



**CCE -PROFICIEENCE  
INDIAN INSTITUTE OF SCIENCE,  
BENGALURU 560012**

**INFORMATION HANDBOOK  
January -May 2024**

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### REGULAR COURSES

Sl. No.	Name of the Course	Credit
1.	Online Course Basic Principle and Application of Electron Microscopy and Cryo-EM (Mon & Wed) (6 pm to 7.30pm)	3:0
2.	Offline Course on Separation Technologies for Industrial Processes (Mon & Wed) (6 pm to 730 pm)	3:0
3.	Online Course on Simulation and Modelling (Tue and Thu) (6.00PM to 7.30 PM)	3:0
4.	Online course on Business Analytics with Management Science Models and Methods (Tue and Thu) (8.30PM to 10.00PM)	3:0
5.	Online Course on Flight Dynamics (Tue and Thu) (6.00PM to 7.30pm)	3:0
6.	Online Course on Learning, Memory, Behavior and Brain (Tue and Thu) (8:00PM to 9.30PM)	3:0
7.	Online Course on Computational Fluid Dynamics: Fundamentals and applications through open-source computing tools, (Tue and Thu) (8:00PM to 09.30)	3:0
8.	Online Course Transgenic Technology: Principles and Applications (Tue) (8:00PM to 10.00PM)	2:0
9.	Online Course on Learning Metamaterials and Metasurface using Circuit Theory (Tue and Thu) (8:00PM to 09.30)	3:0
10.	Online Course on Spectroscopic analysis of protein structures and functions (Wed) (6.00PM to 8.00PM)	2:0
11.	Online Course on Vibration and Noise Control: Theory and Practice (Wed) (6.00PM to 8.00PM)	2:0
12.	Online Course OECD Principles of GLP (Wed) (8.00PM to 10.00PM)	2:0
13.	Online Course on Analysis and Design of Composite Structures (Thu) (8.00PM to 10.00PM)	2:0
14.	Online Course Principles of Laboratory Animal Management (Thu) (8.00PM to 10.00PM)	2:0
15.	Online Course on Interactive Data Science (Thu) (8.00PM to 10.00PM)	2:0
16.	Online Course on Structural Analysis and Design Optimization: Theory and Practice (Saturday) (12.00PM to 2.00PM).	2:0
17.	Online Course Principles and Advances in Genetic Engineering (Sat) (10.00PM to 12.00PM).	2:0
18.	Online course on Machine Learning Interpretability: Unveiling the Black Box with Case Studies (Mon & Wed) (8.00PM to 9.30PM)	3:0

## INTRODUCTION

Indian Institute of Science (IISc) established in 1909, is a Deemed University and Centrally Funder Technical Institution under the Department of Higher Education, Ministry of Human Resources Development, Government of India. Rapid strides in science and technology make it imperative that the education of professionals be continued over their entire career rather than be confined to a single *stretch*. What is needed is a complete integration of education with work during their productive life span, which will be adequate to help them cope with new demands. Continuing Education embraces all the processes of education that one undergoes throughout one's working life and which have a relevance to the practical problems likely to be encountered in one's career. It may be realized through formal and informal modes of teaching, or through mass media. In recent years, there has been a growing awareness on the part of universities that imparting knowledge to people beyond their boundaries is an equally important part of their service to the community. With this broad perspective of their function in society, Universities have begun to seek ways of reaching out to professionals. The IISc has evolved several mechanisms to make the expertise and facilities available to qualified technical people in industries, Universities and research establishments. The need for forging links between academic institutions and industries and R&D organizations has been a goal set for the IISc by its illustrious founder, J.N. Tata. CCE-PROFICIENCE was established with the objective of providing a sustained and rigorous continuing education program offering courses on subjects of topical interest to scientists and engineers in and around Bangalore. This program, believed to be the first of its kind in the country, is a joint venture between IISc and several Professional Institutions/Societies in Bangalore. The program name signifies the coming together of Professional Institutions and the Indian Institute of Science. It was started on an experimental basis in 1980 and has proved to be extremely popular and has attracted wide attention in academic and professional circles. The demand for some courses, especially on computers, microprocessors and management is so overwhelming that it has not been possible to admit all the Eligible applicants. Every year, there has been a steady increase in the number of students as well as the types of courses offered indicative of the growing popularity of this Program. IISc is the custodian of the academic standards of all CCE-PROFICIENCE courses. It has the responsibility of evolving appropriate teaching norms, providing the venue and facilities for conducting courses, organizing the tests and examinations and issuing certificates to the successful participants. These tasks are coordinated by the Centre for Continuing Education (CCE).

## COURSES

Continuing education program organized under CCE-PROFICIENCE offers semester long courses in areas of topical interest. The courses are organized during evening hours so that working professionals can participate without getting their normal work affected. All courses are normally at the postgraduate level and many of these are in fact offered to the IISc students regularly. Participants in certain selected courses are provided practical training in computer and other laboratories, as appropriate. The course contents are regularly upgraded on the basis of feedback from the faculty and the participants. Courses are offered during the period AUG-DEC and JAN-MAY and around 15-20 courses are scheduled during each semester. Each course has lectures at the rate of two or three hours per week depending upon the number of course credits. Tests and examinations are conducted according to the IISc norms.

A series of courses leading to different specializations are offered in a sequential manner, especially in the area of Computer Science and Engineering. This would enable the participants who start with the entry level courses progress towards more advanced ones and specialize in one of the streams.

## EVALUATION

The total marks for assessment will be equally distributed between the seasonal work and end semester examination. The seasonal work consists of class tests, mid semester examination, and homework assignments etc. as determined by the instructor. The participants who maintain a minimum of 75% attendance both in the theory and

computer/laboratory classes will be evaluated based on the combined performance in the end semester examination and seasonal work and assigned a letter grade.

**NO RE-EXAMINATION SHALL BE CONDUCTED UNDER ANY CIRCUMSTANCES.**

**The letter grades carry a 10-point grading assessment as indicated below.**

<b>Grade:</b>	<b>A<sup>+</sup></b>	<b>A</b>	<b>B<sup>+</sup></b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>F (Fail)</b>
<b>Grade Points:</b>	<b>10</b>	<b>9</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>0</b>

## **CERTIFICATES**

Certificates will be issued only to those who get at least a 'D' grade. Attendance certificates shall not be issued to anyone. This being a continuing education program meant especially for self-improvement, the credits accumulated cannot be equated with the credits earned through formal education. There shall be no claims for CCE-PROFICIENCE credits being counted towards partial fulfillment of credit requirements towards any degree/diploma or other formal recognitions offered by IISc.

Formal Course completion certificates will not be issued under any circumstances to any candidate.

## **FACULTY**

The instructors for the courses are mostly Institute Faculty. However, competent professionals from other R&D organizations and industries are also involved in teaching some of the courses.

## **REGULAR COURSES**

**Computer Lab:** A Computer Laboratory with adequate computer machines and a Silicon Graphics workstation with a variety of latest software have been set up for the CCEPROFICIENCE program. All these machines have been locally networked. A good collection of video cassettes pertaining to several courses is also available for viewing at the Centre for the participants.

**Library:** CCE-PROFICIENCE participants of offline courses can avail themselves of the facility of IISc Main Library and they can also make use of the books in CCE. The books at both the IISc Main Library and CCE are meant only for reference. The participants can avail themselves of this facility by producing their ID card issued by CCE-PROFICIENCE.

