Department of Mechanical Engineering
IIT Delhi

Proposed syllabus for the written comprehensive examination

3rd March 2021

Name: Deepak Raina
Entry No.: 2019MEZ8497
Topic: AI-based modeling and control of robotic systems

1. **Linear Algebra**
   Vector spaces, matrix algebra, singularity, condition numbers, LU, LL^T, QR, SVD decompositions, Sensitivity analysis, Eigen-value problems.

2. **Differential Calculus**
   Differential equations-linear and non-linear, Analytical and numerical solutions (Runge-Kutta, Adams-Bashforth and others), Stability of numerical solutions, Error and tolerances in numerical methods.

3. **Robotics**
   Mathematical Representation of Robots, Kinematics of serial chain manipulators, Statics and Dynamics of manipulators, Control of manipulators (Feedback control, PID control, Cartesian control and force control)

4. **Control Theories**
   The necessity of control, Transfer function, observability and controllability, poles and Zeros, stability criteria, PD, PI and PID controls, State Space form, Linear control theories.

5. **Artificial Intelligence**
   Bayesian State estimation, Machine Learning, Reinforcement Learning, Planning as search, Markov Decision Process, Applications of AI in Robotics