CCE-PROFICIENCE
Centre for Continuing Education
Indian Institute of Science

INFORMATION HANDBOOK
AUG-DEC 2024

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REGULAR COURSES

Sl. No.	Name of the Course	Credit
1	Online Course on Machine Learning for 5G and 6G wireless communication (Mon & Wed) (8.00PMto 9.30PM)	3:0
2	Online Course on Hands-on Machine Learning Driven Business Analytics- Zero Code Approach with Case-Studies (Mon & Wed) (8.30PM to 10.00PM)	3:1
3	Online Course on AI and Machine Learning (Mon & Wed) (6.00PM to 7.30PM)	3:1
4	Online Course on Hands-on Machine Learning (Tue & Thu) (6.00 PM to 7.30PM)	2:1
5	Online Course on Flight Dynamics 3:0 (Tue & Thu) (6.00PM to 7.30PM)	3:0
6	Online Course on Graph Theory and related Algorithms. (Tue & Thu) (8.00PM to 9.30PM)	3:0
7	Online Course on Transgenic Technology: Principles and Applications (Tue & Thu) (8:00PM to 9.30PM)	3:0
8	Online Course on Vibration and Noise Control: Theory and Practice (Wed) (6.00PM to 8.00PM)	2:0
9	Online Course on Analysis and Design of Composite Structures (Thu) (8.00PM to 10.00PM)	2:0
10	Online Course on Structural Analysis and Design Optimization: Theory and Practice (Sat) (12.00PM to 2.00PM).	2:0
11	Online Course on Prescriptive Analytics (Sat) (1.00PM to 4.00PM)	3:0
12	Online Course on Principles and Advances in Genetic Engineering (Sat) (10.00AM to 12.00PM)	2:0
13	Online course on Fundamentals of Electromagnetic Compliance for Electrical System Design (Sat) (10.00AM to 1.00 PM)	3:1

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.

Grade: A^+ A B^+ B C D F (Fail)
Grade Points: 10 9 8 7 6 5 0

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 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 the 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

Sl. No.	Name of the Course	Credit	Faculty	Department
	Schedule of Online Courses for Aug - Dec 2024			
1	Online Course on Machine Learning for 5G and 6G wireless communication, Credits	3:0	Prof. Sudhan Majhi	DEPT ECE
2	Online Course on Hands-on Machine Learning Driven Business Analytics- Zero Code Approach with Case-Studies	3:1	Dr. M Mathirajan	DEPT MGFE, IISc
3	Online Course on AI and Machine Learning	3:1	Prof. Sashikumaar Ganesan	CDS IISc
4	Online Course on Hands-on Machine Learning	2:1	Dr. Pandarasamy Arjunan	DEPT RBCCPS
5	Online Course on Flight Dynamics	3:0	Prof. O N Ramesh	AE, IISc
6	Online Course on Graph Theory and related Algorithms	3:0	Prof. Sunil Chandran Leela	CSA IISc
7	Online Course on Transgenic Technology: Principles and Applications	3:0	Dr.N. Ravi Sundaresan	Dept. Microbiology and Cell Biology, IISc
8	Online Course on Vibration and Noise Control: Theory and Practice	2:0	Dr. S B Kandagal	AE, IISc
9	Online Course on Analysis and Design of Composite Structures	2:0	Dr. G. Narayana Naik	DEPT AE, IISc
10	Online Course on Structural Analysis and Design Optimization: Theory and Practice	2:0	Dr. S B Kandagal	AE, IISc
11	Online Course on Prescriptive Analytics	3:0	Dr. M Mathirajan	DEPT MGFE, IISc
12	Online Course on Principles and Advances in Genetic Engineering	2:0	Dr. N. Ravi Sundaresan	Dept Microbiology and Cell Biology, IISc
13	Online course on Fundamentals of Electromagnetic Compliance for Electrical System Design	3:1	Dr. Yoginder Kumar Negi	SERC, IISc

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 Assignments/simulation session

01. Online Course on Machine Learning for 5G and 6G wireless communication (3:0)

Objectives:

AI/ML has several applications in physical layer communication. It brings adaptiveness to the transmitter as well as the receiver and improves the performance and latency of the communication system. The 3GPP standards already adopted AI/ML as a study material for 5G and 6G wireless communication. 6G AI Native radio also requires a solid knowledge of AI/ML. Most of the Telecom companies (network and modem) are looking for people who have knowledge in AI/ML for wireless communication; having this knowledge may help them find a job in these companies.

