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Department of Mechanical Engineering
IIT Delhi

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May 04, 2020

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Sub: Syllabus for the written comprehensive examination of Mr. Adnan Jawed (2018MEZ8581). **Topic: Vision Based Guidance of Aerial Manipulator**

1. Linear Algebra
Vector spaces, matrix algebra, singularity, condition numbers, LU, LL^T, QR, SVD decompositions, and 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. Multibody Dynamics
Linkages, Degree of freedom, Mobility, Constraints, Types of chains, Loop equations, Holonomic and Non-Holonomic constraints, Lagrange, Newton- Euler, DeNOC, dynamic formulations.

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

5. Control Theories
Necessity of control, Transfer function, poles and Zeros, stability criteria, PD, PI and PID controls, State Space form, linear control theories.

6. Introduction to Computer Vision
Image analysis, Calibration, Geometric invariance, Transformations, Camera models, 3D structure, Object detection and recognition. Visual servoing.

SRC Members:
Prof. A.K. Darpe (Chairman), Prof. Supreet Singh Bagha, Prof. Shubhendu Bhasin (EE), Prof. S.K. Saha, Prof. Sumantra Dutta Roy

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