminars

Short course on - Computer Aided Analysis using ANSYS Workbench

Short course on - Advanced Course on Structural Dynamics using ANSYS Workbench

Achievement

Secured 12th and 7th positions in Shell Eco Marathon in 2014

Won the AirEx-13 Xtreme Engine powered Air Craft Challenge at GIKI



**DEPARTMENT OF
MEDICAL
SCIENCES**

DMS

Introduction

The vision of the Department of Medical Sciences (DMS) of PIEAS is “the advancement in Medical Sciences by taking leading role for excellence in academics and innovation, through strong commitment toward betterment of healthcare system”.

Currently the department is offering MSc degree programmes in Nuclear Medicine and Radiation & Medical Oncology for medical doctors. These programmes are designed to provide them a thorough grounding in the principles and applications of diagnostic and therapeutic techniques using radiations and radioisotopes. During training medical doctors are also equipped with the necessary tools for carrying out meaningful research in their respective fields.

Since Nuclear Medicine and Radiation & Medical Oncology are multi disciplinary fields that combine medicine, chemistry, physics, statistics, mathematics and computer sciences, the department also has a rich amalgam of full time and part time faculty comprising of physicians, radio-pharmacists, physicists, engineers, mathematicians and computer experts, all contributing in the programmes of DMS efficiently.

Academic Programs

PhD Nuclear Medicine
M.Sc Nuclear Medicine
M.Sc Radiation & Medical Oncology

Courses Offered

MS-501	Introduction to Nuclear Physics
MS-502	Mathematics and Statistics
MS-503	Radiation Detection and Instrumentation
MS-504	Radiation Protection and Radiation Biology
MS-505	Radiochemistry and Radiopharmaceutical
MS-510	Introduction to Nuclear Technology
MS-601	Diagnostic Imaging and Function Techniques
Ms-602	In vitro Studies and Therapeutics
MS-512	Quantitative Analysis and Data Processing in Nuclear Medicine
MS-506	Clinical Radiology
MS-515	Nuclear Medicine Laboratory
MS-697	Thesis Project
MS-690	Intensive Clinical Training in Nuclear Medicine
MS-521	Principles of Radiotherapy and Cancer Chemotherapy
MS- 522	Mathematical Modeling of Biological Systems and Epidemiology
MS-523	Radiation Detection, Protection and Instrumentation
MS-524	Tumor and Radiation Biology

Faculty

FCPS	2
MS	3
PhD	1

Laboratories and Equipment

The nuclear medicine laboratory is equipped with Siemens® Orbiter gamma camera integrated with Macintosh based ICONTM software capable of performing all the commonly used nuclear medicine procedures. The department also has a well-equipped “Hot Lab”, essential to prepare and deal with unsealed radiation sources for human/animal



use. They are primarily used for hands on training of the students and clinical and basic research. Other facilities in the department that complement the training and research are a treadmill for exercise tolerance tests, an ultrasound scanner and thyroid uptake system. The department also has the access to nearly 25 cancer hospitals for research as well as clinical training of the students.

Gamma Scanner

It is Siemens® Orbiter gamma camera fitted with ICONTM workstation with Macintosh, capable of all commonly

performed nuclear medicine procedures. It is used for hands-on training of students for quality control procedures and research.

Hot-Lab

Containing dose calibrator, fume hood, radioactive, shieldings survey meters, various phantoms and other necessary lab items. It also has a radioactive waste storage facility.



ETT Tread Mill

Ultrasound Scanner



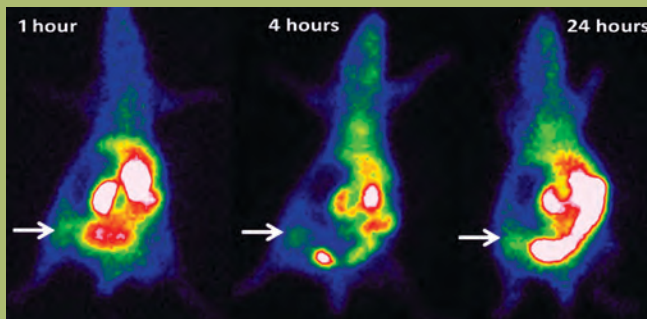
Research activities

Active Areas of Research

Oncology
 Nuclear Oncology
 Nuclear Cardiology
 Infection Imaging
 Radio Nuclide Therapy

Recent Research Publications

International Journals	23
National Journals	03
International Conference	30
National	03
Book Chapters	01
Online	05



Academic Collaborations

The department has the privilege of collaboration with more than 25 specialized nuclear medicine and oncology institutes for clinical training of the students and their research projects. They include:

They include:

Eighteen Nuclear Medicine and Oncology Medical Centres of Pakistan Atomic Energy Commission throughout the country

Shaukat Khanum Memorial Hospital, Lahore
 Isotope Production Division, Pakistan Institute of Nuclear Science and Technology
 Punjab Institute of Cardiology, Lahore
 Armed Forces Institute of Pathology, Rawalpindi
 Pakistan Institute of Medical Sciences, Islamabad
 Aga Khan University Hospital, Karachi
 The Kidney Centre, Rawalpindi
 NESCOM Hospital, Islamabad

Achievements

First prize of Ali Nawaz Khan Research Award, 5th International Radiological Conference (1999)
 Research Productivity Award by Pakistan Council for Science & Technology (2013)
 Best Poster Award at 9th World Congress in Nuclear medicine and Biology (2006) Seoul, Korea

Seminars and Workshops

- Hospital Management of Irradiated Contaminated Patients & Basics of Radiation Physics for Doctors, 2012
- Professional Competency Enhancement Programme for Teachers, 2010-11
- PIEAS International Conference on Nuclear Medicine and Oncology, 2009
- PIEAS-MINAR Ultrasound Workshop, 2001
- 1st American Society of Nuclear Cardiology (ASNC)-PIEAS workshop on Nuclear Cardiology
- Short Course on Abdominal Ultrasound, in collaboration with National Institute of Handicapped

**DEPARTMENT OF
METALLURGY AND
MATERIALS
ENGINEERING**

DMME

Introduction

The Department of Metallurgy and Materials Engineering consists of a strong faculty of scientists and engineers, most of whom possess PhD degrees from renowned overseas universities. The faculty members have academic backgrounds and relevant specializations in the areas of Materials Engineering, Chemical Engineering, Environmental Engineering, Minerals Engineering, and Basic and Applied Chemistry. This rich amalgam of various disciplines is the strength of our department allowing us to pursue R & D and conducting postgraduate academic and research programs in the general direction of Materials Processing.