Syllabus:

Introduction to Machine Learning: Overview of supervised, semi-supervised and unsupervised. Wireless Communications: AI/ML-based Modulation classification, channel estimation, Channel prediction, Classification of wireless signals Autoencoder (based on 3GPP Standard), CSI compression and feedback (based on 3GPP Standard), Beam forming and beam Management (based on 3GPP Standard). Signal Estimation and Detection: AL/ML based Parameter estimation, STO and CFO estimation, MIMO/OFDM/OTFS detectors. Spectrum sharing and resource allocation: Resource allocation, Spectrum sharing, Power allocation using reinforcement learning (RL) and deep RL.

Basic tools: Python, TensorFlow and PyTorch.

Target Group:

IITs, NITs, IIIT, Samsung, Qualcomm, Nokia, Jio, MediaTek, Mavenir, Tejas Networks, Sasken Technologies, Tata Elxsi, Mistral Solutions, BEL, Sterlite Technologies Limited, CDOT, HFCL, Wipro Limited, DRDO, BSNL, ISRO, L&T Technology, and Tech Mahindra, ECE department of Local colleges in Bangalore

Faculty:

Prof. Sudhan Majhi
SP 1.05, Dept. of ECE,
IISc, 560012
Email: smajhi@iisc.ac.in

Reference Books

1. I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning, MIT Press, 2016.
2. R.-S. He and Z.-G. Ding, Applications of Machine Learning in Wireless Communications, IET, 2019.
3. F.-L. Luo, Machine Learning for Future Wireless Communications, Wiley-IEEE Press, 2020.
4. Y. C. Eldar, A. Goldsmith, D. Gündüz, and H. V. Poor, Machine Learning and Wireless Communications, Cambridge University Press, 1st edition, 2022.

Who Can apply?

ME/MTech, BE/BTech, MSc/MS, PhD in ECE can apply

Pre-requisites required: Nil

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

Online Seats are Limited to 100

Schedule: Monday & Wednesday (8.00PM to 10.00PM)

02. Online Course on Hands-on Machine Learning Driven Business Analytics- Zero Code Approach with Case-Studies (3:1)

Objectives:

Apart from basics of machine learning concepts, Participants would be introduced to real life scenarios through case-study method, where Statistical and Machine Learning concepts will 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 business problem

There will be a bridge course (which will be offered before the main course starts for about 3 to 6 hours) on Mathematics and Statistics, that can be taken up by the students who would like to refresh their statistical concepts. Content of Bridge course: Central Tendency (Mean, Median, Mode), Random Variables - Discrete, Continuous, Probability Density Function, Normal distribution, Central Limit Theorem, Standard Normal Distribution, Probability Computation, Estimation, Confidence Interval

Note: It's recommended that all students should take it to enable faster learning during the main course.

Syllabus:

Introduction of statistical inferences, Exploratory data analysis, Data preprocessing, 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.

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 Business Administration/Management, Operations Research, Computer Science, Computer Applications, Mathematics, Statistics, Economics.

Faculty:
Dr M Mathirajan, Chief Research Scientist, Dept. of MS, IISc, Bangalore 560012
Email: msdmathi@iisc.ac.in; drmuthu.mathirajan@gmail.com

Faculty:
Vineet Srivastava, Zero Code Learning (OPC) Pvt. Ltd.
Email: vineet@zerocodelearning.com

Faculty:
Gaurav Gupta Zero Code Learning (OPC) Pvt. Ltd.
Email: gaurav@zerocodelearning.com

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 (Data Science), Computer Science, Mathematics, Statistics, MCA, MA in Economics, MBA

Pre-requisites: Basic knowledge of statistics, mathematics

Course Fee: Rs. 20,000/- + 18% GST

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule:
Monday and Wednesday (8.30PM to 10.00PM)

03. Online Course on AI and Machine Learning 3:1

Objectives:

The objective of this course is to provide a comprehensive understanding of AI concepts, techniques, and practical applications using Python, enabling participants to develop and deploy AI solutions to real-world problems.