**Timings: IISc. Library – 8.00 AM - 9.00 PM**

## INSTRUCTIONS

### HOW TO APPLY:

Details of the courses are available online at [cce.iisc.ac.in](http://cce.iisc.ac.in) and also download CCE App from Google Play store. Essential Qualification for any course is a degree in Engineering or a postgraduate degree in Science/Humanities as applicable with pre-requisites. Each participant will be admitted for a Maximum of Two Courses. Applying to courses is strictly through the online portal of CCE. Please read all the instructions provided at our portal before applying. Payment of the course fee is through the payment gateway provided at our online portal and no other means of payment is accepted. The course fee is Rs. 5000/- per credit and registration fee is Rs. 300/- per course. Any other gateway charges must be borne by participant during online payment. For each application, participants must upload (BE, B. Tech / Post Graduation) Convocation/Degree Certificate without fail. (Class conducted: Weekdays 6 pm. to 8 pm) & (Saturday's 10 am to 1 pm & 2 pm to 4 pm)

### FEES

The course fee is Rs. 5000/= per credit. Some of the courses include a limited exposure to computer operation and programming / Lab Fee (C). The additional fees of this are Rs. 5,000/- The course fee and laboratory fee should be paid in full at the time of joining the course.

### REFUND OF COURSE FEE

A refund of course fee will not be made, unless the course is withdrawn officially, in which case, the course fee paid will be refunded in full. Application registration fee once paid will NOT BE REFUNDED under any circumstance. Refund of fees in case of dropped courses will take a minimum of 3-4 weeks.

### CLASSES

Offline Classes will be held in the department lecture halls for which venue details will be shared after the last date of admissions and before the class starts. Lectures will be between 6.00 p.m. and 8.00 p.m. Monday through Friday and between 10 a.m. to 1 p.m. and 2pm to 4 pm on Saturdays.

Online classes will be conducted via MS Teams and links to join the first class will be shared after the last date of admissions and before the first class.

### LABORATORY CLASSES

The timings and days for laboratory classes will be fixed in the second week of the respective months (August & January) after the complete registration is known. This will be done, keeping in view the convenience of the faculty and all the students of the courses with laboratory component.

### RESULTS

Results of the courses will be announced normally around 1st week of January for August-December term and 1st week of May for January-May term. Certificates will be issued on or after the date of announcement of results and against surrendering the Identity Card.

### IDENTITY CARD

Participants will be issued identity cards (**only for Offline courses**) which should be shown on demand. The participants who have successfully completed should surrender the ID card at the time of receiving certificate, failing which the certificate(s) will not be issued to her/him. Police authorized by lodging and compliant and then request



the Section Officer, CCE to issue duplicate ID during submitting police compliant and Rs.100/- on penalty in the event of loss of identity card, the matter should be immediately reported to the Officer-in-Charge, CCE-PROFICIENCE in writing.

**NO REQUEST FOR CHANGE OF EITHER THE STIPULATED DATES, MODE OF PAYMENT, CHANGE OF COURSE OR SUBMISSION/VERIFICATION OF ENCLOSURE TO APPLICATION ETC., WILL BE ENTERTAINED UNDER ANY CIRCUMSTANCE**

**Schedule of Online Courses for Jan – May 2024**

<b>Sl. No.</b>	<b>Name of the Course</b>	<b>Credit</b>	<b>Faculty</b>	<b>Department</b>
1.	Online Course Basic Principle and Application of Electron Microscopy and Cryo-EM	3:0	Dr. Somnath Dutta.	Molecular Biophysics Unit
2.	Offline Course on Separation Technologies for Industrial Processes	3:0	Dr. Yagnaseni Roy	DEPT CST, IISc
3.	Online Course Simulation and Modelling	3:0	Prof. Sumit Kumar Mandal	CSA IISc
4.	Business Analytics with Management Science Models and Methods	3:0	Dr. M Mathirajan	MAGT, IISc
5.	Online Course on Flight Dynamics	3:0	Prof. O N Ramesh	AE, IISc
6.	Online Course on Learning, Memory, Behavior and Brain	3:0	Prof. Balaji Jayaprakash	DEPT CNS, IISc
7.	Online Course on Computational Fluid Dynamics: Fundamentals and applications through open-source computing tools,	3:0	Prof. Ratnesh Shukla	DEPT ME, IISc
8.	Online Course Transgenic Technology: Principles and Applications	2:0	Prof. N. Ravi Sundaresan	Dept. Microbiology and Cell Biology, IISc
9.	Online Course on Learning Metamaterials and Metasurface using Circuit Theory	3:0	Dr. Debdeep Sarkar	DEPT ECE, IISc
10.	Online Course on Spectroscopic analysis of protein structures and functions	2:0	Prof. Mahavir Singh	Dept Microbiology and Cell Biology, IISc
11.	Online Course on Vibration and Noise Control: Theory and Practice	2:0	Dr. S B Kandagal	AE, IISc
12.	Online Course OECD Principles of GLP	2:0	Dr. Ramachandra S.G.	CAF, IISc
13.	Online Course on Analysis and Design of Composite Structures	2:0	Dr. G. Narayana Naik	DEPT AE, IISc
14.	Online Course Principles of Laboratory Animal Management	2:0	Dr. Ramachandra S.G.	CAF, IISc
15.	Online Course on Interactive Data Science	2:0	Pandarasamy Arjunan	RBCCPS, IISc
16.	Online Course on Structural Analysis and Design Optimization: Theory and Practice	2:0	Dr. S B Kandagal	AE, IISc
17.	Online Course Principles and Advances in Genetic Engineering	2:0	Dr. N. Ravi Sundaresan	Dept Microbiology and Cell Biology, IISc
18.	Online course on Machine Learning Interpretability: Unveiling the Black Box with Case Studies	3:0	Dr. M Mathirajan, Mr. Vineet Srivastava, Mr. Gaurav Gupta	Dept. of Management Students, Zero Code Learning Pvt. Ltd.

## FEE STRUCTURE AT A GLANCE

### Regular Courses

**Per Credit - Rs.5,000/-**

**Computer Lab Fee - Rs.5,000/-**

- 1. Course with 2 credits # Rs.10,000/-**
- 2. Course with 2+C credits # Rs.15,000/-**
- 3. Course with 3+0 credits # Rs.15,000/-**
- 4. L Stands with 2+L Credits # Rs.15,000/-**

**# Credits Stands for Lecture Hours per week**

**\$C Stands for Computer Laboratory**

**\$L Stands for Online Course**



## 01. Online Course Basic Principle and Application of Electron Microscopy and Cryo-EM (3:0)

### Objectives:

Electron microscopy (Cryo-EM). After completing this course, students will learn various components and functions of these components of EM, the principles of TEM, SEM, Cryo-SEM & Cryo-TEM, the operational procedures of these electron microscopes, biological and chemical sample preparation techniques (e.g., Biological Samples: bacteria, different types of cells, viruses, protein, DNA-Protein, RNA-Protein complexes, liposomes, brain tissue, and tissues; Chemical Samples: nanoparticles, liposomes-drugs/nanoparticles, various small peptides). Importantly, this course would be helpful for students to learn the imaging techniques of these biological and chemical samples by TEM/SEM/Cryo-EM and learn to analyze the data. Basic image processing will be taught in this course. Finally, 3-4 classes will be conducted to observe the sample preparation, imaging, and image analysis techniques. At the end of this course, students will be capable of handling the basic electron microscope, sample preparation, imaging, and image analysis.

