

CCE -PROFICIEENCE
INDIAN INSTITUTE OF SCIENCE, BENGALURU
560012



INFORMATION HANDBOOK
August -December 2022

12. 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, Chemical, Electrical, Electronics etc). 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.

Macro mechanics 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,

Bending Analysis of Beams,

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

Buckling analysis of plates,

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.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule: Wednesday's 8.00 PM to 10.00 PM

13. Online Course on Vibration and Noise: Theory & 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. The Artificial Intelligence and Machine learning (AIML) methods for structural condition health monitoring in industries has become most important.

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:

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 Engineers. Inc, 2010.
4. Beranek, L.L,”**Noise and Vibration Control**”, Wiley, 2008

Who Can apply?

B.E / 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’s 6.00PM to 8.00PM

14. Online Course BIM Thinking and Digitalization Strategy for Construction Projects and Organizations (2:0)

Objectives:

Building Information Modelling (BIM) and digitalization are expected to play a critical role in shaping the future of the construction sector. This course will discuss BIM and digitalization-related strategies and concepts. This course is NOT a hands-on training course on how to make BIM models in given commercial software.

Syllabus:

Keywords: Building Information Modelling concepts, BIM Thinking and related thinking paradigms, BIM ecosystem, Construction Management, Digitalization in Construction, Digital Twins, Digitalization strategy, Facilities Management, Research trends and related advancements in BIM and digitalization in construction

Target Group:

People working in the construction and built environment sector. This includes architects, engineers, managers, designers, consultants, researchers, etc



Faculty:

Prof. Vishal Singh

Centre for Product Design and Manufacturing
Indian Institute of Science, Bangalore- 560012
Email: singhv@iisc.ac.in

Reference Books:

1. Rafael Sacks, Chuck Eastman, Ghang Lee, Paul Teicholz (3rd Edition) BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, ISBN: 978-1-119-28753-7
2. Other content and reading material will be shared during the course.

Who can apply?

BArch, BE, BTech

Pre-requisites:

Basic mathematics and programming background

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule: Thursday's 8.00PM to 10.00PM

15. Online Course on Embedded Systems and IoT (2:0)

Objectives:

This advanced course is on the design and development of Embedded Systems using mainly ARM Processors for IoT applications.

Syllabus:

Familiarization of Open-Source Embedded Systems, ARM Architecture, Understanding the Evaluation kits like ESP32, TIVA etc., Introduction to Sensors and their interfaces to ADC/DAC etc. Introduction to communication modules like WiFi, GPS, GSM, Demonstration of IoT based projects. Note: Few offline classes may be arranged during the course.

Target Group:

Hardware Electronic Engineers.



Faculty:
Mr. M Krishna Kumar (Retd.),
PRS., Dept. of ESE
(CEDT), IISc.,
Bengaluru
Email. mkkumarcedt@gmail.com



Faculty:
Mr. S M Narasimhan
Electronic Design
Consultant,
Mysuru



Faculty:
Dr. Arulalan Rajan,
Formerly Assistant
Prof.,
Dept. of E& C Engg.,
NITK., Surathkal.
Email:
perarulalan@gmail.com

Reference Books:

1. **Jonathan W. Valvano Embedded Systems:** Real-time Interfacing to ARM Cortex-M Microcontrollers. Volume 2 Fourth Edition, July 2014.
2. **Joseph Yiu System-on-Chip Design with Arm Cortex-M Processors**
3. **Steve Furber Arm System-On-Chip Architecture.**

Who can apply?

BE/B.Tech/ AMIE or equivalent.

Pre- Requisites:

Basic Knowledge in Analog, Digital Electronics and Microcontrollers.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule: Friday's 6.00PM to 8.00PM

16. Calculus and Optimization for Machine Learning (3:0) (Offline)

Objectives:

A solid background in calculus, linear algebra, probability, and optimization is essential for understanding foundational concepts in machine learning (ML). While probability and linear algebra is useful for building and interpreting models, it ultimately comes down to calculus and optimization as far as solving these models is concerned. The goal of this course is to provide a self-contained introduction to core concepts in calculus and optimization, keeping ML applications in mind. While even beginners should be able to follow the content, the course is targeted at professionals who wish to hone their math skills and understanding of the fundamentals. We will start with foundational topics and gradually build up to various models and algorithms. Problem solving (assignments) and coding (mini projects) will be involved.

