July6-July 10, 2026

1) Data-Driven Flow Modelling

Department	Aerospace Engineering
Course Instructor	Professor ANIRUDDHA SINHA
Eligibility	Senior UG (3rd and 4th Year), PG and PhD
Specialization	Aerospace, Mechanical, Chemical, Civil
Prerequisite	Should have taken courses in Fluid Mechanics and Linear Algebra
Course Overview	Powered by ever-improving computational resources, Computational Fluid Dynamics (CFD) has become the default tool for understanding and designing fluid flows. However, the huge amounts of data coming out these calculations bedevil the easy grasping of the fundamentals of the flows. It turns out that many flows – even highly turbulent ones – have an innate simple (reduced-order) structure that often affords an intimate, albeit approximate, insight that is difficult to attain directly from CFD data. This course will introduce the student to the tools required to arrive at such reduced-order models using data derived from CFD. Such models allow (a) grasping the essential features of the flow, (b) predicting the flow for 'unseen' parameters and/or times, and (c) flow control. This course will allow students to bridge the gap between the simple canonical flows studied in theoretical fluid mechanics and the practical engineering flows computed with CFD. Students wishing to take this course must have completed courses in Fluid Mechanics and Linear Algebra.

2) Application of Biostatistics in Biology & Biomedical Engineering

Department	Biosciences and Bioengineering
Course Instructor	Professor AMBARISH KUNWAR
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	All Branches Eligible
Prerequisite	Mathematics at 10+2 level or should have done a basic mathematics course
Course Overview	Biostatistics deals with application of statistical tools and concepts data derived from the biological sciences and medicine. Proposed summer course would cover how biostatistics help answer pressing research questions in medicine, biology, and public health. Course will be focussed on understanding the basic concepts and terminology of biostatistics, including the various kinds of variables, measurement, and measurement scales. Participants will be able to learn about selecting a simple random sample and other scientific samples from a population of subjects. This would also introduce them to the processes involved in the scientific method and the design of experiments. Finally, the course would cover various diverse examples from healthcare sector to emphasize how biostatistics principles/tools are deeply involved in the design, analysis, and interpretation of data for research in public health and medicine.

3) Predicting Evolution: Quantitative & Experimental Approaches to Fitness Landscapes and Systems Biology

Department	Chemical Engineering
Course Instructor	Professor SUPREET SAINI
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	Bioengineering; Biology; Evolution & Ecology; Microbiology; Chemical Engineering
Prerequisite	A one-week course that teaches how to design, analyze, and interpret microbial evolution experiments using mathematical modeling, sequencing data, and fitness landscapes, with direct applications to antibiotic resistance, metabolic engineering, and synthetic biology. By the end of the week, participants will be able to: 1. Design microbial evolution experiments 2. Infer relative fitness landscapes 3. Quantify epistasis & evolutionary constraints 4. Build simple predictive models of evolution 5. Analyze NGS data 6. Apply these tools to: antibiotic resistance, metabolic engineering microbial consortia design, synthetic biology

4) Mathematical Foundations of Strategic Decision-Making: Game Theory, Mechanism Design & Social Algorithms

Department	Computer Science & Engineering
Course Instructor	Professor SWAPRAVA NATH
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	Computer Science and Engineering, Mathematics, Electrical Engineering, Economics, Operations Research, Mathematical Social Sciences, Artificial Intelligence
Prerequisite	None
Course Overview	This rigorous international summer course interweaves game theory, mechanism design, and computational social choice to equip mathematically inclined students with tools to model and solve algorithmic problems that arise organically in society. Over five intensive days, you will engage with foundational mathematical structures—sequential and simultaneous games, equilibria, stability, incentive compatibility, and fairness—and learn to analyse them with precision. Topics include zero-sum and general games, Nash and dominant-strategy equilibria, voting rules and the Gibbard-Satterthwaite impossibility, stable matching via deferred acceptance, VCG auctions and payment rules, and fair division algorithms such as cake-cutting with envy-freeness properties. Each module balances formal definitions and proofs with real-world phenomena—from peer-to-peer protocols to internet advertising markets and inheritance division—all grounded in developments from economics and computer science over the last four decades. Students with a passion for theorems and proofs will find this course a gateway to deep, algorithmic thinking about societal mechanisms and strategic interaction.

