Course Number : AR507
Course Name : Probabilistic Robotics
Credit Distribution : 3-0-0-3
Intended for : UG, PG and PhD
Prerequisite : Consent of faculty advisor
Mutual Exclusion : None

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1. Preamble:

This course will introduce various techniques for probabilistic state estimation and discuss their application to problems such as robot localization, and mapping.

2. Course Modules with quantitative lecture hours:

Introduction to Probability Theory and Linear Algebra: Sample space and events, Conditional probability, Expected value and variance. Uniform, normal, exponential random variables. Systems of linear equations, Linear dependence and independence, Operations with Matrices, Eigenvalues and eigenvectors. **(6 hours)**

Robot Motion: Probabilistic kinematics, Velocity motion model, Odometry motion model. **(4 hours)**

Sensors for robotics: Coordinate frame transformations**,** camera model, camera calibration, Sonar, Lidar, GPS, etc. **(5 hours)**

Recursive State Estimation: Bayesian filter, Kalman filter (KF), EKF, & Particle filter. **(11 hours)**

Robot Localization, Mapping, and SLAM: Localization problems, Markov localization, EKF localization, Grid localization, Monte Carlo localization, Occupancy grid mapping algorithm, EKF SLAM. **(16 hours)**

3. Textbooks:

1. Probabilistic Robotics. Sebastian Thrun, Wolfram Burgard and Dieter Fox. MIT press, 2005.
2. Papoulis A. and Pillai S. U., Probability, Random Variable, and Stochastic Processes.

4. References:

1. Probabilistic Robotics: http://www.probabilistic-robotics.org/
2. Strang G., Linear Algebra and its Applications.
3. Calculus: Elementary Linear Algebra by Ron Larson, 8th edition, Cengage Learning, 2017.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.		None	None	None

6. Justification of new course proposal if cumulative similarity content is >30%: None