**Syllabus:** Basic introduction to electron microscopy (TEM/SEM/Cryo-EM) and electron optics. Basic components of Transmission Electron Microscope, use of these components, various parts, and function of these components. Principles of image formation, electron scattering, electron-specimen interactions, and various SEM/TEM/Cryo-EM imaging techniques. Advanced sample preparation, imaging, and data collection techniques of biomolecules by negative staining and cryo-electron microscopy. Theoretical, computational, and practical aspects of image analysis.

**Target Group:** Professors/students /researchers (Science/Engg) from academic institutes, research institutes, colleges/universities (Science/Engg) and researchers from pharmaceutical companies.



### Faculty:

**Dr. Somnath Dutta.**  
Associate Professor  
Molecular Biophysics Unit  
Indian Institute of Science  
Bangalore - 560012, INDIA  
Email: somnath@iisc.ac.in

### Reference Books:

1. John J. Bozzola and Lonnie D. Russell (1992). Electron Microscopy (Jones & Bartlett Publishers).
2. Ludwig Reimer; Helmut Kohl. Springer Optical Sciences: Transmission Electron Microscopy: Physics of Image Formation (Series #36) (Edition 5). ISBN-13: 978-0387400938, ISBN-10:0387400931.
3. Gabor T. Herman and Joachim Frank (2014). Computational Methods for Three-Dimensional Microscopy Reconstruction (Birkhäuser Basel).
4. Joachim Frank (2006). Three-Dimensional Electron Microscopy of Macromolecular Assemblies (New York, Oxford U. Press).
5. John Kuo (2007). Electron Microscopy: Methods and Protocols (Methods in Molecular Biology) (Humana)

### Who can apply?

Minimum qualification B.E. B.Sc. and B.Tech.

### Pre-requisites required.

Basic Mathematics Physics, Chemistry and Biology knowledge is required.

**Course Fee:** Rs. 15,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams/Google**

**Meet**

**Schedule:** Monday and Wednesday (6.00 PM to 7.30 PM)

## 02. Offline Course on Separation Technologies for Industrial Processes (3:0)

### Objectives:

Separation technologies are responsible for several important processes, such as extracting the final product from the synthesis medium; treating effluent streams before environmental discharge; recovering materials that can be reused for subsequent manufacture cycles; or isolating valuable intermediate products that can be used in a different industry or sold. This course will cover the operating mechanisms, basic design methods, thermo-economic analysis, and ecological impact evaluation of these separation techniques, in order to select and design the optimal sustainable separation solution for a given practical problem.

### Syllabus:

Major industrial separation methods, namely distillation, membrane separations, adsorption, absorption, and liquid-liquid extraction; basic design and analytical methods for the technologies; thermodynamic analysis and second law efficiency; economic analysis; case studies on important practical separation problems; the ecological impact of proposed technology in case study

### Target Group:

Chemicals productions companies, oil and petroleum companies, pharmaceuticals companies, bioengineering-related companies.



### Faculty:

**Dr. Yagnaseni Roy**

Centre for Sustainable Technologies (CST),  
Indian Institute of Science,  
Email: yroy@iisc.ac.in

### Reference Books:

- De Haan, André B., and Hans Bosch, 'Industrial separation processes: fundamentals. Walter de Gruyter, 2013'.
- Seader, J., E. Henley, and D. Roper 3rd. Edition of "Separation Process Principles, ISBN: 9781118139622."
- Chapters 7-9 from 'Chemical Engineering Design Principles, Practice and Economics of Plant and Process Design' by Gavin Towler and Ray Sinnott, Second edition.

### Who Can apply?

Bachelor's degree in engineering (preferably Chemical Engg., Mechanical Engg., Bio Engg., Materials Engg.).

### Pre-requisites: nil

**Course Fee:** Rs. 15,000/- + 18% GST

**Seats are Limited to 40**

**Schedule:** Monday and Wednesday (6.00 PM to 7.30PM)

### 03. Online Course Simulation and Modelling (3:0)

**Objectives:**

Modelling and Simulation of Computer Systems

**Syllabus:**

Introduction to Probability theory, Random variables. Introduction to Stochastic Process, Poisson process, Markov chains, steady state, and transient analysis. Queuing theory: little's law, closed form analytical model, queuing network. Pseudo random numbers: Methods of Generation and testing. Methods for generating continuous and discrete distributions. Building blocks of Simulation, Data Structures and Algorithms. antithetic variates, control variates, common random numbers, Analysis of Simulation results. Machine learning-based simulation: linear regression, regression tree, support vector machines. Demonstration of state-of-the-art simulation and modelling tools.

**Target Group:**

Industries dealing with modelling of computer systems (e.g., Intel, AMD etc.)

**Faculty:**

**Dr. Sumit Kumar Mandal**

Department of Computer Science and Automation,  
Indian Institute of Science

Email: [skmandal@iisc.ac.in](mailto:skmandal@iisc.ac.in),

**Reference Books:**

- Introduction of Probability Models (12th Edition) by Sheldon M. Ross
- Data Networks (2nd Edition) by Dimitri Bertsekas and Robert Gallager
- Queueing Networks and Markov Chains by Gunter Bolch

**Who can apply?**

Engineering in electrical/Electronics/Computer Science/Mathematics

**Pre-requisites required.**

Basic Probability

**Course Fee:** Rs. 15,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Tuesday's and Thursday's (6.00PM to 7.30PM)

#### 04. Business Analytics with Management Science Models and Methods (3+0)

##### Objectives:

To provide business practitioners and those who are interested in Business Analytics a selected set of Management Science and Optimization Techniques along with the fundamental concepts, methods, and models for understanding prescriptive analytics implementation of these techniques in the era of Big Data.

##### Syllabus:

Introduction to Business Analytics, Linear/Integer/Non-Linear Optimization, Optimization of Network Models, Dynamic Programming, Heuristic Programming, Goal Programming, Multi-Attribute Decision Making Methods, and Monte Carlo Simulation. These are believed to be among the most popular Prescriptive Analytics tools to solve a majority of business optimization problems, with case studies from Business, Industry, and Government (BIG) applications using LINDO/LINGO/CPLEX optimization package.

##### Target Group:

“Business Analytics, Business Intelligence, Operations Research” group in every Business, Industry and Government (BIG) organizations / People who are interested in addressing various problems associated with Prescriptive Analytics in Business / Industry / Government (BIG) organization.



##### Faculty:

**Dr M Mathirajan,**  
Chief Research Scientist,  
Department of Management Studies, Faculty of Engineering,  
Indian Institute of Science, Bangalore 560012  
Email: [msdmathi@iisc.ac.in](mailto:msdmathi@iisc.ac.in); mathiisc@gmail.com

##### Reference Books:

1. Wayne L Winston. Operations Research: Applications and Algorithms (Latest Edition). Duxbury Press. An Imprint of Wadsworth Publishing Company, Belmont, California, USA
2. William P Fox. Mathematical Modeling for Business Analytics. CRC Press. Taylor & Francis Group, LLC. 2018
3. Anderson, Sweeney and Williams. An Introduction to Management Science: Quantitative Approaches to Decision Making (Latest Edition). South-Western College Publishing.
4. Abben Asllani. Business Analytics with Management Science Models and Methods. Personal Education. 2015
5. U Dinesh Kumar. Business Analytics: The Science of Data-Driven Decision Making. Wiley India, 2017

##### Who Can apply?

ME/MTech, BE/BTech and master's in business administration, Management, Operations Research, Computer Science, Computer Applications, Mathematics, Statistics, Economics.