The Department of Metallurgy and Materials Engineering offers extensive coursework in its both postgraduate programs, and has the depth and breadth of expertise to match. The Pakistan Institute of Engineering and Applied Sciences was the first Pakistani University to offer full-time Masters' by coursework and Ph.D. programs by research work in engineering. It has continuously updated the contents of courses to ensure relevancy to the needs of government organizations and industry. Currently the Postgraduate programs of this Department are of 24 months duration with full time enrolment

Programs

MS Materials Engineering
PhD Materials Engineering

Faculty

PhD	10
MS	01
Pursing PhD	05
Total	16

Facilities

Equipment in the Department

Nano Devices Characterization Laboratory

Cryogenic Probe Station
LCR meter [Agilent 9480a]
Time Interval Counter
CV/IV Software
Programmed Power Supply
DC Resistance meter
Source meter [Kiethley 2400]
Semiconductor Parameter Analyzer [Agilent 4156c]
Temperature Controller
Lock-in Amplifier
Nano Voltmeter
A/C resistance Bridge

Nanoscopy Laboratory

X-ray Diffractometer
Field Emission Scanning
Electron Microscope
Sputter Coater
Scanning Probe Microscope

Nanoscale Characterization Laboratory

UV-Vis spectrometer
CHNS-O Analyzer
Thermo-Mechanical Analyzer
Electrochemical Impedance
Spectrometer

Nanomaterials Synthesis Laboratory

Potentiostat-Galvanostat
Planetary Ball Mill
Mono Mill
High Pressure Reactor
Muffle Furnace
Oven
Fume Hoods
Spin Coater

Thermal Characterization Laboratory

Thermo-Gravimetric Analyzer
Gel Permeation Chromatograph
Differential Scanning Calorimeter
Fourier Transform IR Spectrometer
Moisture-meter
Membrane Osmometer

Polymeric Nanocomposites Laboratory

Minijet Extruder
Heating Ovens
Rheometer
Melting Point Apparatus
Controlled Environment Glove Box
Blender and Extruder
Rotary Vacuum Pumps
Electric Balance
Centrifuge



DC power supplies
Programmable Function Generator

Polymer Synthesis Laboratory

- Blender and Extruder
- Hot Press
- Electric Balance

Nanostructures Synthesis Laboratory

- Electrospinning Setup
- Inert Gas Condensation System
- High Temperature Box Furnace

Powder Processing Laboratory

- Freeze Dryer
- Sieves for Powder Size Analysis
- High Energy Planetary Ball Mill
- High Temperature Furnace
- Tube Furnace
- Vacuum Drying Oven
- Vacuum Rotary Evaporator

Materials Modeling Laboratory

- Pentium Computers
- GULP-Static lattice Simulation Code
- WIEN2k-A density Functional Computer Code
- IntelliSuite Software for Microelectromechanical Systems (MEMS) Design and Analysis

Powder Characterization Laboratory

- BET Surface Area Analyzer (Micromeritics)
- Laser Particle Analyzer
- Pycnometer (Micromeritics)

Near-Net Shape Manufacturing Laboratory

- Injection Molding Machine
- Rubber Mixing Mill
- Vacuum Induction Furnace
- Vacuum Sintering Furnace
- Vacuum Hot Press
- Microwave Sintering Furnace

Materials Testing Laboratory

- Impact Testing Machine
- Tensile Testing Machine
- Hardness Tester

Microstructure Laboratory

- Metallurgic
- Slow speed cutter
- Sample Grinding and Polishing Machines

Limiting Oxygen Indexer
Notch Cutter



A graduate student performing high resolution microscopy at FESEM

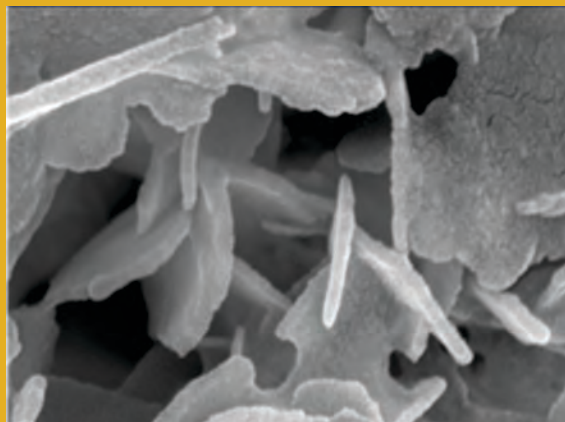


Research

Recent Publications 122

National Center for Nanotechnology

Development of Porous Anodic Alumina (PAA) and Its Applications



AAO Nano Flakes Structure Produced by Graduate Student

alumina was also developed which showed quite interesting photoluminescence properties.

Porous anodic alumina with ordered porosity, controlled inter pore distance, highly parallel aligned pores and smooth pore walls has been developed in our laboratories. This high quality PAA may be used as template for growth of high aspect ratio ordered nano-structures as well as in optical devices. Electrodeposition of magnetic metal nano wires using PAA as template has been successfully demonstrated. Formation of carbon nano wires through graphitization of PVC, PVA and chitosan infiltrated inside the nano pores / nanochannels of PAA has also been achieved. Through thickness porous anodic

alumina was also developed which showed quite interesting photoluminescence

Materials for High Density Data Storage Devices

Nickel nano particles were formed by electrolysis of alcogel containing nickel salts. Electrolytic reduction of nickel salt inside the gel resulted in the formation of nickel nano particles embedded in silica matrix. Such structures are useful for high density data storage devices.

Wear Resistant Nanocomposite Coatings

Nano composites have been developed by gas carburizing of electrodeposited alloys of iron group elements (IGEs) with tungsten resulting in the formation of tungsten carbide precipitates inside IGE-W alloy. These nano composite coatings may be employed for high wear resistance applications.

Biocompatible Ceramic Nanocomposites for Dental Applications

High toughness ceramic nano composites, consisting of yttria stabilized zirconia reinforced with alumina nano whiskers, have been developed. The biocompatibility of these nano composites was enhanced by the incorporation of hydroxyapatite and in vitro studies proved very good biocompatibility after hydroxyapatite incorporation while keeping good mechanical properties. These nano composites can be used as dental implant materials.

Corrosion Resistant Nanocrystalline Coatings

Nano crystalline Zn-Ni coatings were developed and evaluated for their corrosion resistance properties. These coatings show very good protecting capability against chloride environments and may be employed as better sacrificial coatings for steels.

Nanomaterials for Optoelectronic Devices

ZnO nano structures have been developed by electrochemical techniques. The morphology of these nano structures has been controlled through the control of synthesis parameters that result in tuning their optoelectronic properties.

Gold / Silver Nanoparticles for Antibacterial and Optoelectronic Applications

Irradiated chitosan has been employed for the reduction of silver and gold from their aqueous solutions resulting in the formation of silver and gold nanoparticles. These particles show varying absorption spectra within visible light range depending on their sizes. They can be used for antibacterial applications.



Nanomaterials for Solar Applications

SnO nanocrystalline films and multilayers of Ge-TiO₂ nanocrystalline films have been developed by physical vapor deposition techniques. These films show interesting properties for solar cell

Micro and Nano Devices Laboratories

Synthesis of Nanostructures

Nano structures are synthesized using chemical route, electrospinning and inert gas condensation techniques. The main aim is to develop new nano materials for applications in sensing, photodetection, photocatalysis and nano electronics.

Electron Transport in Nanostructures

It is extremely important to understand electron transport in nano structures (nano wires, nano particles, thin films, etc.) for application of these nano structures as functional components in nano and optoelectronic devices. Therefore, AC and DC electron transport properties of nano structures are investigated in detail.

Photodetectors and Gas Sensors

Semiconductor nanostructures are utilized to prepare sensing elements for photodetectors and gas sensors. These sensing detectors and sensors are then tested and evaluated in the laboratory. The main purpose of the research is to develop low cost and efficient photodetectors and sensors based on semiconductor nano structures.

