**EE 5355: Discrete Transforms and their Applications**

**Fall 2014**

**Instructor(s):** Dr. K. R.Rao

**Office Number:** NH 530

**Office Telephone Number:** 817-272-3478

**Email Address:** [rao@uta.edu](mailto:rao@uta.edu)

**Office Hours:** Mon: 10:00-11:00 A.M, Wed: 3:00-4:00 P.M.

**Section Information:** EE 5355 001-LEC(849505), 002-LEC(84906)

**Time and Place of Class Meetings:** T/TH 5:30–6:50 P.M., Room 112 NH

**Description of Course Content:** Principles and properties of discrete transforms such as discrete Fourier, discrete cosine, Walsh-Hadamard, slant, Haar, discrete sine, discrete Hartley, LOT and Wavelet transforms, and their applications in signal and image processing.

**Student Learning Outcomes:** The course provides a thorough understanding of the discrete transforms and emphasizes their applications

**Requirements:** None.

**Textbooks:** The following books are reference material only and are not required:Do not buy them

[1] K. R. Rao and P. Yip “Discrete Cosine Transform”, Academic Press, 1990.

[2] K.R. Rao and P.C. Yip “The Transform and Data Compression Handbook”. Boca Raton, FL: CRC Press, 2001.

[3] P. Yip, V. Britanak and K.R. Rao, Discrete Cosine and Sine Transforms. Oxford, UK: Elsevier, 2007.

[4] Info on extensive literature will be provided. Course Description: Discrete transforms such as KLT, DFT, WHT, DCT, DDCT, DST, ST, HT, and DWT – definitions, properties and fast algorithms – Their applications in digital signal/image processing.

[5] K. R. Rao, D. N. Kim and J. J. Hwang “Fast Fourier Transform – Algorithms and Applications”, Springer, 2010.

**Attendance:** Attendance in all classes is required. Prior permission is suggested if the student needs to be absent (not too many)

**Grading**:

A=90–100%

B=80–89%

C=70–79%

D=60–69%

**PLAN A**

Test 1 15%

Test 2 15%

Final 15%

Pop Quiz 5%

Design Projects 50%

**PLAN B**: (For those who miss a test – not recommended)

Maximum of Test 1 and Test 2: 25%

Final: 20%

Pop Quiz 5%

Design Projects: 50%

Everyone must take the final. Course grades are based on Maximum of Plan A and Plan B, i.e., whichever is higher.

1. No makeup. 2. No incomplete.

Grades are based on the student’s performance in the course  and nothing else. This includes tests/projects etc  based on the grading formula  - all described in detail in the course web site. This format is universal and applies equally to all students.

Please do not ask

1.       “I will do additional work/project etc to improve my course grade after the grades are assigned.”

2.       My GPA is low and I need an A to avoid probation etc.

3.       I must graduate this semester and the only way is to get grade A.

4.       My grades in TPC are low and I need an A.

       5. Any other excuse.

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

Final exam papers will not be returned. The student, however, has the right to look at his/her exam paper and discuss it with the instructor. Deadline for this is normally the mid semester of the following long semester. Final exam papers will be kept until the mid-semester of the following semester. After this, the course grades are considered to be final.

Summer counts as one semester. (No telephone calls or inquiries regarding course grades, please.)

Everyone must take the tests and final exam at the same time and at the same place. If you have any questions on your returned tests, please do so within a week. Per the DE policy, the distance education students are supposed to have a 24hr window to take their exams. This time frame is to accommodate working students and students located in different time zones.

Distance Education: Please contact Engineering Center for distance education (Room 242 Nedderman Hall) 817-272-5630, Donya: (phone: 1-817-272-2352 FAX: 1-817-272-5630, EMAIL: drandolph@uta.edu)

**Make-up Exams**: None

**Grade Grievances**: It is the obligation of the student, in attempting to resolve any student grievance regarding grades, first to make a serious effort to resolve the matter with the instructor with whom the grievance originated. Individual instructors retain primary responsibility for assigning grades. The instructor's judgment is final unless compelling evidence shows preferential treatment or procedural irregularities. If students wish to appeal, their requests must be submitted in writing on an Academic Grievance Form available in departmental or program offices to the department chair or program director. Before considering a grievance, the department chair or program director will refer the issue to a departmental or program committee of graduate faculty. If the committee cannot reach a decision acceptable to the parties involved, the department chair or program director will issue a decision on the grievance. If students are dissatisfied with the chair or director's decision, they may appeal the case to the academic dean. If they are dissatisfied with the academic dean's decision, they may appeal it to the Dean of Graduate Studies. Students have one year from the day grades are posted to initiate a grievance concerning a grade.

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/ses/fao>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Academic Integrity:**  All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

Instructors may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents’ Rule* 50101, §2.2, suspected violations of university’s standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University.

**Student Support Services**:UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may contact the Maverick Resource Hotline by calling 817-272-6107, sending a message to [resources@uta.edu](mailto:resources@uta.edu), or visiting [www.uta.edu/resources](http://www.uta.edu/resources).