**Course Fee:** Rs. 15,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Tuesday and Thursday (8.30PM to 10.00PM) - Online only

## 05. Online Course on Flight Dynamics 3:0

### Objectives:

Flight Dynamics with a strong Aerodynamics Perspective so that the physics behind the math is brought out clearly This is meant as a refresher course for people working in Aero industry R&D labs who want to revisit Flight Mechanics with a strong Aerodynamics slant. Please note that this course will not cover many of the flight control aspects.

### Syllabus:

Review of Aerodynamics, Review of Performance, Trim and Equilibrium, Static stability - longitudinal and lateral, Equations of motion for a rigid body, Dynamic stability

### Target Group:

DRDO labs scientists and faculty from Engineering colleges



### Faculty:

**Prof. O N Ramesh**

Room 221

Department of Aerospace Engg,

IISc.

Email: onr@iisc.ac.in

### Reference Books:

- Warren F Philips Mechanics of Flight McGraw Hill
- R F Stengel, Flight Mechanics, Princeton
- E L Houghton and Carruthers, Aerodynamics for Engineering Students, 3rd Edition, Edward Arnold (Publishers) Ltd, London. 1982

### Who Can apply?

BE, BTech in Aero or Mechanical Engg.

**Pre-requisites:** First courses in Aerodynamics and Flight Mechanics

**Course Fee:** Rs. 15,000/- + 18% GST

**Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Tuesday and Thursday (6.00PM to 7.30PM for 3 credits course)

## 06. Online Course on Learning, Memory, Behavior and Brain (3:0)

### Objectives:

Have you ever wondered why, if and what our brain (and hence we) learns? What are the rules that govern the learning process? In this course starting from a set of initial experiments and studies that were done to understand these I will introduce and develop a formal theory of learning. In doing so the course will bring out the intricate connection that exists between the psychological process of learning, the structure and function of the brain. We will be studying how complex behaviors can be tracked down to molecules and the inner functions of the brain in the context of learning and memory. Simultaneously we will also be learning about how the information is stored, organized and utilized in our brain. Towards the end we will compare how these rules have led to emergence of neural networks.

### Syllabus:

Origin of memory studies, Substrates of memory, Brain and Behavior, Memory and its classification, Memory consolidation, The standard model of memory consolidation. Learning and its classification, Contingency, Salience and Valence, Classical Conditioning, Pavlov's Experiment: What it is and what it is not.? Rescorla's experiment on contingency, Garcia and Koelling Experiments, Kamin's Observations, Rescorla and Wagner Model of Learning, second order conditioning, Latent Inhibition, Reinforcement learning, Punishment learning, Positive and Negative reinforcement and Positive and negative punishments, Different types of scheduling and their implication in reinforcement learning, Cognitive vs Reflexive behavior, Sign vs Goal directed behavior, Rodent model of learning and memory, Molecular basis of memory, Contemporary research in the field of memory.

### Target Group:

Drug industry, College students, HR professionals, Neuropharmacologists, Animal Model Developers, Learning Model Developers.



### Faculty:

**Prof. Balaji Jayaprakash**

Associate Professor

B-09, CNS,

IISc

Email: jbalaji@iisc.ac.in

### Reference Books:

- Learning: David Liberman, Memory:
- Pruves: Fundamentals of Neuroscience
- Kandel and Squire : Memory from molecules to mind

### Who can apply?

Bachelor of Science in any discipline

**Pre-requisites:** Basic Science

**Course Fee:** Rs. 15,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Tuesday and Thursday (8.30PM to 10.00PM)

Online only



## 07. Online Course on Computational Fluid Dynamics: Fundamentals and applications through open-source computing tools, (3:0)

### Objectives:

To familiarize students with the modern state of computational fluid dynamics (CFD), the discretization methods (finite-volume, finite-element, finite-difference and spectral approximations), concepts of convergence, stability and conservation that are common to all the discretization methods. Students will also gain basic knowledge necessary to perform fluid flow simulations using open-source software tools.

### Syllabus:

- Governing equations for fluid flows and their classification,
- Interpolation, integration, spatial discretization, systems of ordinary differential equations (ODEs), ODE integrators.
- Finite-volume, finite-element and finite-difference methods for partial differential equations, accuracy, consistency, stability and conservation,
- Development and analysis of the discretization methods used in simulations of incompressible and compressible fluid flows including shock-capturing methods.
- Introduction to data-driven approximation techniques for fluid flow simulations.

### Target Group:

Researchers and practicing engineers interested in modern computational techniques for high-fidelity fluid flow simulations and their implementation in open-source computing framework.



### Faculty:

**Prof. Ratnesh Shukla**

Department of Mechanical Engineering,  
Indian Institute of Science,  
Bangalore 560012  
Email: ratnesh@iisc.ac.in

### Reference Books:

1. J. H. Ferziger, M. Perić, R. L. Street, Computational Methods for Fluid Dynamics, Springer-Verlag Berlin, 2002.
2. D.A. Anderson, J.C. Tannehill, and R.H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Hemisphere Publishing Corporation, 1984.

### Who can apply?

Bachelor's (B.E. B. Tech) or Masters (M.E./M. Tech/M.Sc) degree

### Pre-requisites required.

Introductory courses on fluid mechanics and numerical methods. Familiarity with a programming language (such as C, C++, Python).

**Course Fee:** Rs. 15,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Tuesday and Thursday (8.00PM to 9.30 PM) - Online only

## 08. Online Course Transgenic Technology: Principles and Applications (2:0)

### Objectives:

This course is proposed for those who wish to develop a strong background in technologies and principals involved in the generation of genetically modified experimental organisms, from worms to animals, and explore their use in scientific research.

**Syllabus:**History and overview of transgenic technology- Molecular technologies used in transgenic technology- Direct single-cell embryo pronuclear injection, embryonic stem cells, and somatic cell nuclear transfer- Lentiviral and BAC transgenesis- Zinc finger nuclease technology- Genome editing approaches such as TAL effector nucleases and Cas9/CRISPR- Generation of the stable transgenic and mutant nematode worm *Caenorhabditis elegans*- Production of transgenic and mutant zebrafish and *Xenopus*- Production of transgenic mice (Embryonic development, Design, and optimizing Constructs for transgenic expression, Preparation of females for embryo collection- Pronuclear microinjection, Generation of Pseudo pregnant Females, Implantation in foster mothers, Identification of transgenic progeny)- Generation of knock-out mice ( Isolation and culture of embryonic stem (ES) cells, Gene targeting construct design, Transfection, Homologous recombination in ES Cells, Positive and negative selection; blastocyst injection, Breeding of germ-line chimeras)- Transgenic animal model supporting techniques (Cryopreservation and rederivation; ICSI and IVF)- Cre/lox and Flp/FRT system for inducible transgenics, general knockouts, conditional knockouts, and reporter strains in mice – Chemically inducible transgene expression systems- Use of transgenic technology in the modelling of human diseases, including cardiovascular diseases, diabetes, obesity, cancer, atherosclerosis, neurodegenerative diseases, muscle degeneration, and aging.