Materials Modeling

Static lattice simulations and density functional theory is used to predict and study materials properties. Intelli Suite software is used to design and analyze MEMS.

Powder Metallurgy Laboratories

Synthesis and Characterization of non-ferrous alloys

Non ferrous alloys such as AZ31 and Al 6063 have been developed and the effect of alloying additions and thermo-mechanical treatments on the properties including texture was also studied.

Synthesis of Advanced Materials by Powder Metallurgy

Quasicrystal reinforced aluminum matrix composites, interpenetrating phase composites (IPCs), high entropy alloys (HEAs) and metallic glasses are being synthesized by high energy planetary ball milling and sol-gel processing followed by shaping through compaction and sintering.



Graduate students performing electrical measurements

Powder Characterization

Characterization of the powders has been performed to measure their surface area, volume & shape of porosity, powder size analysis and density of green and sintered compacts.

Powder Injection Molding

Polymeric and ceramic parts including those of alumina, polypropylene and polyethylene have also been prepared by injection molding process.

Advanced Polymer Laboratories

- Polymeric hydrogels for controlled drug delivery
- Natural polymers as post harvest preservative and plant growth promoters
- Radiation resistant polymeric materials
- Polymer nano composites for high strength and high impact
- Flame retardant polymeric materials
- Modification of polymers using ionizing rays
- Recycling of polymeric waste
- Biodegradable polymeric composites
- Development of antimicrobial hydrogels
- Development of silicas and silanes



Collaborations

International

Tohoku University Japan

Fuel cells, hydrogen storage materials and oxygen permeable membranes

Institute of Metals Research, CAS, China

Magnetism of nanomaterials

University of Calgary

Wear and corrosion resistant nanocrystalline coatings

Elettra Sincrotrone Trieste

SAXS of nanoporous materials

Cambridge University

SAXS of nanoporous materials

Kuwait University

Polymeric nanocomposites

University of Manchester

Nanomaterials characterization

Nanjing University China

Nanomaetrialis

University of Hong Kong

Optoelectronic devices

Memorial University of Newfoundland

Synthesis and properties of nanomaterials



Au Particles on ZnO Nanorods



National

Various Establishments of PAEC and NESCOM

Quaid-i-Azam university (QAU)

National University of Science & Technology (NUST)

Institute of Space Technology (IST)

COMSATS Institute of Information Technology (CIIT)

National Centre for Physics (NCP)

Arid Agriculture University,

Hazara University

International Islamic University

University of Peshawar

Islamia College University

Federal Urdu University

Mirpur University of Science and Technology

Lahore University of Management Sciences

Riphah International University

Fatima Jinnah women university

Hazara University

Punjab University

Gomal University

The logo features a large orange circle on the right side of the page, with a white curved line on the left side that separates it from the light blue background. The text is centered within the orange circle.

**DEPARTMENT OF
NUCLEAR
ENGINEERING**

DNE

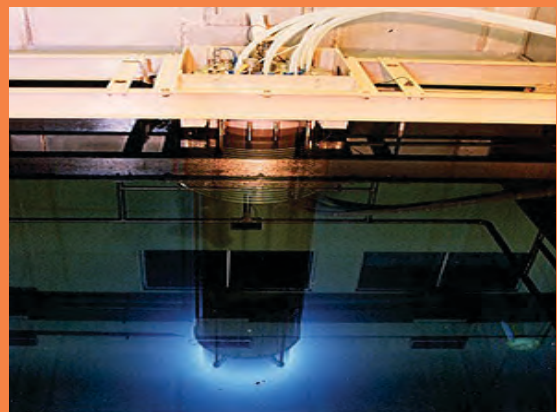
Introduction

The mission of the program is to produce competent and academically sound, thoroughly trained nuclear engineers who are competent to work in the reactor operation, reactor design, reactor safety, nuclear fuel cycle and nuclear security, to carry out commissioning of new reactor facilities, to assist in developing advanced nuclear power systems thus bringing progress and prosperity to our nation and humanity. The programs of DNE are oriented towards objectives such as imparting high quality education in nuclear engineering and to inculcate culture of analysis and research among students.

Academic Programs

MS Nuclear Engineering

This program is by far the oldest at PIEAS. More than 1300 engineers and scientists have graduated under this program over the past four decades and today they form the backbone of various projects of the Pakistan Atomic Energy Commission and other strategic organizations. The participants of this program are taken from almost all the engineering and scientific disciplines. This diversity is just one of the imperatives of the multi-disciplinary nature of nuclear engineering itself.



Criticality study at Pakistan Research Reactor-I

PhD Program

PhD in nuclear engineering includes course work, qualifying exams and an original research work on a topic of choice in nuclear engineering. PhD thesis requires an international review and publications in reputed journals. At present various PhD scholars are conducting their doctoral level research in various fields of nuclear engineering in the department.

Short Courses

- Radiation Protection Course for IAEA Fellows
- Nuclear Orientation Course for Newly Inducted Officers at PAEC
- Radiation Protection/ Basic Health Physics Course

Specialized Streams

- Core Neutronics
- Nuclear Reactor Thermal Hydraulics
- Radiological & Environmental Engineering
- Nuclear Fuel Cycle
- Nuclear Security

Faculty

PhD	13
MS	02
Pursing PhD	02

Facilities

The department has the following laboratories encompassing and enriching the range of academic disciplines in which it has qualified faculty. A brief introduction to the facilities in each laboratory is presented in the following paragraphs:



A view of PARR-I control Room

Pakistan Research Reactor-I (PARR-I)

PARR-I is a research reactor located at the Pakistan Institute of Nuclear Science and Technology (PINSTECH). It was started in 1965 at 5MW and later was upgraded to 10MW in 2000. Since criticality, PARR-I has rendered invaluable services in the training of manpower, production of radioisotopes and as a source of neutrons and gamma radiation for

basic and applied research. PIEAS students use this important facility of performing experiments and doing research in nuclear engineering.

Pakistan Research Reactor-II (PARR-II)

PARR-II is the on campus MNSR type research reactor of PIEAS. It has been a valuable asset for PIEAS graduates for the last three decades. Primary purpose of PARR-II is training and research. Due to its inherent safety features, it is also used fearlessly for the initial training of the reactor operators. Students of MS Nuclear engineering perform experiments related to reactor operation and control as a compulsory part of their curriculum. Researchers used its irradiation facilities in their neutron activation analysis

Advanced Computational Reactor Analysis Laboratory (ACRE)

ACRE Laboratory is a state of art laboratory containing latest computational resources for lengthy and cumbersome calculations involved in nuclear reactor analysis & design, nuclear reactor safety, thermal hydraulics, plasma physics, radiation shielding, seismology and environmental engineering. It contains work stations with Windows and Linux operating system connected to servers for storage solution. It also will soon add Cluster computing (36 nodes) and ALTIX system to its resource list. This hardware is equipped with latest computational tools for reactor engineering calculations.

PWR Training Simulator

Department of nuclear engineering has a PWR simulator that provides an opportunity to MS Nuclear Engineering students to step into the shoes of a reactor operator. Simulator helps students in understanding of various systems of nuclear power plant. Real time data can be seen and stored on digital computer for further analysis. The sequence of events in case of accidents such as reactor trip, turbine trip, and loss of coolant can be simulated.



