CE-676A

Laser Scanning and Photogrammetry

2022 – 23-II

COURSE MANUAL

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Course Objective

To learn the principles, theory, and practices of laser scanning and photogrammetry technologies.

Learning Objectives

The course is aimed at introducing the general concepts of laser scanning and photogrammetry, so one is prepared to do research in these areas and work in related industries. Having done this course, one should understand various ways of generating point cloud and image data, their processing, data derivatives, and some applications.

Course Content (2-0-3-0-9)

- Altimetric LiDAR: Physics of laser, spectral characteristics of laser, laser interaction with objects;
- Airborne Altimetric LiDAR: principle: topographic and bathymetric LiDAR, multiple return, full wave digitization;
- Components of a LiDAR system, INS technology, INSGPS integration, measurement of laser range, calibration;
- Flight planning;
- LiDAR geo-location models;
- Accuracy of various components of LiDAR and error propagation, error analysis of data and error removal;
- Data classification techniques, raw data to bald earth DEM processing, uses of return intensity and full waveform in information extraction
- LiDAR data integration with spectral data;
- LiDAR applications: building, tree, powerline extraction; LiDAR data visualization;
- Photogrammetry: metric and non-metric cameras; Geometry of near vertical and tilted photographs, heights and tilt distortions; Rectification and ortho-photographs;
- Stereoscopy, parallax equation and stereo measurements for height determination;
- Orientation interior, exterior, relative, and absolute,
- Mathematical model relating image, model and object space; Collinearity and coplanarity conditions, DLT;
- Image matching techniques; Strip and block triangulation and adjustment;
- Automatic DTM and Orthophoto production.

Text/Reference Books

Book on photogrammetry

1. Digital Photogrammetry: A practical course by Linder
2. Introduction to modern photogrammetry by Mikhail, Bethel and McGlone
3. Photogrammetry by P R Wolf

Book on laser scanning

1. Topographic laser ranging and scanning by Jie Shan and Charles K Toth

2. Airborne and terrestrial laser scanning by Prof. Vosselman and Prof. Mass
3. Manual of Airborne Topographic LiDAR Ed. by Michael S Renslow, Published by ASPRS

You could procure some of the above books in ebook form. Your seniors (TAs) can help you with this.

Journals

1. Remote sensing of environment (RSE)
2. IEEE on remote sensing and geosciences (Tran and letters)
3. International society for photogrammetry and remote sensing (ISPRS)
4. Photogrammetry engineering and remote sensing(PE&RS)
5. International journal of remote sensing (IJRS)
6. International journal of applied earth observation
7. Journal of Indian society of remote sensing (JISRS)

IIT Kanpur subscribes to many of these journals. Otherwise, you can read the abstract of all publications for free.

Course Notes

The course lecture PPTs and other material will be provided as we progress.

Online Platform for Course

All materials related to the course will be uploaded on the MookIT course site. The link to the site is:

CE676A: LASER SCANNING AND PHOTOGRAMMETRY (iitk.ac.in)

Lecture Schedule

The classes will be in offline mode.

Lectures will be as per the following schedule. The course has two lectures. These will be held on Wednesday and Friday 9:00 am to 10:00 am in the Instruction Room of PEB building.

Week	Lecture nos.
1.	1 to 3
2.	4 to 5
3.	6 to 7
4.	8 to 9
5.	10 to 11
6.	12 to 13
7.	14 to 15
8.	16 to 17
9.	18 to 19
10.	20 to 21
11.	22 to 23
12.	24 to 25
13.	26 to 27
14.	28 to 29

Attendance is not mandatory during lectures, but students are advised not to miss any lectures.
Any change in the above will be intimated.

Laboratory Hour – Offline Mode

The laboratory hour for the course is on Wednesday 1430 to 1730 hours.

The laboratory assignment will be supplied a day before through email or other platforms by the course TAs. The students should complete the laboratory during the assigned slot as above. The lab assignment must be submitted by 1800 hours each Wednesday at the designated site specified by the TAs.

Help about the laboratory will be provided during these hours by the course instructor and TAs. Course Instructor and TAs will be available for any query on the laboratory during this period.

The labs will be conducted in the GI laboratory in PEB Building.

All Software and Hardware will be available in the laboratory. Any additional requirements will be informed.

Home Assignment

The home assignment will be submitted on the designated day and time which will be informed when the home assignment is being given.

Prior to approaching the Course Instructor for any queries regarding assignment submissions and marks obtained, students are advised to talk to TAs.

TAs and Contact Details

Tutor Name	Prog.	Dept.	Email	Tel.
Moonis Ali	PhD	CE	moonisali@	9027555653
Kaustav Saha	PhD	CE	kaustavs21@	8936935285

Validation of Uploaded Marks

The marks earned by students are uploaded on a spreadsheet with the instructor. A copy of this sheet with the marks of each students individually will be sent to the students through email at two occasions:

1. After Mid-Sem
2. Before End-Sem

The students are advised to inform the TAs / Course Instructor in the case of any discrepancy in the marks uploaded immediately upon receipt of the above email. It is the responsibility of students to inform any correction in the tabulated marks at each stage.

Course Evaluation Policy

The course will follow a continuous assessment policy, i.e., formative and summative assessments will be made throughout the course. The summative assessment will be made through the following means:

1. Quizzes
2. Home assignment
3. Laboratory assignment
4. Lab exam
5. Project
6. Mid sem exam
7. End sem exam

The format of the above assessment will be informed at the time of the exam only. All assessment will be in online or offline mode. Therefore, students are advised to prepare for all possible questions, e.g., multiple choice, subjective, numerical, hands-on exercise etc. The Mid Sem and End Sem exams will be in the slots as in the institute calendar.

Weightage

- Quizzes 15%
- Home assignment 5%
- Lab assignments 15%
- Lab exam 5%
- Project 15%
- Mid sem exam 20%
- End sem exam 25%

Use of Unethical Means

Cheating in exams or assignments would result in lowering of grade by appropriate number of slabs even leading to awarding of grade 'F' depending the nature of cheating. The decision of Course Instructor will be final.

Grading Policy

Letter grades A*, A, B+, B, C+, C, D+, D, E, F, and I will be awarded on the basis of natural grouping or statistical grouping method. Grade 'I' is awarded for incomplete.

Leaves

Leaves will be permitted only if DPGC/SPGC has recommended the same. Late submission of an assignment or make-up quiz or exam or proration of marks will only be permitted if the leaves are sanctioned by DPGC/SPGC. It is the responsibility of students to obtain such official leave and inform the instructor.

Plagiarism

Students should make themselves aware of what constitutes plagiarism. Plagiarism in any form if more than 10% in reports, assignments, term paper etc. will result in reduction of the marks obtained to zero in that particular case. The student's submission may be checked by plagiarism checker available in institute. You may like to visit the site https://www.plagiarism.org/article/what-is-plagiarism to know more.

Copyright

Please read the following regarding the copyright of the course material being supplied to you during this course.

"The instructor of this course owns the copyright of all the course materials. This lecture material was distributed only to the students attending the course "CE676A – Laser Scanning and Photogrammetry" of IIT Kanpur, and should not be distributed in print or through electronic media without the consent of the instructor. Students can make their own copies of the course materials for their use."