### Target Group:

College students (Veterinary, Pharmacy, Biotechnology & Medical) · Industry (Pharmaceutical Companies & Biotech Companies) · Researchers, Postdocs and students in the field of biological sciences



### Faculty:

**Prof. N. Ravi Sundaresan**

Dept. of Microbiology and Cell Biology

Indian Institute of Science

Bengaluru-560012

Email: rsundaresan@iisc.ac.in

### Reference Books:

1. Principles of Gene Manipulation and Genomics by Sandy B. Primrose, R. Twyman Oxford press; 7th edition.
2. Transgenic Animal Technology: A Laboratory Handbook. Carl A. Pinkert Elsevier Science Publishing Co Inc: 3rd Revised edition.
3. Transgenic Mouse Methods and Protocols (Methods in Molecular Biology) Marten H. Hofker, Jan van Deursen. Humana Press.2nd Edition.

### Who can apply?

Students either studying or completed, BSc (research), MSc, B. Tech, B. Pharam., BVSc., MBBS,

B.Pharm., MS (Biotech), or Equivalent

**Pre-requisites:** Basic knowledge in the Life Sciences

**Course Fee:** Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams/Google Meet**

Schedule: Tuesday (8.00PM to 10.00PM)

## 09. Online Course on Learning Metamaterials and Metasurface using Circuit Theory (3:0)

### Objectives:

Electromagnetic metamaterials and meta surfaces in the radio frequency (microwave, mm-wave) find potential applications in advanced communication, defense and energy sectors, by leading to innovative designs of filters, sensors, antennas, intelligent reflectors and super lenses. Besides the conventional spatial metamaterials and meta surfaces, recently there has been emphasis on using time-modulation to realize more exotic EM properties from them. In this course, emphasis will be provided on disseminating the underlying EM concepts of these structures (mainly in the RF regime), from a circuit theoretic approach using transmission lines. MATLAB Antenna Toolbox as well as FDTD (finite difference time-domain) codes will be deployed for visualization and understanding.

### Syllabus:

- Module-1: Maxwell's Equations and EM Boundary Conditions, Formulation and Solution of Wave-equation, Phasor Concepts, Plane-wave propagation in simple medium, Relating Circuit Theory with Maxwell's Equations, Analysis of Conventional RH (Right-handed) Transmission Lines.
- Module-2: CRLH TLs (Composite Right-Left Handed Transmission Lines) and demonstration of Backward (Left-handed) EM Wave propagation, Understanding Effective Medium Permittivity and Permeability, Generalized Snell's Law and Negative Refraction, realizing "Super lens" using CRLH TLs, CRLH TL based Leaky wave Antennas.
- Module-3: Design of HIS (High Impedance Surface) using CRLH TL Concepts, Surface wave engineering and EBG (electromagnetic) Metasurfaces, Metasurface based Radomes and Absorbers, Beam-steering Anomalous Reflectors using Coded Metasurfaces.
- Module-4: TL realization of time-varying metamaterials, Time-varying meta surfaces and their applications in on-air mixers and non-reciprocal antenna design.

### Target Group:

MTech. /Ph.D. students from IITs and NITs working in communication engineering, Project Associates and Engineers working in RF/Microwave domain, Faculty Members from Engineering Colleges working in Electronic Circuits and Communication Engineering, Scientists from ISRO, DRDO.



### Faculty:

**Dr. Debdeep Sarkar**

Department of Electrical Communication Engineering,  
Indian Institute of Science,  
Bangalore-560012,  
Karnataka, India,  
Email: debdeep@iisc.ac.in

### Reference Books:

- D. K. Cheng, Field and Wave Electromagnetics, Pearson Education Asia Ltd, Second Edition, 2006.
- S. A. Ramakrishna and T. M. Grzegorzczak, Physics and Applications of Negative Refractive Index Materials, CRC Press, Taylor & Francis Group and SPIE Press, 2009.
- C. Caloz and T. Itoh, Electromagnetic Metamaterials: Transmission Line Theory and Microwave Applications, The Engineering Approach, John Wiley & Sons, Inc., Hoboken, New Jersey, 2006.
- D. Sarkar, FDTD Analysis of Guided Electromagnetic Wave Interaction with Time Modulated Dielectric Medium, Springer Briefs in Electrical and Computer Engineering, Springer Verlag, Singapore, 2022. (ISBN-13: 978-9811916298).

### Who can apply?

B.E./B.Tech. in Electronics and Communication Engineering

**Pre-requisites:** Preliminary knowledge about electromagnetics would be good, but not necessary.

**Course Fee:** Rs. 15,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Tuesday and Thursday (8.00PM to 9.30PM) - Online only;

## 10. Online Course on Spectroscopic analysis of protein structures and functions (2+0)

### Objectives:

This course will cover different spectroscopic methods to study the structures and functions of proteins.

### Syllabus:

Fundamentals of protein structures; different spectroscopic methods to study protein structures and functions; UV/VIS spectroscopy; fluorescence spectroscopy; CD spectroscopy; NM spectroscopy; protein-protein interactions; protein-nucleic acids interactions; protein-ligand interactions.

### Target Group:

College teachers from technical, engineering colleges (govt and pvt). People working in the biotech and pharma industry, PhD students and postdocs from other institutes



### Faculty:

#### Prof. Mahavir Singh

Molecular Biophysics Unit  
Indian Institute of Science  
Bangalore  
Email: singh@iisc.ac.in

### Reference Books

1. Physical Chemistry Tinnoco Jr., Sauer, Wang, and Puglisi Principles of Physical Biochemistry
2. Kensel E. Van Holde, W. Curtis Johnson, P. Shing Ho
3. Spectroscopy For the Biological Sciences  
Gordon G. Hammes

### Who Can apply?

B.Tech., MSc

### Pre-requisites required:

Fundamental understanding of protein structures and  
biochemistry

**Course Fee:** Course Fee: Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Schedule:** Wednesday (6.00PM to 8.00PM)

## 11. Online Course on Vibration and Noise Control: Theory and Practice (2:0)

### Objectives:

Growing awareness of vibration, noise and harshness feeling has necessitated the valid design criterion in the design of machines, automobiles, buildings, industrial facilities, etc, and the increasing number of standard regulations and human comfort associated with noise, harshness and vibration makes it mandatory to control vibration and noise leading to quieter technology in pumps, engines, compressors, chillers and other consumer products. There is a great demand to enhance ride comfort of bikes, cars, aircrafts and other automobiles. Vehicle Dynamics basics and growing awareness about noise pollution among the consumer necessitates the OEM companies to stress upon the products without NVH problems. Analytical, MATLAB and FEM based tools such as ANSYS, NASTRON, ABACUS and SYSNOISE helps to achieve the goals of NVH study. This course is for engineers/scientists/entrepreneurs/instructors in the industries/institutes to learn the analytical and experimental skills to tackle the problems related noise, vibration and harshness (NVH) during design and manufacturing stage for technically superior and commercially viable product to achieve “EMPOWER INDIA WITH SKILL AND Knowledge.”