Simulator for Pressurized water reactor

Health Physics Laboratory



Health Physics Laboratory

The basic purpose of the health physics laboratory is to ensure the safety of working personnel within safe limits in radiation environment. Health physics laboratory has all the latest equipment including pocket dosimeters, personal radiation monitors, survey meters, contamination monitors and TLD system for the essential training of students and radiation workers in the field of radiation safety. The experiments span a broad spectrum

from basic training to applied research in environmental dose assessment and risk analysis..

Radiation Shielding Laboratory

The Radiation shielding laboratory was established to have a practical sense of radiation safety by means of shielding. It was upgraded to become an integral part of MS Nuclear Engineering curriculum. It provides facilities from basic training to applied research in the field of Shield Design including nuclear cross section measurement, attenuation and albedo calculations. In addition to that the facilities for the study of Neutron diffusion parameters, alpha and fission fragment spectroscopy are available.

Environmental Monitoring Laboratory

This lab possesses the following experimental and analysis equipment:



- Air sampler
- Incubator
- Conductivity and pH meters
- Ion selective electrode
- Field kit for water analysis UV-VIS spectrophotometer
- Distillation unit
- Oxygen analyzer
- Pressure decomposition container

HAPS Laboratory

Hazardous Air Pollutants (HAPS) Characterization and Control Laboratory

HAPS laboratory project has been approved by the HEC and civil work is in progress.

Research and Collaboration

Current Area of Active Research

The faculty is involved in following research areas:

Core Neutronics

Reactor Thermal Hydraulics

Nuclear Waste Management

On going Research Projects



Nuclear Power Plants (NPP) Charcoal Filters : Removal of Radioactive and other hazardous Pollutants by Impregnation and Parametric Optimization of Adsorbent.
The project is being conducted with active collaboration with PAEC and HIT.

Adsorption of ^{131}I , CH_3I , CsI and other atmospheric radioactive products during a potential NPP accident using Passive Filtered Containment Venting System at NPPs.
The project is being conducted through active collaboration with KANUPP- PAEC.

Nuclear Accident Plume Dispersion: Modeling and Analysis of Plume Dispersion and Particle Trajectories using Coupled Meteorological and Dispersion Model. (PAEC)
The project is being supported by PAEC.

Potential Nuclear Power Plant Accident Cost Estimation
The project is being supported by Pakistan Nuclear Regulatory Authority (PNRA)

Effect of High Gamma Flux on Coaxial Cables
The project is being conducted through active collaboration with PAEC.

Modification in design of GM Tube by quench gas study
The project is being supported by PAEC.

Feasibility study of Passive Filtered Containment Venting System at NPPs
The project is being conducted through active collaboration with PAEC.

Increasing Shelf life of BF₃ Detectors

The project is being conducted through active collaboration with PAEC.

Reactor Shielding Design for nuclear reactors

The project is being conducted through active collaboration with PAEC.

Assistance in production of ultrafine lead for spectroscopy background shielding, general shielding and for lead accumulators

The project is being conducted through active collaboration with PAEC, HIT and PAL.

Total Publication 2008-2013

Journal	85
Conferences	81



A group discussion with instructor during a lab session

Collaboration with Industry/Academia

HIT

Testing of Al-Khalid tanks.

KANUPP

R&D of FCVS

National Center for Physics

Lectures delivered by Dr. Aman ur Rehman

Center of Excellence in Nuclear Security

Lectures delivered by Dr. Tariq Majeed on nuclear security.

Atominstitute-Vienna University of Technology, Austria

Collaboration of Dr. Rustam Khan in field of Monte Carlo simulations

PAEC

Continuous research collaboration with various organizations of PAEC

DESTO

Lectures delivered by Dr. Naseem Irfan and Dr. Tariq Majeed in NBC warfare agents

Workshops/Conferences/Seminars 2012- Dec. 2013

Key Issues in Nuclear Science and Technology

Short Course on Porous Carbon Materials and Polymer-Fiber Composite

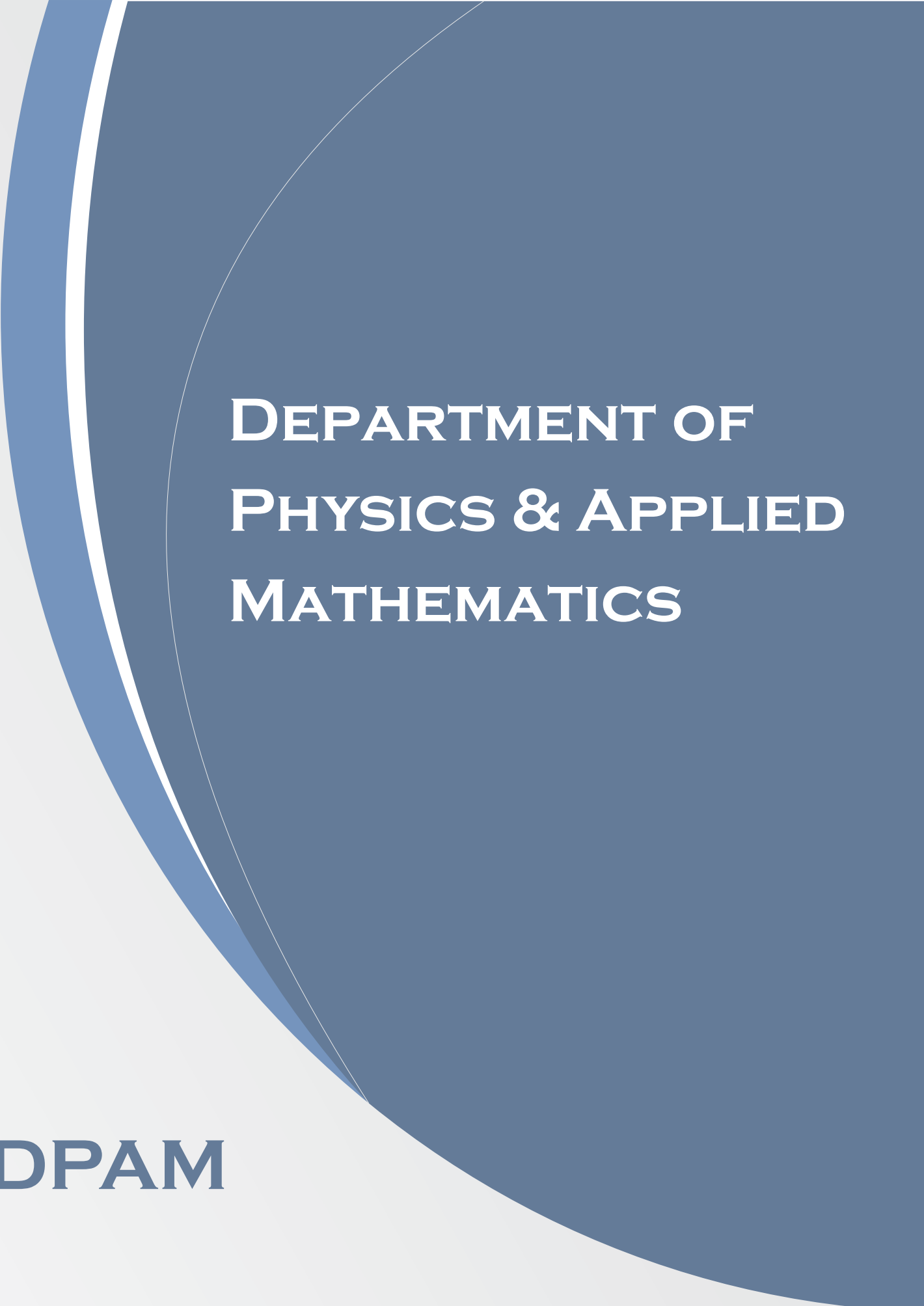
Lectures on Small-Medium Modular Nuclear Reactors

Short Course on Nuclear Reactor Thermal Hydraulics

Planned Workshops/Seminars

Short Course on Design, Neutronics & System Analysis of Advance SMRs

Key Issues in Nuclear Science and Technology.