Syllabus:

Introduction to AI and Python: Overview of AI, history, Python basics, essential libraries (NumPy, Pandas, Matplotlib). Data Preprocessing and Exploration: Data types, collection, preprocessing (missing data, normalization), Exploratory Data Analysis (EDA). Machine Learning Fundamentals: Key concepts, supervised vs. unsupervised learning, linear regression, model evaluation metrics. Classification Algorithms: Logistic regression, decision trees, evaluation metrics (accuracy, precision, recall, F1 score). Advanced Machine Learning Techniques: Support Vector Machines (SVM), ensemble methods (random forests, gradient boosting), hyperparameter tuning. Unsupervised Learning: Clustering (K-means, hierarchical), dimensionality reduction (PCA, t-SNE). Neural Networks and Deep Learning: Basics of neural networks, deep learning with TensorFlow/Keras. Natural Language Processing (NLP): Text preprocessing, sentiment analysis, word embeddings (Word2Vec, GloVe). Computer Vision: Image processing with OpenCV, Convolutional Neural Networks (CNNs). AI in Practice: Deploying models, Flask for deployment, AI applications, ethical considerations. Capstone Project involves project planning and proposal, selecting a problem statement, data collection and preparation, implementation of learned techniques, and model building and evaluation. Project Presentation and Course Wrap-Up includes project demonstrations, peer review, feedback, a course recap, Q&A, discussion on future directions in AI.

Target Group:

This course is designed for a diverse range of participants, including working professionals who are interested in enhancing their skills and knowledge in AI and Machine Learning.

Faculty:

Prof. Sashikumaar Ganesan

Dept. Computational and Data Sciences,
Indian Institute of Science
Bengaluru-560012
Email: sashi@iisc.ac.in

Reference Books:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Media, Inc. 2022

2. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th edition. 2022"

Who can apply?

BE/BTech/ME/MTech or MCA

Pre-requisites: Basic programming knowledge

Course Fee: Rs. 20,000/- + 18% GST

Online Seats are Limited to 150

Online Classes using Microsoft Teams/Zoom

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

04. Online Course on Hands-on Machine Learning (2:1)

Objectives:
This course aims to teach students the fundamentals of Machine Learning using Python programming. Participants will gain proficiency by implementing and understanding various ML algorithms through hands-on coding exercises and projects with real-world datasets.

Syllabus:
Introduction to Machine Learning, Types of learning algorithms, ML workflow, data manipulation with Pandas, exploratory data analysis, feature engineering, train/validation/test datasets, overfitting, underfitting, bias, variance, evaluation metrics. Supervised Learning: Linear regression, logistic regression, Naïve Bayes, K-Nearest Neighbors, Decision Trees, ensemble learning. Unsupervised Learning: Clustering, K-Means, dimensionality reduction. Case studies and end-to-end ML applications.

Target Group:
Bachelor's in engineering/technology and Master in Engineering/Technology students, faculty members, industry professionals, and AI enthusiasts with engineering academic background who want to learn ML fundamentals.

Faculty:
Dr. Pandarasamy Arjunan
Room #3, 3rd floor,
RBCCPS,
IISc
Email: samy@iisc.ac.in

Reference Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition" by Aurélien Géron, published by O'Reilly Media in 2022.
2. Grokking Machine Learning" by Luis Serrano, published by Manning Publications in 2019.
3. An Introduction to Statistical Learning" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani Published by Springer in 2013.

Who can apply?
B.E/B.Tech (any discipline), or Master' degree in Engineering/Science/Computer application/Computer science or equivalent

Pre-requisites:
High-school mathematics and familiarity with Python programming.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule:
Tuesday and Thursday (6.00PM to 7.30PM)

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.