### Syllabus:

Vibration of structural systems. SDOF, 2-DOF, MDOF and continuous systems. Eigen values and vector estimation methods. Free and Forced vibration analysis. Torsional vibration and applications. Damping estimation methods  
Structural Vibration control elements: isolation, damping, balancing, resonators, absorption, barriers and enclosures. Vibration and noise standards. NVH measurement tools and techniques. Modal parameter (natural frequency, mode shape and damping) estimation techniques. Signal and system analysis. Demonstration of vibration and noise experiments – beam, plates, impulse excitation, electrodynamic shaker excitation, FFT analyzer, stroboscope and mode shape animation, sound level meter, microphones. Vibration transfer function (VTF) and noise transfer function (NTF)  
Noise and its effects on man. Acoustic and sound field. Enclosures, shields and barriers-design. Silencer and suppression systems. Noise level interpolation and mapping. Harshness effects and measurements and solutions. NVH Parameters related to vehicle dynamics. Case studies discussion (vibration reduction in passenger car, tiller, tractors, steering column/wheel vibration diagnosis, Modal analysis of Helicopter, Vibration diagnosis in diesel engine power plant, rotodynamic analysis of DWR and tracking antenna and engine and compressor noise attenuation and vibration isolation, engine-compressor mount design, vibration diagnosis in power plants, gear shift harshness, newspaper printing cylinder vibration diagnosis, engine filter bracket dynamic analysis, noise reduction for mixer grinders, field audit of industrial chimney for wind induced vibration, stability studies of sports bike, aerodynamic stability derivatives of scaled model of aerospace vehicles)

**Target Group:** Mechanical, Civil, Aerospace, Automotive, Industrial engineers, construction technologists, R & D Labs, New product design and development groups, Entrepreneurs and Engineering college instructors. Professionals to pursue postgraduate and higher studies



### Faculty:

**Dr. S B Kandagal**  
Principal Research Scientist,  
Dept of AE,  
IISc., Bengaluru.  
Email: ksb@iisc.ac.in

### Reference Books

- Harris, C.W” Shock and vibration handbook” McGraw Hill, New York, 2012.
- Ewins, D.J.” Modal analysis: Theory and Practice”, Research Studies Press Ltd, England, 2014
- Gillespie, T.D., “Fundamentals of Vehicle Dynamics”, Society of Automotive Engr’s., Inc, 2010.
- Beranek, L.L,” Noise and Vibration Control”, Wiley, 2008

### Who Can Apply?

BE, ME, MSc, AMIE, or equivalent

**Course Fee:** Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Wednesday (6.00PM to 8.00PM) Online only

## 12. Online Course OECD Principles of GLP (2:0 )

### Objectives:

Preclinical studies are undertaken to identify a lead candidate and to select the best formulation; determine the route, frequency, and duration of exposure; and support clinical trial design. This course provides essential information on the OECD Principles of GLP, test guidelines and requirements by various regulatory authorities while conducting Preclinical studies.

### Syllabus:

The syllabus includes History and OECD Principles of GLP, GLP Consensus Documents, Guidance Documents for Compliance Monitoring Authorities, Advisory Documents of the Working Group on GLP, Position Papers, Regulatory authorities, Introduction to Toxicology, Toxicology studies, Ecotoxicology studies, Genetic Toxicology studies, Developmental & Reproductive Toxicology studies, OECD test guidelines and Biocompatibility studies.

### Target Group:

1. Biomedical Research Institutes,
2. R&D units,
3. Pharmaceutical industries,
4. Contract Research Organizations



### Faculty:

**Dr. Ramachandra S.G.**  
Chief Research Scientist  
Central Animal Facility  
Indian Institute of Science  
Bangalore 560012  
Email: sgr@iisc.ac.in

### Reference Books:

- Handbook: Good Laboratory Practice (GLP): Quality practices for regulated non-clinical research and development - 2nd ed. Publisher: WHO, 2009.
- Good Laboratory Practice, OECD Principles and Guidance for Compliance Monitoring. Publisher: Organization for Economic Co-operation and Development (OECD). 2006.
- Animal models in toxicology. Second Edition. Ed. Shayne C. Gad. CRC Press. 2007.

### Who can apply?

BVSc./B.Pharma/MSc./M.Pharma/MVSc.

### Pre-requisites required

Basic Probability

**Course Fee:** Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Wednesday (8.00PM to 10.00PM)



### 13. Online Course on Analysis and Design of Composite Structures (2+0)

**Objectives:**

Composites are future materials and have been finding applications in all fields of Engineering (Aero, Civil, Mechanical, Automobile, Marine). Many FEM software packages like ANSYS, MSC-NASTRON, PATRAN, ABACUS, LS-DYNA, etc. are available for Analysis & Design Optimization. One should first understand the Mechanical behavior of the Composite Structures before using FEM packages. After the completion of this course one can use the FEM software packages for better quality of professional work and optimum usage of time, computing and human resources.

**Syllabus:**

Introduction: Basic Concepts and Terminology, different types of fibers and matrices, their properties and applications. Micromechanics of Composites: Prediction of properties etc. Micromechanics of Lamina: The theory of elasticity, Constitutive equations of a lamina, transformations, Numerical examples. Failure theories for composite lamina, Numerical examples. Mechanics of Laminated Composites: ABD matrices, etc. Hygrothermal Analysis, Numerical examples. Bending Analysis of Beams: Theory, Numerical examples.

Analysis of Laminated composite plates: Classical and first order theories, Energy Method, numerical examples.

Buckling analysis of plates: Theory, Numerical examples. Design of laminates using Carpet plots, AML plots, Design of laminates with Numerical examples.

**Target Group:**

1. Technologists/ Engineers/ Scientists/ Trainees/ Project Staff/ etc. from Industries, R & D Organizations, Institutions, Colleges etc. 2. Faculty of Engineering/ Diploma Institutions etc. 3. Fresh Graduates, Postgraduates, Ph.D. Students, Research Fellows, SRFs, JRFs, etc.

**Faculty:**

**Dr. G Narayana Naik**  
Principal Research Scientist,  
Dept. of AE.,  
IISc., Bengaluru.  
Email: gnn@iisc.ac.in

**Reference Books:**

1. Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures- Universities Press- Engg. 2004.
2. Zafer Gurdal, Raphael T Haftka, Design and Optimization of Laminated Composite Materials, John Wiley & Sons, INC – 1999.
3. J.N. Reddy, Mechanics of Laminated Composite Plates and Shells Theory and Analysis – CRC Press – 2004.

**Who can apply?**

B.E / B.Tech. / AMIE / M.Sc. (Engg.)/ AMAeSI (Engg.)  
(Mechanical, Aero, Civil, Automobile, Marine, Ocean) OR  
equivalent.

**Pre-requisites: NIL**

**Course Fee:** Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Thursday (8.00PM to 10.00PM) - Online only;

## 14. Online Course Principles of Laboratory Animal Management (2 :0)

### Objectives:

The use of animals in research imposes moral, scientific and legal obligations for humane care and treatment. This course provides essential information for the investigators/animal house managers about the standard practices to be followed in the scientific management of the animal house, production of quality animals, current regulations and laboratory animal care.