**DEPARTMENT OF
PHYSICS & APPLIED
MATHEMATICS**

DPAM

Introduction

The Department aims to train students by involving them in a wide range of experimental and theoretical studies in specialized areas like Laser, Plasma, Radiation & Computational Physics and Medical Physics. Our graduates are fully equipped to tackle real world challenges.

Area of Specialization

Currently main research and education thrust of the department is in following areas:

**Medical Physics, Neutron Dosimetry, Radiation Physics
Lasers, Quantum Optics & Applied Electronics
Computational Physics
Reactor Physics**

Academic Programs

PhD (Specializations offered)

Computational Physics
Reactor Physics
Radiation Physics
Quantum Optics
Optics
Bio photonics
Medical Physics

MS

Medical Physics

MPhil

Laser, Plasma and Computational Physics

Faculty

PhD	12
MS / MPhil	02
M.Sc	01
Pursuing PhD	01

Graduate Students

PhD graduates	18
MS/MPhil graduates	152
Current PhD enrollment	35
MS/MPhil enrollment	12

Lab Facilities

Radiation Detection Lab

Variety of radiation sources and detectors
The lab has high sensitive HPGe Detector for gamma spectroscopy

Reactor Physics Lab

Home built neutron source for experiments in reactor physics

Medical Physics Laboratory



Students getting instructions in Radiation Detection Lab

X-ray unit - Thermo - luminescence detection equipment and diode system.
Tissue Phantoms.
Therapeutic and diagnostic radiation chambers

Radiation Shielding Lab

Neutron scattering
Neutron activation facilities

Radiation Dosimetry Lab

SSNTD facilities
Radon Measurement

Biophotonics Lab

Muller Matrix Polarimeter for material characterization using polarization properties.
Double Integrating Sphere for measurement of optical properties of bio-material
Optical diagnostics equipment

Ultra-Short Pulse Laser Lab

A mode locked Ti: Sapphire laser with 2nd and 3rd harmonics has pulse duration of 140 femto-seconds
Auto-correlator for the measurement of femto-seconds pulses

Teaching Laser Lab

Michelson interferometer
Parametric measurements of a laser
Diffraction
Optical communication
Super resolution

Photo Medicine Lab

Cell culturing facility



A PhD student experimenting in Medical Physics Laboratory

Research Groups

More than 150 International Journal Publications (2008-2013)

The department consists of four major research groups



Computational Physics Group

- Modeling and simulation
- Dynamical systems
- Advanced numerical techniques
- Stochastic simulations
- GAs and SA Monte Carlo Methods
- Complex system dynamics
- Nonlinear systems and optimization techniques
- Applications in nuclear research reactors, detector designing and modeling for neutron and gamma particles

Quantum Optics Group

- Quantum optics
- Quantum Computing
- Quantum Information
- Micro maser

Biophotonics Group

- Optical coherence tomography
- Polarimetry
- In-vitro/in vivo photodynamic therapy
- Super resolution
- Optical communication
- Nonlinearities in fiber optics

Medical Physics Group

- Monte Carlo simulations of radiotherapy treatments
- Polymer gel dosimetry
- Radiation Biology

Collaborations

International Collaborations

Harvard University, Boston, USA
Tufts University, Boston, USA
Texas A&M University, College Station Texas, USA
University of Memphis, Memphis, USA
University of Sao Paulo, Brazil
Queensland University of Technology, Brisbane Australia
University of Victoria, Canada

National Collaborations

Center for Quantum Physics, CIIT, Islamabad
National Institute of Health, Park Road, Islamabad
National Institute of Laser and Optronics, Islamabad
NUST, Rawalpindi
PNRA, Islamabad.

Honors & Activities

Symposium on Biophotonics, March 2009, Collaborators:

Prof. Tayyaba Hasan from Harvard Medical School, Boston, USA
Dr. Irene Georgakoudi from Tufts University, USA

Participation in National Physics Talent Contest (NPTC)

Department is organizing the NPTC and grooming the high school students for participation in IPhOs. Pakistani team is contesting in IPhO since 2001 and won one Silver, 8 Bronze and 22 Honorable Mentions