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 /ISRO labs scientists and faculty from Engineering colleges, Private Aerospace Companies

Faculty:
Prof. O N Ramesh
Room 221
Department of Aerospace Engg,
IISc,
Email: onr@iisc.ac.in

Reference Books:

1. Warren F Philips Mechanics of Flight McGraw Hill

2. R F Stengel, Flight Mechanics, Princeton

3. 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 40

Schedule:
Tuesday and Thursday (6.00PM to 7.30PM)

06. Online Course on Graph Theory and related Algorithms (3:0)

Objectives:
"This course will enable students:
· To design efficient Graph Algorithms.
· To understand advanced graph theoretic concepts and laying fundamentals for research
· To understand approximation algorithms and design approximation algorithms for NP hard graph problems.
 The course will help   students who want to prepare for GATE exam and to prepare for interviews for higher studies."

Syllabus:
"Introduction, Graph Theory Basics: Definition and basic concepts, Efficient representations of Graphs; Graph Searching: DFS and BFS; Application of Graph Searching: finding connected components, bi-connected components, testing for bipartite graphs, finding cycle in graph; Trees: Definitions and basic concepts. Paths and Distance in Graphs: Single source shortest path problem, All pairs shortest path problem, center and median of a graph, activity digraph and critical path; Hamiltonian Graphs: sufficient conditions for Hamiltonian graphs, traveling Salesman problem; Eulerian Graphs: characterization of Eulerian graphs, construction of Eulerian tour Planar Graphs: properties of planar graphs, a planarity testing algorithms; Graph Coloring: vertex coloring, edge coloring, planar graph coloring; Matching: maximum matching in bipartite graphs, maximum matching in general graphs; Networks: The Max-flow min-cut theorem, max-flow algorithm; NP-Complete Graph problems; Approximation algorithms for some NP-Hard graph problems; Algorithms for some NP-Hard graph problems on special graph classes;".

Target Group:
 Anyone who is interested in studying graph theory and have some mathematically oriented mind to learn discrete mathematics

Faculty:
Prof. Sunil Chandran Leela
 Department Computer Science and Automation,
Indian Institute of Science,
Bangalore- 560012.
email: sunil@iisc.ac.in

Reference Books:
1. Graph Theory, Reinhard Diestel, Graduate Texts in Mathematics (GTM, volume 173), 2017
2. D.B. West, Introduction to Graph Theory, 2nd Edition, PHI 2022
3. M. C Golumbic, Algorithmic Graph Theory and Perfect Graphs, Volume 57 in the series
4. Annals of Discrete Mathematics. North Holland, second edition, 2004.
5. Cormen, Leiserson, Rivest, and Stein, Introduction to Algorithms, PHI, 4th Edition, 2022."

Who can apply?
BE/B. Tech or graduation in other Engineering disciplines.

Pre-requisites:
Basic understanding of discrete mathematics and algorithms and General mathematical maturity

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)

07. Online Course on Transgenic Technology: Principles and Applications (3:0)

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: Dr. N. Ravi Sundaresan

Associate Professor
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.
4. 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. 15,000/- + 18% GST

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Tuesday and Thursday (8.00PM to 9.30PM)

08. 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 rowing 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 help 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	**Who Can Apply?**
1. Harris, C.W" Shock and vibration handbook" McGraw Hill, New York, 2012. 2. Ewins, D.J." Modal analysis: Theory and Practice", Research Studies Press Ltd, England, 2014 3. Gillespie, T.D., "Fundamentals of Vehicle Dynamics", Society of Automotive Engr's., Inc, 2010. 4. Beranek, L.L," Noise and Vibration Control", Wiley, 2008	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

09. 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. Macromechanics 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. Robert M Jones, Mechanics of Composite Materails – Second Edition; Taylor and Francis 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 / AMAeSI (Engg.) (Mechanical, Aero, Civil, Automobile, Marine, Ocean) OR equivalent.

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

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

11. Online Course on Prescriptive Analytics (3:0)

Objectives:

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

Syllabus:

"Introduction to Prescriptive 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/etc. optimization package.

Target Group:

"Every Business, Industry and Government (BIG) organization has "Business Analytics" group to address various problems associated with Prescriptive Analytics. In addition, all Faculty and interested UG and PG Graduates in Engineering and Postgraduate in Business Administration/Management, Operations Research, Computer Science, Computer Applications, Mathematics, Statistics, Economics.