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Student Feedback Survey:**  At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory will be asked to complete an online Student Feedback Survey (SFS) about the course and how it was taught. Instructions on how to access the SFS system will be sent directly to students through MavMail approximately 10 days before the end of the term. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback data is required by state law; student participation in the SFS program is voluntary.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedure:** Should we experience an emergency event that requires us to vacate the building should exit the room and move towards the nearest exit, which is located next to main entrance of nedderman hall .When Exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

**Librarian to Contact:**  Sylvia George-Williams

NH - B03D  
(817) - 272-7519

sylvia@uta.edu

**http://** [**www.uta.edu/library**](http://www.uta.edu/library)

**Course Schedule.**

**First Day of Classes**: Thursday, Aug 21, 2014

**Last Date of drop**: Wednesday, Oct 29, 2014

**Last Day of Classes**: Wednesday, Dec. 3, 2014

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| **Project No.** | **Project Title** | **Due Date** |
| 1 | [KLT](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/p1.doc) | Tue, Sept 2, 2014 |
| 1A | [KLT basis images for Lena image](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/p1a.pdf) | Tue, Sept 9, 2014 |
| 2 | [1D DFT](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project2.doc) | Tue, Sept 16, 2014 |
| 2A | [Zero Padding in the DFT Domain](http://www-ee.uta.edu/dip/Courses/EE5355/Project%202a.pdf) | Sat, Sep 27, 2014 |
| 2B | [2D DFT](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/Project%203.doc) | Sat, Sep 27, 2014 |
| 3 | [Convolution](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project4.doc) | Thu, Oct 2, 2014 |
| 4 | [2D DCT](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project5_N.pdf) ; [Hint.pdf](http://www-ee.uta.edu/dip/Courses/EE5355/Hint.pdf) | Thu, Oct 9, 2014 |
| 5 | [Basis restriction error, Fractional (Residual) correlation](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project5.doc) | Sun, Oct 19, 2014 |
| 6 | [INTDCT](http://www-ee.uta.edu/dip/Courses/EE5355/INTDCT_project1.pdf) | Tue, Oct 21, 2014 |
| 7 | MDCT | TBD |
| 8 | [2D-DCT Mirroring](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project%205b.pdf) , [Compressed-Domain Image Mirroring](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/2D-DCT%20Mirroring.pdf) | Fri, Oct 24 2014 |
| 8 A | [Image resizing in the DCT compressed domain](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project%205c.pdf) | Fri, Oct 31, 2014 |
| 9 | [7-point DST with offset](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project6DST.pdf) | Sun, Nov 9, 2014 |
| 10 | [Transform Coding Gain](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project6a.doc) | Fri, Nov 14, 2014 |
| 11 | [Slant Transform image coding](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project8.doc) , [ST matrix](http://www-ee.uta.edu/dip/Courses/EE5355/slant.zip) , [References](http://www-ee.uta.edu/dip/Courses/EE5355/streferences.pdf) | Sat, Nov 22, 2014 |
| 12 | [JPEG Baseline](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project7.doc) , [Software](http://www-ee.uta.edu/dip/Courses/EE5355/jpeg.html) | Sat, Nov 29, 2014 |
| 13 | [Spectral Distortion: Image Quality Measures](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project11ImageQualityMeasure.pdf) | Wed, Dec 3, 2014 |
| 14 | [Gaussian lowpass filtering](http://www-ee.uta.edu/dip/Courses/EE5355/pdfs/project%209.pdf) , [Sample text](http://www-ee.uta.edu/dip/Courses/EE5355/sampletext.html) | Wed, Dec 3, 2014 |

**Projects delayed will be penalized by 10 points (10%)  for each day.  After 10 days they will not be considered any more.**

**Descriptions of major assignments and examinations:**

Test#1: Tuesday, 23 Sep 2014; 5:30–6:50 P.M.

Test#2: Thursday, 6 Nov 2014; 5:30–6:50 P.M.

Final : Tuesday, 9 Dec 2014; 5:30–8:00 P.M

*As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. –K. R. Rao.*

***UT Arlington Library***

*Library Home Page http://www.uta.edu/library*

*Subject guides* [*http://libquides.uta.edu*](http://libquides.uta.edu)

*Subject Librarians* [*http://www.uta.edu/library/help/sunject-librarians.php*](http://www.uta.edu/library/help/sunject-librarians.php)

Database List <http://www.uta.edu/library/database/index.php>

Course Reserves <http://pulse.uta.edu/vwebv/enterCourseReserve.do>

Library Catalog <http://discover.uta.edu>  
E-journals <http://liblink.uta.edu/UTAlink/az>

Library tutorials <http://www.uta.edu/library/help/tutorials/php>

Connecting from off campus <http://libguides.uta.edu/offcampus>

Ask A Librarian <http://ask.uta.edu>

The following URL houses a page where we have gathered many commonly used resources needed by students in online courses: <http://www.uta.edu/library/services/distance.php>