5) Group Testing: An Important Tool for Data Science

Department	Computer Science & Engineering
Course Instructor	Professor AJIT RAJWADE
Eligibility	Senior UG (3rd & 4th Year), PG & PhD
Specialization	CSE, EE, ECE, Data Science, Mathematics, Statistics
Prerequisite	None
Course Overview	Consider a set of n items that need to get tested for a certain defect. Group testing (or pooled testing) is a technique that replaces tests on individual items from this set of n items, by a set on m < n groups of items, where each group consists of a subset of the n items. The aim of group testing is to save on testing resources and time due to the reduced number of tests (m instead of n). This field has a rich history dating back to the classical `Dorfman's technique' in the 1940s, and has seen renewed interest due to the COVID19 pandemic. Apart from biological testing, it also has applications in data science for tasks such as near neighbour search, scene tagging and multi-label classification. This course will cover theory, algorithms and applications of group testing in data science.

6) Becoming an entrepreneur: Leveraging Your University & Local Ecosystems

Department	Desai Sethi School of Entrepreneurship
Course Instructor	Professor SANKALP PRATAP
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	Any Branches Eligible
Prerequisite	None
Course Overview	Entrepreneurship goes beyond the idea of establishing a VC backed scalable startup, to roles like a social innovator or an intrapreneur in a large organization. It is now understood that the seeds of entrepreneurship have to be sown early on, for individuals to harvest its benefits as they progress in their respective careers. Students can leverage entrepreneurship support systems existing in their institutes, even as they continue their mainstream studies, to activate their entrepreneurial cognition and identity. This course would provide inputs in form of practices and frameworks which students can adopt towards building an entrepreneurial identity independent of whether they wish to create a new venture during the period of their education. Having an entrepreneurial identity and related skill sets is known to create opportunities for the individual across domains and across time, apart from the possibility of creating a new venture should the circumstances afford such a possibility.

7) Semiconductor Photonics

Department	Electrical Engineering
Course Instructor	Professor ARUN SURENDRAN
Eligibility	Senior UG (3rd and 4th Year), PG and PhD
Specialization	Electronics Engineering, Electrical Engineering, Photonics/Optics, Physics, etc.
Prerequisite	UG Level course in Semiconductor Devices / Semiconductor Physics
Course Overview	This course provides a rigorous treatment of the physics and engineering of semiconductor light sources and photodetectors. Building on fundamental semiconductor theory, it quantitatively analyses the operation and performance of light-emitting diodes (LEDs), laser diodes, and photodetectors through their underlying physical principles and governing equations. The course is very relevant in the context of the recent rise in interest in semiconductor technologies and emphasizes a quantitative understanding of device operation, performance limits, and design considerations. By bridging core semiconductor physics with practical optoelectronic devices, the course prepares students to pursue advanced study, research, or industry careers in semiconductor photonics.

8) Brain-Inspired/ Neuromorphic Computing for edge AI

Department	Electrical Engineering
Course Instructor	Professor DEBANJAN BHOWMIK
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	Electrical Engineering, Electronics and Communication, Computer Science, Physics, Mathematics and Computing
Prerequisite	First year undergraduate level knowledge of mathematics, physics, electronics, and computer programming knowledge expected
Course Overview	It's not an understatement to call the current age the age of AI, with applications of AI becoming all pervasive day by day. However, training large neural networks for different AI applications consume a huge amount of energy and involves a huge carbon footprint. Also, many applications of AI in involve implementation in edge devices, where energy budget is very low. Neuromorphic computing, a brain-inspired implementation of AI that makes uses of spikes as well as memory-computing intertwining like the brain does, comes to the rescue. In this course, we will discuss this novel form of AI from different perspectives: biological inspiration, modification of standard AI applications to make them neuromorphic, and implementations of these algorithms on emerging non-volatile memory devices and circuits and also field programmable gate array (FPGA). Coding exercises as well as experimental implementation on FPGA boards will be explored.