Syllabus:

Part I - Fundamentals of real analysis, multivariate calculus, and nonlinear optimization.

Part - II: Applications to machine learning: linear and normal equation, nonlinear regression, dimensionality reduction and PCA, K-means clustering, binary and multiclass classification, logistic regression, convex learning models, linear and kernel SVM, backpropagation and stochastic gradient descent for training neural nets, momentum methods and ADAM optimizer, etc.

Target Group:

Data Scientists, AI Engineers, Research Scholars, Teachers, and Professionals.



Faculty:

Prof. Kunal Narayan Chaudhury

Associate Professor,
Department of Electrical Engineering
IISc, Bengaluru.

Email: kunal@iisc.ac.in

Reference Books

1. **Linear Algebra and Optimization for Machine Learning** by C. Aggarwal, Springer, 2020.
2. **Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares** by S. Boyd and L. Vandenberghe, Cambridge University Press, 2018.
3. **Mathematics for Machine Learning** by M.P. Deisenroth, A.A. Faisal and C.S. Ong, Cambridge University Press, 2020.

Who Can apply? B.Tech., MSc or MCA

Pre-requisites required:

Some knowledge of linear algebra and calculus; prior exposure to machine learning can help but is not essential

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

GST

Offline Seats are Limited to 40

Schedule: Saturday's 10.00 AM to 1.00 PM

17. Online Course on Robotics with AR/VR (3:0)

Objectives:

Controlling Robotic Agents using AR/VR Technology Introducing AR/MR/VR Technology Case Studies on Human Robot Interaction Discussing Industrial, Social and Assistive Robotics with Immersive Technology

Syllabus:

Augmented and Virtual Reality, Coordinate Space Conversion, AR/VR Content Development using Unity, Human-Robot Interaction, Collaborative Robotics, Social Robotics, Basics of Robotic Navigation, Obstacle Avoidance, Case Studies from Assistive Technology, Defense and Manufacturing Sectors,

Target Group:

Industry Professionals, Masters Students, Early Career Lecturers



Faculty:

Prof. Pradipta Biswas

Assistant Professor,

Dept. of CPDM, IISc.

E-mail: pradipta@iisc.ac.in

Reference Books:

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016 Dieter
2. Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson
3. Education India, 2016 Ashitava Ghosal, Robotics: Fundamental Concepts and Analysis,
4. Oxford University Press Pradipta Biswas, Online Lecture Notes at <https://cambum.net>
5. PB/lecture-notes.php

Who can apply?

BE, B.Tech., MCA

Pre-requisites required,

Knowledge of Programming and Mathematics

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule: Saturday's 10.00AM to 1.00PM

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

Objectives:

Advanced research in material science to enhance the 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, NASTRAN, 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 ub-systems for technically superior and commercially viable value-added products. The Artificial Intelligence and Machine learning (AIML) methods for structural design optimization have become most important to realize the best product”

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 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. 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, design criteria for Van pump, 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

1. Beer F P and Johnson, E.R,
“**Vector Mechanics for Engineers- Statics and Dynamics**”, Tata-Mac Graw Hill, Sixth Edison, 2012.
2. Shigley, J.E and Mischke, C.R.,
“**Mechanical Engineering Design**”
Tata-Mac Graw Hill, sixth Edison, 2010.
3. 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’s 12.00PM to 2.00PM

19. Online Course Artificial Intelligence - Theory and Applications (3:0)

Objectives:

An insight into Artificial Intelligence, AI programming languages and applications of AI. It would benefit those who are doing research at postgraduate and doctoral level in AI or machine learning as well as those in industry and those working in academic institutions.