### Syllabus:

The syllabus includes an introduction, uses of animals in biomedical research, physiology, nutrition, selection of animals and models, breeding, animal acquisition, housing, animal husbandry and care, occupational health and safety, animal use protocol, personnel and facility management, health and genetic monitoring, quality control, anesthesia, euthanasia, animal welfare, and CPCSEA guidelines.

### Target Group:

1. Biomedical Research Institutes,
2. R&D units,
3. Veterinary/Medical/Pharmacy Colleges
4. Pharmaceutical industries
5. Contract Research Organizations



### Faculty:

**Dr. Ramachandra S.G.**  
Chief Research Scientist  
Central Animal Facility  
Indian Institute of Science  
Bangalore 560012  
Email: sgr@iisc.ac.in

### Reference Books:

1. The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals, Eighth Edition. Editor(s): Robert Hubrecht and James Kirkwood. Wiley-Blackwell Publishing Ltd. 2010.
2. Handbook of Laboratory Animal Science. Vol. I and Vol. II. CRC Press. 2010/2011.
3. Guide for the Care and Use of Laboratory Animals. Eighth edition. National Academy Press, USA. 2011

### Who can apply?

BVSc./B.Pharma/MSc./M.Pharma/MVSc.

**Pre-requisites required: Nil.**

**Course Fee: Rs. 10,000/- + 18% GST**

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule: Thursday (8.00PM to 10.00PM) - Online only.**

## 15. Online Course on Interactive Data Science (2:0)

### Objectives:

The objective of this course is to introduce interactive data science, focusing on programming tools to develop data-driven interactive systems and dashboard applications. Participants will learn the human-centered aspects of data science, including interactive data visualization, analysis, and the art of storytelling with data. This course features weekly hands-on programming tutorials using tools such as Streamlit, Plotly Dash, and Shiny for implementing case studies.

### Syllabus:

Introduction to the data science pipeline, data collection, data wrangling, and manipulation, exploratory data analysis, visualization methods and tools, univariate and multivariate data visualization, interactivity in visualization, feature extraction, dimensionality reduction, principal component analysis, discriminant analysis, regression, and classification algorithms such as linear and logistic regression, decision tree, and Naïve Bayes classifier, data clustering with k-means, interpretation of models and their explain ability, interpretation and presentation of results, storytelling with data and interactive visualizations.

### Target Group:

Bachelor and Master students, faculty members, industry professionals, and data science enthusiasts who want to learn and improve their data visualization and interpretation skills.



### Faculty:

#### Dr. Pandarasamy Arjunan

Robert Bosch Centre for Cyber Physical Systems  
Indian Institute of Science,  
Bengaluru - 560012  
Email: samy@iisc.ac.in

### Reference Books:

- Cecilia Aragon, Shion Guha, Marina Kogan, Michael Muller, Gina Neff Human-centered data science: an introduction. MIT Press, 2022.
- Christian Tominski and Heidrun Schumann, Interactive Visual Data Analysis, CRC Press, 2020
- Elias Dabbas, Interactive Dashboards and Data Apps with Plotly and Dash, Packt Publishing, 2021

### Who can apply?

BE/B.Tech (any discipline) or any Masters

**Pre-requisites:** High-school mathematics and familiarity with Python programming. In addition, having prior knowledge of using machine learning libraries such as Scikit-learn, and web technologies will be a plus.

**Course Fee:** Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Thursday (8.00PM to 10.00PM) - Online only

## 16. Online Course on Structural Analysis and Design Optimization: Theory and Practice (2:0)

### Objectives:

Advanced research in material science to enhance life with reduced cost resulted in metal alloys, plastics, composites and nano materials. Structural design and optimization of components with unusual shapes became possible with current available finite element software tools such as ANSYS, NISA, NASTRON, ABACUS, SYSNOISE, LSDYNA and MATLAB etc. The fundamental knowledge of stress, strain, shear, torsion in relation to the structures and S-N curves in relation to the material fatigue life becomes important. The interpretation of the FEM software output calls for the knowledge of analysis and design optimization of mechanical systems. This course essentially trains engineers/scientists/entrepreneurs/instructors in the industries/institutes to optimally design various mechanical systems and sub-systems for technically superior and commercially viable value-added products and achieve "EMPOWER INDIA WITH SKILL AND Knowledge."

**Syllabus:** Applied mechanics, Strength of materials, SFD, BMD, AFD, solid mechanics, concept of stress, strain and fatigue. Constitutive laws. Mohr's Circle, Engineering materials and their properties. Structural analysis concepts, tension, compression, shear, torsion, coupled system, and S-N curves. Design of beams, torsion, compression members and fasteners. Stability of structures. Composite materials and their importance in structural analysis design optimization. Principles of optimization, formulation of objective function and design constraints, classification of the optimization problem. Single and multivariable optimization. Optimization with equality and inequality constraints. Optimal design of mechanical elements – fasteners, springs, gears, bearings, belts, clutches, brakes, shafts, and axles. Procedures for product design, development and testing. The vibration of structures Practical problem discussion with industrial products (optimization of passenger car sub-systems for vibration and noise reduction, Rail-coach-CBC couplers, Car door window regulator, satellite tracking antenna and DWR antenna design, Tractor canopy, hydraulic crawler driller (drilling machine), Bike brake system, sluice valve design, failure analysis if piston drill bit, thermally insulated box, IP turbine blade failure analysis, design analysis of super pump impeller, Structural design aspects in power plants. Hydraulic jacks/Feed cylinder with intermediate supports, Industrial chimney design, optimization of box culverts, metal-composite sprocket for bikes, Thermal analysis of heat exchangers, 6-DOF force balance, pitch flexure, roll flexure design for wind tunnel model studies for aerodynamic derivatives of aerospace vehicle and automobiles).

**Target Group:** Mechanical, Civil, Aerospace, Automotive, Industrial engineers, R & D Labs, Construction technologists, new product design and development groups, Entrepreneurs and Engineering college instructors. Professionals to pursue postgraduate and higher studies.



### Faculty:

**Dr. S B Kandagal**  
Principal Research Scientist,  
Dept of AE,  
IISc., Bengaluru.  
Email: ksb@iisc.ac.in

### Reference Books

- Beer F P and Johnson, E.R,  
"Vector Mechanics for Engineers- Statics and Dynamics", Tata-Mac Graw Hill, Sixth Edition, 2012.
- Shigley, J.E and Mischke, C.R.,  
"Mechanical Engineering Design"  
Tata-Mac Graw Hill, sixth Edition, 2010.
- Johnson Ray, C.  
" Optimum Design of Mechanical Elements",  
Wiley, John & Sons, 2014.

### Who Can Apply?

BE, ME, MSc, AMIE, or equivalent

**Course Fee:** Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Teams**

**Schedule:** Saturday (12.00PM to 2.00PM).

## 17. Online Course Principles and Advances in Genetic Engineering 2:0

### Objectives:

Genetic Engineering is the direct manipulation of an organism's genes using biotechnological tools. Genetic engineering has been applied in numerous fields, including research, medicine, industrial biotechnology, and agriculture. This course is proposed for those who wish to develop a strong background in principles of recombinant DNA technology, Genetic Engineering, Genome Editing, transgenic technology, and its applications in biotechnology. I will also focus on the creation of genetically modified organisms, from bacteria to monkeys, for laboratory research and industrial applications.

