1. Refrigeration And Air-Conditioning

Course layout

**Week-1** : Recapitulation of Thermodynamics, Introduction to Refrigeration, Air Refrigeration Cycle, Aircraft Refrigeration Cycles.

**Week-2** : Aircraft Refrigeration Cycles,Vapour Compression Cycle,P-h Charts, Actual Vapour Compression Cycle

**Week-3** : Actual Vapour Compression Cycle,Compound Compression with Intercooling, Multiple Evaporator and Cascade System, Problem Solving

**Week-4** : Refrigerants, Vpour Absorption Systems.

**Week-5** : Introduction to Air-conditioning, Properties of Moist Air, Psychrometric Chart, Psychrometric Processes.

**Week-6** : Psychrometric Processes, Infiltration Design Conditions, Cooling Load.

**Week-7** : Cooling Load, Air Distribution System, Problem Solving, Air-Conditioning Systems

**Week-8** : Human Physiology, Thermal Comfort, Indoor Environmental Health, Problem Solving

1. Nanotechnology, Science And Applications

Course layout

**Week 1:** Introduction, History of nanomaterials Top down approach, bottom up approach to synthesize nanomaterials

**Week 2:** Thermodynamic considerations

**Week 3:** Inverse Hall Petch relationship

**Week 4:** Optical effects

**Week 5:** Superplasticity

**Week 6:** Magnetic effects, Ferroelectric effects at nanoscale

**Week 7:**Severe Plastic Deformation

**Week 8:** Nanocomposites, bulk nanoscale structures

1. Data Science For Engineers

Course layout

**Week 1:** Course philosophy and introduction to R

**Week 2:** Linear algebra for data science

1. Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse)
2. Geometric view - vectors, distance, projections, eigenvalue decomposition

**Week 3:**Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates)

**Week 4:** Optimization

**Week 5:** 1. Optimization

2. Typology of data science problems and a solution framework

**Week 6:** 1. Simple linear regression and verifying assumptions used in linear regression

2. Multivariate linear regression, model assessment, assessing importance of different variables, subset selection

**Week 7:** Classification using logistic regression

**Week 8:** Classification using kNN and k-means clustering

1. Discrete Time Signal Processing

Course layout

**Week 1:**Discrete Time Signals and Systems

**Week 2:**DTFT, Relation between DTFT and Analog Fourier Transform

**Week 3:**Rational Systems, Z-transform and Pole-Zero Models

**Week 4:**IIR Filter Design

**Week 5:**FIR Filter Design, Filter Structures

**Week 6:**Basics of Multirate Signal Processing

**Week 7:**Discrete Fourier Transform, Circular Convolution

**Week 8:**Fast Fourier Transform

1. Digital Image Processing

Course layout

**Week 1:** Introduction and signal digitization

**Week 2:** Pixel relationship

**Week 3:** Camera models & imaging geometry

**Week 4:** Image interpolation

**Week 5:** Image transformation

**Week 6:** Image enhancement I

**Week 7:** Image enhancement II

**Week 8:** Image enhancement III

**Week 9:** Image restoration I

**Week 10:** Image restoration II & Image registration

**Week 11:** Colour image processing

**Week 12:** Image segmentation

**Week 13:** Morphological image processing  
**Week 14:**Object representation ,description and recognition