PWF PAKISTAN:Advancing Optics and Photonics Education for Women in Khyber Pakhtunkhwa

Quantum Optics Intensive School

Department Physics

Mardan University

Course Title: Quantum Optics

Level: MS/M.Phil

Pre-requisite: Electromagnetic Theory I/ Laser Physics

Duration: 4-Day Intensive School (**30th March, 2026-2nd April, 2026**)

Quantum Optics Intensive School – Complete Schedule

Day	Session	Time	Activity	Details / Title	Speaker / Instructor	Topics
Day 1 Foundations of Quantum Optics	Morning	10:30–11:00pm	Inauguration	Welcome Cermony	Chief Guest: Prof. Razia Sultana	Opening remarks
Day 1	Morning	11:00–12:30pm	Lecture 1	Review of Quantum Mechanics	Dr.Imrana Ashraf	Wave mechanics; Dirac notation; Two-level quantum systems
Day 1	Morning	12:30–01:30pm	Lunch Break	–	–	–
Day 1	Afternoon	01:30–02:15pm	Lecture 2	Special Lecture	Prof. Joe Niemela (ICTP)	Ruminations on science and being a scientist

Day 1	Afternoon	2:15-3:15pm	Lecture 3	Quantum Pictures	Dr.Imrana Ashraf	Schrödinger picture Heisenberg picture Interaction picture
Day 2 Quantum Statistical description	Morning	09:00–10:30am	Lecture 4	Density Matrix Formalism	Dr.Imrana Ashraf	Pure vs mixed states Ensemble description Decoherence concepts
Day 2	Morning	10:30–10:45am	Coffee Break	–	–	–
Day 2	Morning	10:45–12:15pm	Lecture 5	Atom-Field Interaction (Semi-Classical Approach)	Dr. Raheel Ali (Online)	Rabi model Optical Bloch equations Spontaneous emission
Day 2	Morning	12:15–01:15pm	Lunch Break	–	–	–
Day 2	Afternoon	01:15–02:15pm	Lecture 6	Quantization of Electromagnetic Field	Dr.Imrana Ashraf	Mode expansion Creation and annihilation operators Vacuum fluctuations
Day 2	Afternoon	02:15–03:15pm	Hands-on Optics I	–	Masad, Sanwal, Nimra	–

Day 3 **Fully Quantum Interaction**	Morning	09:00–10:30am	Lecture 7	States of Quantized Field	Dr.Imrana Ashraf	Fock states Coherent states Photon statisticss
Day 3	Morning	10:30–11:00am	Tea Break	–	–	–
Day 3	Morning	11:00–12:15pm	Lecture 8	Quantum Theory of Atom-Field Interaction	Dr. Raheel Ali (In person)	Minimal coupling Hamiltonian; Dipole approximation; Rotating wave approximation; Jaynes–Cummings model
Day 3	Morning	12:15–01:00pm	Lunch Break	–	–	–
Day 3	Afternoon	01:00–02:00pm	Special Lecture	Light, Lasers and the Nobel Prize	Prof. John Dudley	
Day 3	Afternoon	02:00–03:00pm	Demonstration Session	Michelson interferometer	Zeeshan Ali and Hamna Shoaib	–
Day 4 **Hands on session**	Morning	09:00–10:30am	Hands-On Session II	–	Masad, Sanwal, Nimra	–
Day 4	Morning	10:30–10:45pm	Tea Break	–	–	–
Day 4	Morning	10:45–12:30pm	MCQs Session	–	–	–

Day 4	Morning	12:30-1:30pm	Lunch Break	–	–	–
Day 4	Afternoon	01:30–02:30pm	Concluding Remarks	Certificate Distribution	–	–