### Syllabus:

Growth and maintenance of recombinant bacterial strains. Transformation and transfection methods. Vectors used in molecular cloning and expression of genes. DNA, RNA, and protein isolation, purification, and fractionation methods. Enzymes used in genetic engineering. Radioactive and non-radioactive labelling of nucleic acids and proteins and their detection. Nucleic acid hybridization methods. Gene and cDNA cloning methods. Construction of genomic DNA and cDNA libraries. Detection and characterization methods for genes and chromosomes. Nucleic acid sequencing methods, including Next-Generation Sequencing. Methods for protein analysis, protein-nucleic acid, and protein-protein interactions. Sitespecific mutagenesis. Polymerase chain reaction, Real-time Quantitative PCR., and applications. Antisense technology and RNA silencing techniques. Recombinant protein production in bacteria, yeast, and mammalian cells, Genome editing approaches such as Cas9/CRISPR technology. Exome Sequencing- Chip Sequencing. Generation of Lentiviral, retroviral and Adenoviral vectors, and Gene therapy, Genetic Engineering of mammalian stem cells, Generation of induced pluripotent stem (iPS) cells, Mitochondrial genome editing, Somatic cell nuclear transfer, Generation of transgenic and mutant *Caenorhabditis elegans* –Generation of knock-out mice (isolation and culture of embryonic stem (ES) cells, Gene targeting construct design, Transfection, Homologous recombination in ES Cells, Positive and negative selection; Breeding of germ-line chimeras Cre/lox and FLP/FRT system for inducible transgenic mice – Chemically inducible transgene expression systems. Use of transgenic technology in modelling human diseases, including cardiovascular disease, diabetes, obesity, cancer, atherosclerosis, neurodegenerative diseases, muscle degeneration, and aging

**Target Group:** Goodfellow, Bengio and Courville, Deep Learning, MIT Press, 2016



### Faculty:

**Dr. N. Ravi Sundaresan**  
Associate Professor  
Microbiology and Cell Biology  
Indian Institute of Science  
Bengaluru-560012  
Email: rsundaresan@iisc.ac.in

### Reference Books:

- Molecular Cloning: A Laboratory Manual, Sambrook and D.W. Russell, ed., Cold Spring Harbor Laboratory Press
- 2. S. B. Primrose and R. M. Twyman. Principles of Gene Manipulation and Genomics, 7th Edn, Blackwell Publishing.
- 3. J. J. Greene and V. B. Rao. Recombinant DNA Principles and Methodologies. CRC Press

### Who can apply?

Students either studying or completed, BSc (research), MSc, B. Tech, B. Pharma., BVSc., MBBS, B.Pharm., MS (Biotech), or Equivalent

**Pre-requisites:** Basic knowledge in the Life Sciences

**Course Fee:** Rs. 10,000/- + 18% GST

**Online Seats are Limited to 100**

**Online Classes using Microsoft Team**

Schedule: Saturday (10.00AM to 12.00PM)

**Course 18: Online course on Machine Learning Interpretability: Unveiling the Black Box with Case Studies (3:0)**

**Objectives:**


Apart from basics of machine learning concepts, Participants would be introduced to real life scenarios by case-study method, where Statistical and Machine Learning concepts can be applied to solve business/data problems. This course takes a deep dive to explain and interpret the machine learning output in the context of case-study using Zerocodelearning machine learning tools.

**Syllabus:**

Introduction of statistical inferences, Exploratory data analysis, Data pre-processing, hypothesis, machine learning, different types of machine learning (supervised: Regression, classification, , time-series, decision tree, random forest, unsupervised learning : clustering, factor analysis, PCA), Overview deep learning, and hands on experience using Zerocodelearning machine learning tools

**Target Group:**

Every Business, Industry and Government (BIG) organizations which has “Data Science” “Machine Learning” group to address various problems requires knowledge of Data Science, AI/ML. In addition, all Faculty and interested UG and PG Graduates in Engineering and Postgraduate in Computer Science, Computer Applications, Operations Research and Mathematics.

	<p><b>Faculty:</b> <b>Dr M Mathirajan</b>, Chief Research Scientist, Dept. of Management Studies, Indian Institute of Science Email: <a href="mailto:msdmathi@iisc.ac.in">msdmathi@iisc.ac.in</a>; mathiisc@gmail.com</p>			<p><b>Faculty:</b> <b>Gaurav Gupta</b> Zero Code Learning (OPC) Pvt. Ltd. Email: <a href="mailto:gaurav@zerocodelearning.com">gaurav@zerocodelearning.com</a></p>
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**Reference Books:**

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow Publisher(s): O'Reilly Media, Inc. Author: Geron Aurelien
2. Data Science from Scratch. Publisher(s): O'Reilly Media, Inc Author: Joel Grus
3. Complete Business Statistics | 7th Edition: Publisher(s): McGraw Hill, Author: by Amir Aczel (Author), Jayavel Sounderpandian (Author), P Saravanan (Author)
4. Marketing Analytics: Data-Driven Techniques with Microsoft Excel: Publisher(s): Willey, Author: y Wayne L. Winston

**Who can apply?**

ME/MTech, BE/BTech, MSc/MS in Computer Science (CS) / Data Science, Master’s in Computer Applications (MCA), Computer Science, Operations research and Mathematics

**Pre-requisites required**

Basic knowledge of Statistics, Mathematics

**Course Fee:** Rs. 15,000/- + 18% GST

**Online classes via Microsoft Teams**

**Schedule:** Every Monday and Wednesday (8.00PM to 9.30PM)



**Appendix 'A' PROFORMA**

**NAME OF THE COLLEGE**

**PROVISIONAL CERTIFICATE**

This is to certify that Sri/ Smt. .... was a student of this college studying in .....\*

Course ..... \*\*

Branch during the Session ..... to .....

He / She have Successfully Completed the course as prescribed by the .....

.....

University with regard to course of study, attendance, sessional requirements etc.

He / She has passed the final .....\* examination held during ..... securing .....class as per the results announced by the University. He / She will be awarded the .....degree during the next convocation of the university.

College Seal

Date:

PRINCIPAL

\*Appropriate course to be filled in (B.E., B.Tech., M.E., M.Tech., M.Sc., and M.Com. MBBS. Etc.)

\*\*Mention Civil, Electrical, Electronics, Chemistry, Biology, Etc.

### IMPORTANT DATES

Opening of application portal		<b>24<sup>th</sup> Nov 2023</b>	Friday
Receipts of application along with fees (up to)	From	<b>24<sup>th</sup> Nov 2023</b>	Friday
	To	<b>26<sup>th</sup> Dec 2023</b>	Tuesday
Classes Commence	To	<b>01<sup>st</sup> Jan 2024</b>	Monday
Final Exams	From	<b>06<sup>th</sup> May 2024</b>	Monday
	To	<b>11<sup>th</sup> May 2024</b>	Saturday

#### **CCE-PROFICIENCE**

**Coordinator,**

Indian Institute of Science,  
Bangalore - 560 012

**Phone:** + 91 080 22932508

**E-mail:** [prof.cce@iisc.ac.in](mailto:prof.cce@iisc.ac.in)

**URL:** [www.cce.iisc.ac.in/proficiency](http://www.cce.iisc.ac.in/proficiency)

**Working Hours:**

**Monday through Friday: 09.30 hrs. to 18.00 hrs.**