Syllabus:

Introduction, Problem Solving: Representation and Search, heuristics, game playing; Knowledge and reasoning : logic, reasoning using logic , reasoning with uncertain information; Planning and decision making ; Learning : Classification, clustering, reinforcement learning ; Deep Learning – CNN, RNN, GAN; Natural Language processing ;Distributed AI; multiple agents; Artificial intelligence programming and applications

Target Group:

Lectures and researchers in colleges, scientists in R & D organizations



Faculty:

Dr. V Susheela Devi

Department of Computer Science and Automation,
IISc
email: susheela@iisc.ac.in

Reference Books:

1. S. Russel and P. Norvig, Artificial Intelligence – A Modern Approach, Pearson, India, 2015.
2. M N Murty and V Susheela Devi, Introduction to Pattern Recognition and Machine Learning IISc Lecture Series Notes, WorldScientific, IISc Press, 2015.
3. Nils J. Nilsson, Artificial Intelligence– A New Synthesis, Morgan Kaufmann Publishers, 2000

Who can apply?

BE or MCA or MSc (Computers)

Pre-requisites:

Basic mathematics and programming background

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule: Saturday's 10.00AM to 1.00PM

20. Online Course on Principles and Advances in Genetic Engineering (3:0)

Objectives:

Genetic Engineering is the direct manipulation of an organism's genes using biotechnological tools. Genetic engineering has been applied in numerous fields, including basic and clinical 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. We will also focus on the creation of genetically modified organisms from bacteria to monkey, suitable 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-directed 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, and 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 and 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:

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



Faculty:

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



Faculty:

Prof. Subba Rao Gangi Setty
Associate Professor,
Microbiology and Cell Biology
Indian Institute of Science
Bangalore – 560012
Email: subba@iisc.ac.in

Reference Books:

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 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?

BSc (research), MSc, B.Tech, B.Pharm., 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

Schedule: Saturday's 10.00AM to 1.00PM

21. Online Course on Introduction to Deep Learning in Python (3:0)

Objectives:

To introduce both the foundational and practical aspects of Machine Learning with a focus on Deep Learning. The course will be self-contained. It is meant to cater to the needs of both practitioners and academicians.

Syllabus:

Basics of Machine Learning. Introduction to Programming in Python and Scikit-Learn. Neural Networks; Perceptions, Multi-layer Neural Networks, Support Vector Machines, and Logistic Regression; Backpropagation; Autoencoders and Representation; Convolutional Neural Networks; Recurrent Neural Networks; Long Short-Term Memory; Attention Mechanism; Generative Adversarial Networks. Solving problems using Pytorch/Tensorflow.

Target Group:

People working in the industry, academics, and R&D organizations.



Faculty:

Prof. M Narasimha Murty

Honorary Professor,
Dept. of CSA.,
IISc, Bengaluru.
Email: mnm@iisc.ac.in

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Deep Learning, MIT Press, 2016.
2. Mitesh Khapra, NPTEL Course, 2018.
3. Deep Learning with Python, F. CHOLLET, Manning Publications, 2018.

Who can apply?

BE/BTech in any branch of Engineering or MSc in Mathematics/Physics/Statistics/Computer Science or MCA.

Pre-requisites:

A good background of college level mathematics and programming.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams

Schedule: Saturday's – 10.00 am. to 1.00 pm

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 securingclass 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

Apply online on CCE portal		16th June 2022	Thursday
Receipts of online application along with fees (upto)	From	16th June 2022	Thursday
	To	25th July 2022 29th July 2022	Monday Friday
Classes Commence	From	01st August 2022	Monday
Final Exams	From	28th November 2022	Monday
	To	03rd December 2022	Saturday

CCE-PROFICIENCE Coordinator,

Indian Institute of Science,
Bangalore - 560 012

Phone: + 91 080 22932508

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

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

Working Hours:

Monday through Friday: 09.30 hrs. to 19.00 hrs.

Saturdays': 10.00 hrs. to 16.00 hrs.