Honors

One **Pride of Performance** and Order of **Tamgha-e-Imtiaz**

One **Razi-ud-Din Gold Medal**

Best Teacher Award from HEC for two faculty members

One **Associate Member of AS-ICTP**, Trieste, Italy

Three books are published by the faculty members

Four faculty members are receiving

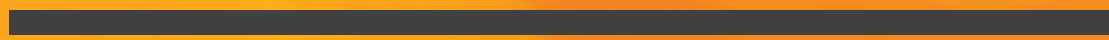
Research and Productivity Allowance

from PCST

PhD

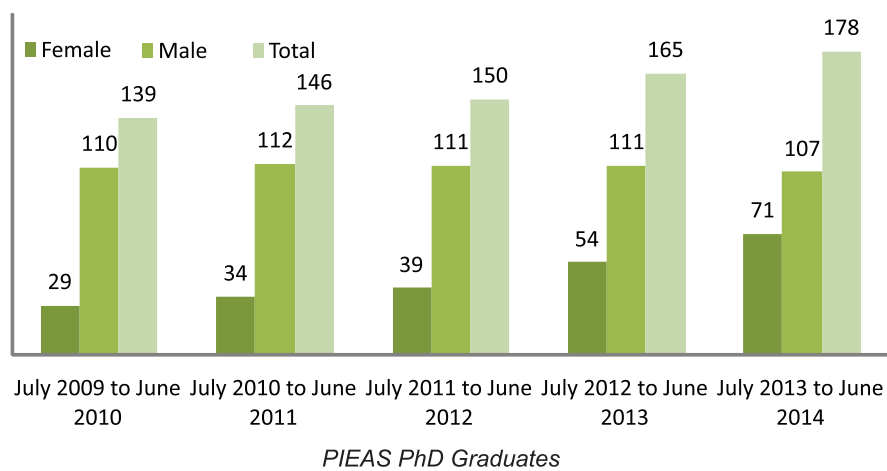
Program

Co-ordination

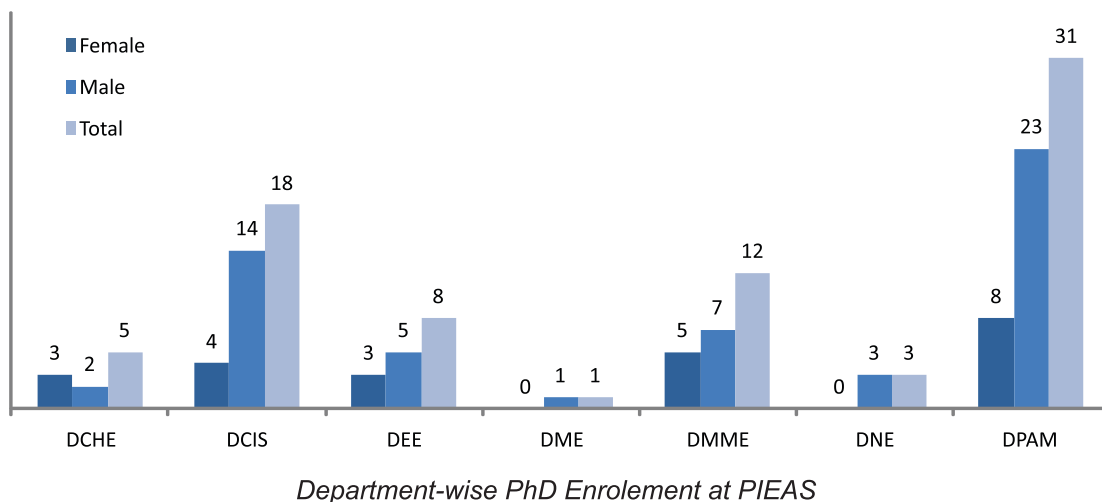


Research at PIEAS

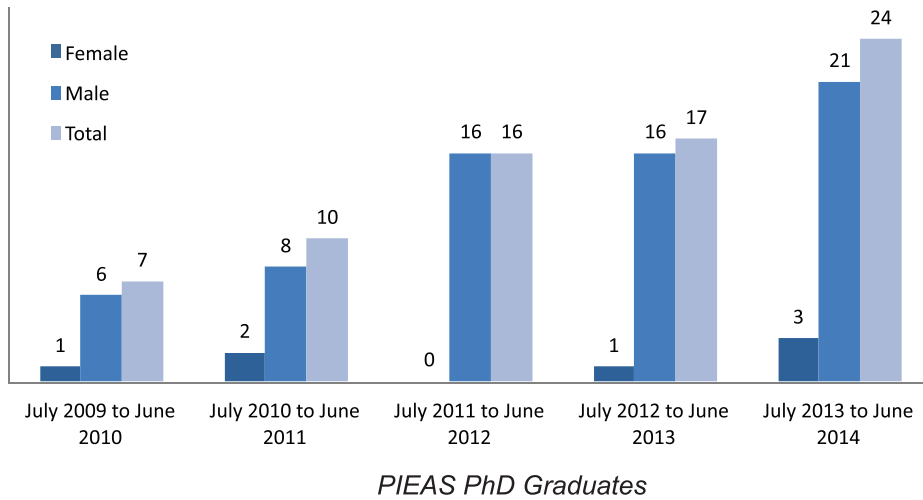
One of the main strengths of PIEAS, which also distinguishes it from other national universities, is its extensive PhD program. More than seventy percent of PIEAS faculty members have PhD degrees, mostly from technically advanced countries, and are now



actively involved in PhD research work. In the same year 2000, when PIEAS got degree awarding status, it launched its PhD program, and first PhD degree was awarded in year 2004 by the Department of Nuclear Engineering. By June 2014, one hundred PIEAS students have successfully defended their PhD thesis. Out of these graduates, more than 50 have graduated in the last three years. For smooth running of PhD program, an office of



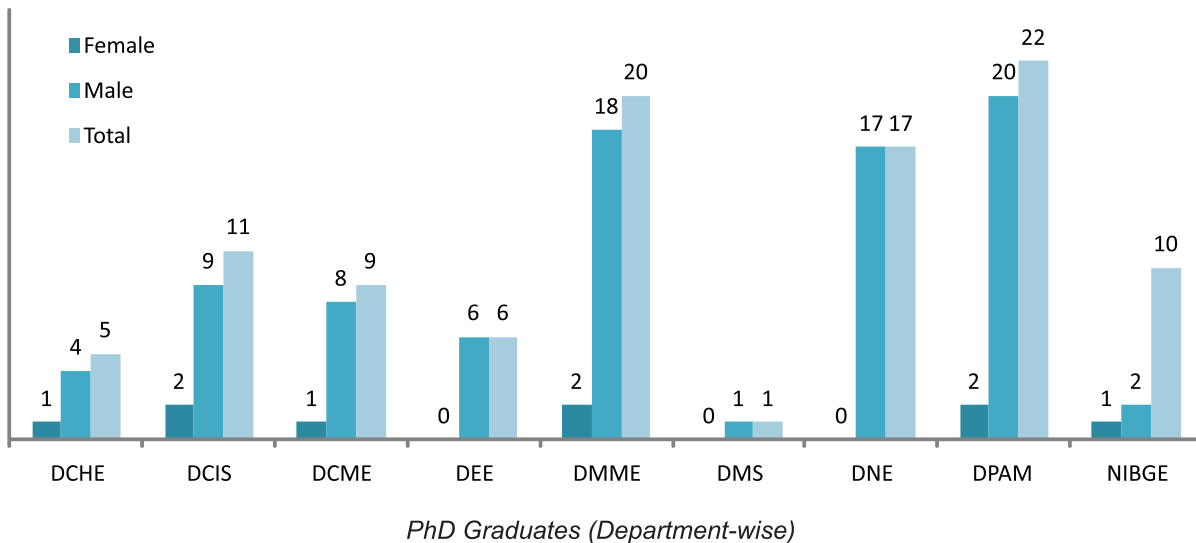
Dean Research has been established at PIEAS. The office submits proposals relating to



PhD rules and regulations for consideration and approval to various PIEAS bodies including Council for Graduate Studies and Research(CGSR), and Academic Committee (AC). It coordinates with other PIEAS departments for timely completion of PhD studies. The office also promulgates research policy and monitors its implementation. In addition to looking after all the matters of research students registered in various departments at PIEAS, the office of Dean Research also takes care of PhD students of the following affiliated institutes:

- i. National Institute of Biotechnology & Genetic Engineering (NIBGE), Faisalabad
- ii. Nuclear Institute of Agriculture and Biology (NIAB), Faisalabad
- iii. National Institute of Lasers and Optics (NILOP), Islamabad

Currently more than 175 PhD students are enrolled in various PIEAS departments and its affiliated institutes including nearly 100 PhD students of NIBGE. The research activities in PhD programs at PIEAS are primarily of applied nature and are aligned with National need



in the realm of socio-economic development. The areas of research range from Nano Technology to Nuclear Engineering on one hand and from Bio Technology to Nuclear Medicine on the other. PIEAS has the honor of producing high quality manpower which forms the back bone of national strategic programs. These graduates are working at leadership positions in various prestigious organizations of the country. Some of the salient features of PIEAS PhD programs are:

- Stringent criterion for admission in a PhD program
- Eighteen credit hours graduate level courses with minimum CGPA 3.
- Passing of Comprehensive Qualifying Examination (CQE)
- Passing of Subject Qualifying Examination (SQE).
- Publication of papers in ISI indexed Journals with good impact factors
- Thesis evaluation by professors from technologically advanced countries



A view of thesis defense of a PhD student at PIEAS

Divisions at PIEAS

Academic Services Division



Objective

Academic Services Division develops & delivers technologies, learning spaces, classroom support, and services that enhance teaching, research, and learning at PIEAS.