9) Waste to Energy

Department	Energy Science & Engineering
Course Instructor	Professor SANDEEP KUMAR
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	Any student from Science or Engineering background
Prerequisite	None
Course Overview	A brief introduction of the course offered - 'Waste-to-Energy' technologies are not only relevant in generating green energy and fuel for various power, transport and industrial/thermal application, but also features as sustainable way in managing the animal, agricultural, industrial and municipal waste towards cleaner environment. The course will discuss about waste categorisation and various waste to energy technologies, including biological, chemical and thermochemical conversion processes, and its underlying principles. Course will have (2 + 2) hrs lecture for 5 days and will have interactive lab session and demonstration of few wastes to energy conversion systems. Take away message from the offered course – At the end of the course, students will be able to understand various categories of waste and apply knowledge towards suitable options for efficient conversion of given waste to energy.

10) Electric Vehicle Charging Infrastructure

Department	Energy Science & Engineering
Course Instructor	Professor RAVI PRAKASH REDDY SIDDAVATAM
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	Electrical/Electronics/Computer/Energy Engineering
Prerequisite	None
Course Overview	There is an increasing trend towards the adoption of electric vehicles (EVs) globally because of the increased carbon footprint over the past few decades. Development of suitable charging infrastructure is one of the major challenges being faced by the EV industry. This course on "Electric Vehicle Charging Infrastructure" begins with a brief outline on various EV charging techniques including AC and DC charging systems, levels and modes of EV charging, power electronics, charging standards, and communication protocols. Moreover, grid integration challenges, load management, renewable energy integration, and the role of smart charging in supporting grid stability will also be discussed. Subsequently, various power converter topologies for both the AC-DC (power factor correction) and DC-DC stages will be discussed. Some of the widely used EV charger topologies in the industry, including boost PFC converter, totem pole PFC converter and resonant converter topologies will also be covered in detail in this course.

11) Foundations of Mechatronics: Hands-on

Department	Mechanical Engineering
Course Instructor	Professor PRASANNA GANDHI
Eligibility	Senior UG (3rd & 4th Year), PG & PhD
Specialization	All Branches eligible
Prerequisite	None
Course Overview	This course focuses on-hands on activities pertaining to foundations of mechatronics. Students will learn basic constituents of mechatronics system: Sensors, Actuators, Controller and plant. 70% of the course will have laboratory activity where students will learn to sense encoder, to actuate motor, and finally to closed loop control (P, PD) a DC servo motor using a microcontroller (XEP 100/TIVA). The course would be useful for students interested in robotics, automation, mechatronics, and related areas. Background in digital electronics, and microprocessors could be useful but not required.

12) Quantitative Finance: From Stochastic Models to Deep Learning

Department	Mathematics
Course Instructor	Professor S. BASKAR
Eligibility	UG (1st, 2nd, 3rd & 4th Year), PG & PhD
Specialization	Mathematics, Physics, any Engineering, and Economics
Prerequisite	Calculus, Linear Algebra, Probability, and an exposure to Python is desired
Course Overview	This course provides a unified training of the mathematical foundations and modern computational advances in quantitative finance. The course starts with classical stochastic models for asset dynamics, including geometric Brownian motion and mean-reverting processes. Students will learn to simulate these models, calibrate parameters from data, and apply them to option pricing frameworks such as the Binomial and Black-Scholes models. After gaining the computational experience from these models, the course transitions to data-driven methods, including deep learning approaches for pricing, risk management, and portfolio optimization. Advanced topics such as deep hedging and reinforcement learning in trading connect theory to cutting-edge research and financial practice. The course is designed for UG and PG students in Mathematics and Physics, as well as students from any Engineering discipline. Students with a good background in Calculus, Linear Algebra, and Probability will also be able to follow the course.