# Navigation and Guidance

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## Objective of Course

- To familiarize the students with different types of navigation methods used for aerospace applications
- To provide exposure of various guidance strategies (classical as well as modern) to guide the aerospace vehicle for a desired mission.

# Navigation and Guidance

## Teaching Assistants

1. Rohit Nanavati (Ph.D. student) [rohit.nanavati@iitb.ac.in]
2. Abhinav Sinha (Ph.D. student) [abhinavsinha@aero.iitb.ac.in]
3. Prajakta Surve (Ph.D. student) [prajaktasurve@iitb.ac.in]
4. Chavda Milan Maganlal (M.Tech. 2nd Year student) [193010016@iitb.ac.in]

## Evaluation Scheme

- Assignments : 40 %
- Quizes : 20 %
- End-semester : 40 % (If the Institute comes with a way to conduct the same)
- In case of changes in evaluation scheme, you will be notified in the due course.

- Attendance (live interactive sessions) is not mandatory.
- Auditing students: Submission of assignments and attend quizzes.
- Dropping of course will be as per the rules of the institute.
- Assignments will be uploaded to the Moodle and you also need to submit a pdf file preferably on Moodle itself.
- In case of difficulties in submission on Moodle: email assignment to Rohit Nanavati
- Late assignment submission: 20% reduction in total weightage per late day

## Tutorials and quizzes

- Quizzes will be hosted on Moodle/Google Form.
- Type of quiz will be mostly MCQ or numerical type.
- Quiz will be conducted once a few topics are covered.
- Quiz will be conducted on Monday/Thursday and will be notified in advance.
- A couple of tutorials to provide further details and problem solving techniques
- Mode of tutorial: Live/Discussion Forum

## Navigation

Fundamentals of Navigation, Coordinate Systems and Transformations, Inertial Sensors: Gyroscopes and Accelerometers, Basic Navigation Strategies: Radio and Radar based Navigation Systems, Inertial Navigation System (INS): General Navigation Equations, Modern Navigation Methods: Global Positioning System (GPS), INS-GPS based Navigation, and Other Specialized Navigation Systems

## Guidance

Fundamentals of Guidance, Types of Guidance, Concepts of Intercept Geometry, Line-of-Sight (LOS), Collision Triangle, Miss Distance, Capturability Region, Guidance Strategies: LOS Guidance, Command-to-LOS and Beam Rider Guidance, Pursuit Guidance, Parallel Navigation Guidance, Proportional Navigation Guidance (PNG), Augmented PNG and its Comparison with PNG, Mechanisation of Guidance Strategies and Related Issues, Adjoint Method for Performance Analysis

## References

1. George M. Siouris, *Aerospace Avionics Systems: A Modern Synthesis*, Academic Press, Inc. 1993.
2. Debasish Ghose, *Guidance of Missile*, Lecture Notes, National Programme on Technology Enhanced Learning, India.
3. N. A. Shneydor, *Missile Guidance and Pursuit: Kinematics, Dynamics and Control*, Woodhead Publishing, 1998.
4. Paul Zarchan, *Tactical and Strategic Missile Guidance*, 6th Edition, AIAA 2007.

## Contact details for Discussions during the Semester

- Office hours: Wednesday 3-5 PM
- Email: srk@aero.iitb.ac.in
- Mobile No.: 8291064010
- You may call/text me during office hours to discuss regarding doubts in the lecture.