Course descriptor B31XN

Course code	**B31XN**
Course title	Multi-sensor image fusion and tracking
Credits	15
School	Engineering and Physical Sciences
SCQF Level	11
Semester	1
Aims	• To enable students to understand advanced concepts in filtering theory • To provide students with a solid foundation in target tracking methods • To design algorithms for multi-camera and multi-sensor fusion • To develop practical implementations of image detectors and tracking concepts applied to robotics and computer vision • To provide students with the knowledge and skills to tackle significant signal processing tasks including their features, terminology and conventions. • Use a range of advanced signal processing tools • To enable students to apply critical analysis, evaluation and synthesis to a range of computer vision and robotics problems • To enable students to apply a range of signal and image processing techniques using MATLAB
Syllabus	**General tracking theory** Fundamental concepts and algorithms for optimal filtering: Bayes filtering, the Kalman filter, the Unscented Kalman filter, the Gaussian sum filter Sequential Monte Carlo methodology for Bayesian filtering; Monte Carlo sampling, importance sampling, Bootstrap filter, SIR filter Multiple object filtering; the multiple object Bayes filter, joint target detection and tracking, the Gaussian mixture Probability Hypothesis Density filter **Tracking in images and analysis of activity** Robust image feature detectors (SIFT, SURF, MSER, Scale-adapted Harris) Real-time implementation: image patch tracking methods; mean-shift, feature tracking Tracking in 3-D via multi-camera network (2 and 3 synchronised) Target behaviour modelling, estimation and prediction via Hidden Marlov models **Advanced Topics** Latest developments in fields of sensor fusion and image tracking.

Learning Outcomes	
Subject Mastery	• A critical understanding of the mathematical background for sensor fusion • Use a range of specialised image processing techniques • Develop novel approaches in the application of tracking and vision • Use a significant range of state of the art signal and image processing techniques and practices
Personal Abilities	• Ability to direct and take responsibility for own work • Undertake critical evaluations of a wide range of experimental work.

Assessment method	50% written examination, 50% course work