Current Course Code and Title	PAP717 Experimental Techniques in Condensed Matter Physics
Details of Course	**Summary of course content** This course seeks to illustrate and explain the plethora of experimental methods available to contemporary solid-state physicists. Examples will predominantly be drawn from the field of strongly correlated electron physics, including such perennial hot topics as phase modulation, nanoscale emergent phenomena and high-temperature superconductivity. A brief introduction (encapsulating the major technical breakthroughs of the last 200 years and highlighting the enduring importance of experimental science) will be followed by a swift phenomenological review of several important theoretical concepts. These will include classical and quantum phase transitions, superconductivity, marginal Fermi liquids and the Luttinger model, density waves, low-dimensional magnetism, electronic glasses and interfacial reconstructions. Armed with the necessary theory, participating students will then be introduced to a wide range of cutting-edge experimental techniques. • Cryogenic and high magnetic field environments • Electrical transport: resistivity, Hall effect, de Haas van Alphen oscillations, Nernst effect, thermopower • Thermal transport: conductivity, Righi-Leduc effect • Magnetic characterization: AC susceptibility, penetration depth, DC and vibrating sample magnetometry, SQUID detectors, torque magnetometry • Bulk thermodynamic techniques: heat capacity, magnetocaloric effect, thermal expansivity • Synchrotron radiation: X-ray diffraction, X-ray magnetic circular dichroism, (resonant) inelastic X-ray scattering • Neutron scattering • Muon spin relaxation, electron spin resonance • Nuclear magnetic/quadrupole resonance, Knight shift • Optical techniques: conductivity, reflectometry, ellipsometry, Raman spectroscopy • Scanning/transmission electron microscopy, energy-dispersive Xray spectroscopy, Auger analysis • X-ray and angle-resolved photo-emission spectroscopy • Tunnelling techniques: planar junctions, break-junctions, point contact/Andreev spectroscopy • Local probes: scanning tunnelling spectroscopy, atomic and magnetic force microscopy, scanning SQUIDs
	Aims and objectives This course aims to acquaint graduate students with the majority of the tools and techniques currently used by experimental condensed-matter physicists. Upon completion of the course, students should understand and feel comfortable with the experimental procedures presented in the majority of condensed-matter publications, even if they may not be familiar with the materials or systems under investigation. They will also have produced a substantial literature review on a technique of their choice.
	Syllabus -
Assessment	Dissertation (one per student): 60%

Please specify if components are individually assessed or group assessed	Oral Presentation (each student will do an oral presentation in the presence of the class): 20% Participation and attendance (students are expected to attend the lectures.): 20%
	Total: 100 %
Hours of Contact/Academic Units	52 hours / 4 AU
Instructor and Co-instructor (if any)	-
Class size	-
Academic Year and Semester/Trimester	-