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;
mathiiisc@gmail.com

Reference Books:

1. "Waynel L Winston. Operations Research: Applications and Algorithms. Thomson, Belmont, CA. [Latest Edition].

2. Abben Asllani. Business Analytics with Management Science Models and Methods. Person Education. 2015.

3. U Dinesh Kumar. Business Analytics: The Science of Data-Driven Decision Making. Wiley India, 2017

4. William P Fox. Mathematical Modeling for Business Analytics. CRC Press. Taylor & Francis Group, LLC. 2018 "

Who Can apply?

ME / MTech, BE / BTech, MSc/MS (in Business Analytics, Operations Research, Computer Science, Mathematics, Statistics), MCA, MA (in Economics), MBA

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule:

Saturday (1.00 PM to 4.00 PM)

12. Online Course on 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. Site specific 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 is 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 modeling human diseases, including cardiovascular disease, diabetes, obesity, cancer, atherosclerosis, neurodegenerative diseases, muscle degeneration, and aging

Target Group:

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

Reference Books:	**Who can apply?**
1. 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 Manipulationand Genomics, 7th Edn, Blackwell Publishing. 3. J. J. Greene and V. B. Rao. Recombinant DNA Principles and Methodologies. CRC Press	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 **Schedule:** Saturday (10.00AM to 12.00PM)

13. Online course on Fundamentals of Electromagnetic Compliance for Electrical System Design (3:1)

Objectives:

Electromagnetic Compliance is essential for any system design/ semiconductor device to function as intended. Thus, it is necessary to protect system/ semiconductor devices, such as processors, integrated circuits, information processing equipment etc., against Electromagnetic Interference. Learn about principles of Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) for electrical/electronic devices, including best practices and a building-block approach with application-specific examples. The students will learn how electromagnetic disturbances are generated in electrical/electronic devices, how they couple to other systems, and how devices can be protected.

Syllabus:

1. Introduction to semiconductor devices/ printed circuit board,
2. Signal Integrity Power Integrity (SIPI), Power Distribution Network (PDN),
3. Basics of E field and H field, Basics of EMI/EMC,
4. Basics of PCB layout design,
5. System design analysis: shielding and grounding
6. components of EMC design,
7. System-level EMC design

Target Group: System engineers, Project engineers, system integrators, DRDO, ISRO, corporate employees, and fresh graduates interested in electrical and electro-mechanical system design.

Faculty: **Dr Yoginder Kumar Negi** Supercomputer Education and Research Centre (SERC) Indian Institute of Science (IISc) Bangalore Karnataka-560012, INDIA email: yoginder@iisc.ac.in	Faculty **Rajiv Panigrahi,** EMC engineer, Network & Edge computing Intel, Bangalore India rajiv.panigrahi@intel.com Mobile No 08861138437

Reference Books:

1. Electromagnetic Compatibility Engineering by Henry W. Ott.
2. Introduction to Electromagnetic Compatibility by Clayton R. Paul (2006)
3. Bogatin's Practical guide to transmission line design and characterization for signal integrity application By ERIC BOGATIN, 2020.
4. EMC and the printed circuit board By Mark I. Montrose

Who can apply?

Minimum qualification Graduation with knowledge of electrical and electronics system design. CAD design engineer

Pre-requisites required.

Familiar with the basics of transmission line, basics of mixed signal design, power distribution network, signal integrity & power integrity

Course Fee: Rs. 20,000/- + 18% GST

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule:
Saturday (10.00AM to 1.00PM for 3 credits course)

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		**28 June 2024**	Friday
Receipts of application along with fees (up to)	From	**28 June 2024**	Friday
	To	**30 July 2024**	Tuesday
Classes Commence	To	**05 August 2024**	Monday
Final Exams	From	**09 December 2024**	Monday
	To	**14 December 2024**	Saturday

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Coordinator,
Indian Institute of Science,
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Phone: + 91 080 22932508

E-mail: prof.cce@iisc.ac.in

URL: www.cce.iisc.ac.in/proficience

Working Hours:

Monday through Friday: 09.30 hrs. to 19.00 hrs.
Saturdays': 10.00 hrs. to 16.00 hrs.