Building upon deep engagement with faculty, students and researchers, this division engages with other units at PIEAS to collaborate, share and integrate resources and services, minimize redundancies, and improve effectiveness.



Teaching Aid Support Section

- Multimedia and overhead projector provision in lecture theaters and conference rooms
- Sound systems arrangement in lecture theaters and conference rooms



Duplication Section



A large number of photocopying and duplicating machines are available in this section. This section is separated in two sub-sections.

- Central facility for all faculty/officers of departments/divisions
- Photocopying/binding facility for students

Photography & Video

The section is responsible for making arrangements for photography and videos for official functions, activities and events.

Management of PIEAS Auditorium

PIEAS has a well-furnished auditorium with a seating capacity of 445. It is well-equipped with audio-visual equipment and furniture. The auditorium is provided for organizing conferences, colloquiums, seminars, workshops, academic functions and student activities.



Applied Electronics Laboratory

This Lab is equipped with the essential lab equipment like oscilloscopes, function generators, frequency counters, DVMs, PCAD designing facilities, training and learning kits, EPROM programmer, and a variety of Digital / Analogue components and consumables. Assistance is provided by a qualified team of lab demonstrators, lab assistants, lab attendants and faculty.

The AE lab is extending support to the students of the undergraduate programs, participants of different electronics courses, students of semester projects and the faculty.



Computational and Internet Services Division

Objective

Computational and Internet Services Division (CISD) is dedicated to facilitate the teaching, learning, and research activities of its registered users (faculty, scholars and students) by providing them computational services. The CISD offers a comprehensive computer services including central computing facilities, e-bank for books, numerous popular software bank, electronic mail, digital library, video conferencing, PCs Cluster, Computing Grid, hardware maintenance, printing and scanning facilities round the clock. These services are accessible campus-wide as well as from hostels and residential area of PIEAS. There is provision of 1500 nodes and currently more than 1200 nodes are active in PIEAS network.

Intranet

CISD has established a large network of 1500 nodes which is divided into multiple VLANs for ease in administration and maximum throughput of the traffic. All edge switches are layer 3 supported and the core switch support layer 4. CISD has established a Network Operation Center "NOC" for providing centralized services and end point physical connectivity

Computer Center

CISD is running a 24/7 Computer Centre of 200 state of the art Core i5 Computers. The technical assistance is available round the clock

Centralized Services

CISD is providing Centralized Authentication Services and hosts its own Mail Server which is providing dedicated email addresses to its users with the capacity of 500 MB for their mail boxes which will be increased soon. There is provision of CD/DVD writing, scanning and printing facility in the computer center. Troubleshooting, S/W Installation, repair and maintenance facilities are provided by its hardware lab. CISD performs technical evaluation of computer and network equipment to make sure intended

*200 Core i5
Computers*

*156 Mbps
Internet
Connection*

*Digital
Library*

*Round The
Clock Service*

equipment fulfils the requirements and is indeed the cost-effective solution.

Technical Support

CISD has established a help desk which is providing technical support in hardware, software and network issues to its users.



Digital Library

CISD is executing this program to provide researchers in the university with access to international scholarly literature based on electronic (online) delivery, providing access to high quality, peer-reviewed journals, databases, articles and e-books across a wide range of disciplines.

PERN Project

CISD is also executing Pakistan Education Research Network project launched by HEC. Under this project a WAN connectivity of all universities will be provided in near future. To establish the WAN a Router N20 which was supplied by the HEC is installed and configured as well as the Fiber Optic cable installation and test phases have been completed successfully.

Electronic License Management System (ELMS)

Higher Education Commission (HEC) in collaboration with the Microsoft has launched Software accessibility to provide genuine (Licensed) software availability to Faculty and Students

Video Conferencing

Video conferencing and interactive lecturing is an initiative of HEC to improve the quality of distance learning education in the country. CISD has established Teleconference Hall for these services. The facility is being used for online short courses, online PhD defense, remote learning such as language courses and teleconferencing on various matters with the participants in Pakistan or in other countries.



Planning & Development Division

After getting degree awarding status in the year 2000, PIEAS initiated many academic programs and still there were more programs in the pipeline. Consequently, the number of programs and students had increased many-fold. As the developmental activities were expected to increase further, need for establishment of a Planning and Development (P&D) Wing was strongly felt not only to initiate proposals and PC-1s to secure funding from sponsoring agencies but also to facilitate the planning and development activities at PIEAS. Moreover, P&D Wing would also be involved in coordination of developmental projects. Planning and Development (P&D) Wing was formally approved and established as per decisions taken in 10th meeting of the Board of Governors (BOG) of PIEAS held on Feb 02, 2006. Immediately after its inception, P&D Wing carried out a detailed topographic survey of whole PIEAS area and planned the need based expansion of the institute while doing step wise phase planning. Moreover, all the previous, ongoing and planned developmental projects were then coordinated by the P&D Wing. These included projects such as Up-gradation of PIEAS Infrastructure (UPI) of worth about Rs. 0.5 Billion, Advanced Computational Reactor Engineering (ACRE) Laboratory (38.5 M), Hazardous Air Pollutants (HAPs) Characterization and Control Laboratory (45 M), PIEAS Central Library (100 M), PIEAS Jamia Mosque (30 M).

The record and further correspondence with sponsoring agencies for the projects funded by Higher Education Commission which were completed under the supervision of different



Outside view of I-Block

faculty members of PIEAS, was also coordinated by P&D Wing with the assistance of respective faculty members. These include Up-gradation of Laboratory Infrastructure (18 M), Up-gradation of Computerization and Networking Enhancement at PIEAS (22 M), Development of Bio-Photonics Laboratory (33.5 M), Development of Powder Metallurgy Laboratory (37 M), Building of Hostel for female students at PIEAS (37 M) etc.



H-Hostel

P&D Wing coordinated the efforts of long awaited contour and digital map with GPS coordinates of all as-built civil structures within PIEAS premises. Based on '15 years Future Vision of PIEAS', zoning and detailed planning was done. The project UPI included construction of various civil structures such as Academic Block, Boys Hostel Buildings, Sponsorship of 14 foreign PhD scholarships of PIEAS faculty development, Equipment of Laboratories of existing and new programs and various other development features for upgradation of PIEAS infrastructure.

The ACRE laboratory implemented by P&D section included all the three concepts of computing that is the stand-alone computer lab for interactive teaching of complex nuclear engineering design and safety codes, computer cluster for distributed computing and above all the high performance Supercomputing facility. Funds for purchase of nuclear engineering computer codes, books, training etc. were also included in this project.

P&D Wing prepared, coordinated and submitted the PC-1 of HAPs Laboratory. The project is unique in the sense that it incorporates the research facilities of dispersion, characterization and control of hazardous air pollutants. It includes a 100 ft high experimental stack for dispersion studies, meteorological sensors for continuous monitoring of several MET parameters. Moreover, it incorporates all the 22 ASTM testing and analysis setups of absorbents, pilot scale tri-ethylene diamine (TEDA) doping setup, pilot scale Selective Non-Catalytic Reduction (SNCR) test facility, testing rig for charcoal filters of nuclear power plant (NPP) ventilation system, test facility for filtered containment vent system (FCVS) for NPPs.

