INDIAN INSTITUTE OF INFORMATION TECHNOLOGY DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

INTRODUCTION OF NEW COURSE

<table>
<tr><td>Course Title</td><td>Applied linear Algebra</td><td>Course Code</td><td colspan="3">EC5XXX</td></tr>
<tr><td>Dept./ Specialization</td><td>ECE</td><td>Structure (LTPC)</td><td>3 ☐ 1</td><td>0</td><td>4 ▬</td></tr>
<tr><td>To be offered for</td><td>UG/PG</td><td>Status</td><td>Core ▬</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Faculty Proposing the course</td><td>Dr. Priyanka Kokil</td><td>Type</td><td>New</td><td colspan="2">Modification</td></tr>
<tr><td colspan="2">Recommendation from the DAC</td><td>Date of DAC</td><td colspan="3"></td></tr>
<tr><td>External Expert(s)</td><td colspan="5"></td></tr>
<tr><td>Pre-requisite</td><td>CoT</td><td colspan="2">Submitted for approval</td><td colspan="2">48th Senate</td></tr>
<tr><td>Learning Objectives</td><td colspan="5">This course is intended to introduce students to all the basic and advanced concepts in linear algebra with an emphasis on practical applications. Linear algebra is one of the fundamental courses that has applications in various fields such as communication, signal processing, machine learning, control, finance etc.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">At the end of the course, the learners are expected to do the following:
• To describe the fundamental principles of linear algebra
• To apply the principles of linear algebra in various problems related to communication, signal processing and analyse them.
• To understand processes that help to develop understanding of machine learning and application in various domains.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours)</td><td colspan="5">Introduction to vectors, properties and applications, introduction to matrices and applications circuits, graphs, social networks, traffic flow (7L+2T)

Eigenvalue decomposition, properties and applications principal component analysis (PCA), Eigen faces for facial recognition, singular value decomposition (SVD) and applications beamforming in MIMO, dimensionality reduction, rate maximization in wireless, MUSIC algorithm (7L+3T)

Structure of FFT/ IFFT matrices, properties, system model for OFDM/ SC-FDMA, signal processing in Wiener filter, modeling of dynamical systems examples: robots, solution of autonomous linear dynamical systems (LDS), solution of with inputs and outputs (9L+3T)</td></tr>
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	Linear regression and least squares, applications: system identification, linear regression, support vector machines (SVM), kernel SVMs, optimal linear MMSE estimation, applications MMSE receiver, market prediction and forecasting, ARMA models (9L+3T) Unsupervised learning, centroid based clustering, probabilistic model-based clustering and EM algorithm, linear perceptron, training a perceptron stochastic gradient, compressive sensing, orthogonal matching pursuit for sparse signal estimation (10L+3T)
Text Book	1. Gilbert Strang, Introduction to Linear Algebra, 5th Ed., Wellesley-Cambridge Press, U.S, ISBN: 9780980232776 2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer; 1st ed. 2006. Corr. 2nd printing 2011 edition (15 February 2010), ISBN-10: 0387310738 3. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press; Illustrated edition (26 May 2005), ISBN-10: 0521845270
Reference Books	1. Kenneth Hoffman and Ray Kunje, Linear Algebra, 2nd Ed. Pearson, ISBN: 978- 1107164284, 2016 2. Lipschutz Seymour and Marc Lipson, Schaum's Outline of Linear Algebra, 3rd ed. McGraw Hill Education India, ISBN: 9780070605022, 0070605025