Masters Thesis Information Showcase
Spring Semester-2026
Year 2026

	Department: Physics Programme: Masters of Science Specialization: Physics
1	**Title of the Thesis** The study of nanoscale surface roughness in magnetron-sputtered silicon dioxide thin films: a quantitative afm analysis**.**
2	**Abstract** (min 300 to 500 words) Silicon dioxide (SiO_2) thin films are widely used as interlayer dielectrics and structural layers in microelectronic and MEMS applications, where surface morphology and film quality are critical. This study investigates the influence of target-to-substrate distance on the surface characteristics of RF magnetron-sputtered SiO_2 thin films. Films were deposited at target-to substrate distances of 8 cm, 10 cm, 12 cm, and 14 cm, and their surface morphology was examined using atomic force microscopy. Quantitative analysis revealed a strong dependence of surface roughness and grain structure on deposition distance. Average surface roughness increased with increasing distance, which indicates reduced surface uniformity and high irregularities at larger spacings. The film deposited at 10 cm exhibited the lowest roughness value of 1.213 nm, along with uniform grain distribution and near Gaussian height distribution, suggesting optimal ion energy and surface diffusion. These results demonstrate that a 10 cm target-to-substrate distance yields superior SiO_2 film quality for microelectronic applications.
3	**Impact on SDG#_9_"** (min 500 words) (Please mention the impact of the relevant attained SDG) **SDG 9: Industry, Innovation and Infrastructure,** which emphasizes upgrading technological capabilities, fostering innovation, and enhancing research in industrial technologies.
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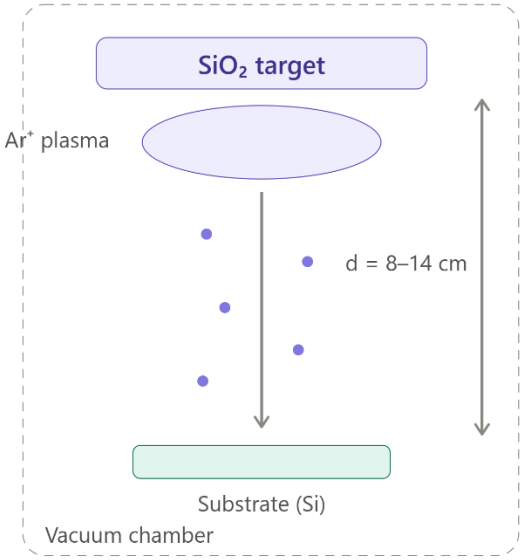
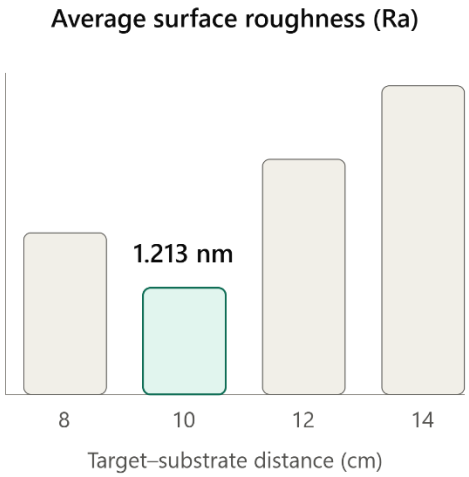
5	**Supervisor & Co-supervisor Name** (along with contact details) Dr. Uzair Majeed (0331-2941342) Email: uzairmajeed@neduet.edu.pk
6	**Graphical Abstract**





Optimal: 10 cm target-to-substrate distance

Lowest Ra (1.213 nm) · uniform grains · near-Gaussian height distribution