P&D coordinated the PIEAS Central Library project by hiring an architect, emphasizing its requirement by arranging and escorting his visits to several libraries of nearby universities, coordinated the architect in preparation of architectural and structural drawings and BOQs, arranging meeting of hired architect with Works and Services Organization (WASO) for timely completion of formalities and completion of project in time. Furnishing and installation of HVAC system, elevator, approach roads etc. were also completed. P&D also coordinated in the efforts for completion of PIEAS Jamia Mosque and made an effort to fulfil the water storage requirement of PIEAS by including the construction of two underground

water tanks of capacity 100,000 gallons each in UPI project.

The policy of power sector envisages greater emphasis on nuclear power resources and its share is increased from current production of around 800 MWe to 8,800 MWe in 2030. This target has recently been further amplified up to 42,000 MWe by the year 2050. In view of current expansion plan of the Government of Pakistan, nuclear power plants along with nuclear fuel cycle facilities are to be enhanced. In this regard qualified and trained



PIEAS Mosque

manpower with strong background of nuclear engineering to the tune of 300 to 400 engineers and scientists per year is required for design, operation and maintenance of upcoming Nuclear Power Plants. After a long continuous effort of about seven years, P&D wing got approved the proposal/PC-1 of project worth about half a billion Rupees, specifically directed towards a strong and dedicated department of nuclear engineering under strengthening of PIEAS (SoP) to fulfill the desired targeted goals. It includes construction of a dedicated purpose built Nuclear Engineering Departmental Building accommodating highly technical nuclear engineering laboratories and relevant equipment.

Planning and Development Wing of PIEAS, though having a very humble strength in terms of manpower is working on forefronts to make the future of the institute prosperous. The division's efforts aim at securing funds from funding agencies by preparing and submitting project proposals and planning for new departments and degree programs. PIEAS Business Plan and PIEAS Annual Report were prepared and submitted to HEC by this wing. Arranging monitoring and evaluation visits from HEC, planning commission and other funding agencies, development of cash flow plans and struggle for release of funds is all domain of P&D Wing. But this is all being done in low profile without any publicity and with minimum resources.

Public Relations Section

Objective

Public Relations Section has been established in PIEAS to handle dissemination of information pertaining to all aspects of academic, research, extracurricular and administrative activities carried out by its various components. Specifically, it is mainly responsible for keeping all information updated regarding research publications of faculty members at PIEAS. This section publicizes information about all components of the institute, namely faculties, departments, divisions, sections, etc. to relevant government and non-government organizations, other universities and the public at large. It also prepares and publishes useful data, information material, advertisements, etc. about PIEAS through circulars, newsletters, brochures, newspapers, magazines, periodicals and electronic media.



Registration & Examination Division



Objective

The Registration and Examination Division is primarily responsible for admission, registration and examination related activities of the students. Furthermore, division is also looking after following activities:

- Placement of students in strategic organizations
- Coordination with affiliated institutes
- Financial assistance to needy students
- Coordination with different organizations providing scholarships to PIEAS students

Functions

- Admissions and registration of students
- Registration of courses
- Maintenance of semester-wise record of students
- Preparation of academic calendar
- Preparation of semester-wise timetables and date-sheets
- Examinations and result notifications
- Issuance of degrees, transcripts and result cards
- Preparation of gold medals and merit certificates
- Convocation related activities
- Arranging interviews for placement of students to strategic organizations
- Students registration and examination related activities of affiliated institutes
- Provision of financial assistance to needy students

Residential Services Division



Objective

The mission of the Residential Services Division (RSD) of PIEAS is to provide the residential students a living environment that offers them support and assistance to maximize the achievement of their educational goals.

Lodging

More than 90% of the PIEAS students live on campus. On campus residence consists of 7 hostels for male students and one hostel for female students. These hostels are situated at a pleasant place in the middle of the beautiful Nilore valley, surrounded by mountains. All rooms are fully furnished with study chairs, study tables, beds with mattresses, easy/rest chairs, fans, bookshelves and wardrobes. All hostels have centrally heating systems to provide comfortable environment for the students in winter. Most of the rooms are double occupancy for shared accommodation. However, the single rooms are also available which are allotted to MS students only during their final year. All hostel allotments are done on merit, based on the results of the prevailing semesters. All hostels have fully air-conditioned common/TV rooms which are well furnished.

Dining Facilities

All residents are provided breakfast, lunch and dinner, prepared and served by well-mannered cooking staff. The mess menu is prepared by the students and also continuously monitored by the students.

Sports

One cricket ground, one football ground, two lawn tennis courts, and a badminton court are available for outdoor activities. The snooker tables, carom, chess and a well-equipped gym etc. are available to promote indoor activities. All the rooms in the hostels have been provided with adequate internet connectivity and an intranet to become part of central network services located at PIEAS network.

Dispensary

A dispensary in the hostel premises is available to deal with emergency medical cases. Also a well-equipped hospital near to the hostels remains open round the clock. An ambulance is available on 24-hours basis to facilitate the emergency medical cases.

Security System

PIEAS has a very strong security system with check posts at all the entrance/exit points of the campus and residential facilities for safety and security of the hostel residents. PIEAS administration discourages the guests to visit hostels frequently as this creates a great disturbance to the hostel residents. However, a guest form is available for the entry of guest in special cases with applicable guest charges as per rules. The maximum stay of the guest is only for three nights.

Student Affairs Division



PBDS

PIEAS Blood Donors Society

PCGC

PIEAS Cyber Gaming Club

PDS

PIEAS Debating Society

PLS

PIEAS Literary Society

PPAS

PIEAS Performing Arts Society

PPS

PIEAS PROPONO Society

PTS

PIEAS Thematic Society

PVS

PIEAS Volunteer Society

SPEL

Society for Promotion of
Entrepreneurship and Leadership

Objective

Education is not only an academic facet of one's life; it should also be reflected in the overall personality of the individual. The social intractability, responsibility and civics sense are a few of the important learning objectives that must be gained through a balanced educational system. These ideas define the bases of education philosophy at PIEAS. We promote all such ideas that contribute towards building the personalities of our students so that they can play their active roles in the service of the nation in particular and the mankind in general.

The Student Affairs Division (SADiv) at PIEAS is responsible for all the co-curricular activities at the Institute. With the above mentioned educational objectives, SADiv organizes a number of activities round the year to promote the mental and physical health of our students.



The following are the regular activities / responsibilities of Student Affairs Division:

- Arrangement and coordination of the technical and recreational tours of PIEAS students
- Coordination of various co-curricular events at PIEAS (e.g. annual sports, cultural, religious functions etc.)
- Coordination of various co-curricular events outside PIEAS e.g. inter-university events.
- Coordination of the PIEAS Expedition
- Coordinate the publishing of PIEAS magazine
- Coordination of student counseling and career planning activities

Sports Clubs

In PIEAS, student bodies called clubs or societies, organize sports and other such events. Currently there are seven sports clubs namely

- PIEAS Football and Athletics Club
- PIEAS Cricket Club
- PIEAS Basketball and Volleyball Club
- PIEAS Indoor Games Club
- PIEAS Rackets Club
- PIEAS Hiking Club
- PIEAS Fitness Club.



Interdepartmental sports are held regularly at PIEAS during spring semester each year. Batch-Clash tournament is held in autumn semester.



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