CCE-PROFICIENCE
INDIAN INSTITUTE OF SCIENCE, BENGALURU 560012

INFORMATION HAND BOOK
August - December 2020

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REGULAR COURSES

Sl. No.	Name of the Course	Credit
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1	Innovative Product Development and Design Methods (Mon) (6 pm – 8 m)	2+0
2	Online Course on Innovative Product Development and Design Methods (Mon) (6 pm – 8 m)	2+0
3	Online Course on Introduction to Data Structures and Algorithms (Mon) (6 pm – 8 pm)	2+0
4	Online Course on Principles and Advances in Genetic Engineering (Mon-Wed) (6 pm – 7.30)	3+0
5	Online Course on Product Prototyping in IoT (Tue) (6 pm – 8 pm)	2+0
6	Optical Communications and Networks (Tue-Thur) (6 pm – 7.30 pm)	3+0
7	Online Course on Optical Communications and Networks (Tue-Thur) (6 pm – 7.30 pm)	3+0
8	Internal Combustion Engines (Tue-Thur) (6 pm – 7.30 pm)	3+0
9	Online Course on Internal Combustion Engines (Tue-Thur) (6 pm – 7.30 pm)	3+0
10	Online Course on Vibration and Noise: Theory and Practice (Wed) (6 pm – 8 pm)	2+0
11	AI for UI/UX Design(Wed) (6 pm – 8 pm)	2+0
12	AI for UI/UX Design(Wed) (6 pm – 8 pm)	
13	Basics of Data Analytics (Sat) (10 am – 12 noon)	2+0
14	Online Course on Basics of Data Analytics (Sat) (10 am – 12 noon)	2+0
15	Online Course on Computational Thinking in India: Insights from the Indic Tradition (Sat) (10 am -12 noon)	2+0
16	Vacuum Thin Film Technology (Sat) (10 am -12 noon)	2+0
17	Online Course on Vacuum Thin Film Technology (Sat) (10 am -12 noon)	2+0
18	Reinforcement Learning (Sat) (10 am – 1 pm)	3+0

19	Online Course on Reinforcement Learning (Sat) (10 am – 1pm)	3+0
19	Online Course on Engineering Optimization (Sat) (10 am – 1 pm)	3+0
21	Online Course on Data Mining (Sat) (10 am – 1 pm)	3+0
22	Protect Your IP (PIP) (Sat) (10 am – 1 pm)	3+0
23	Online Course on Protect Your IP (PIP) (Sat) (10 am – 1 pm)	3+0
24	Online Course on Structural Analysis and Design Optimization: Theory and Practice (Sat) (12 noon - 2.00 pm)	2+0
25	Machine Learning (Sat) (1 pm – 4 pm)	3+0
26	Online Course on Machine Learning (Sat) (1 pm – 4 pm)	3+0
27	Introduction to Robotics (Sat) (1 pm – 4 pm)	3+0
28	Online Course on Introduction to Robotics (Sat) (1 pm – 4 pm)	3+0
29	Business Analytics with Management Science Models and Methods (Sat) (1 pm – 4 pm)	3+0
30	Deep Reinforcement Learning (Sat) (2 pm – 4 pm)	2+0
31	Online Course on Deep Reinforcement Learning (Sat) (2 pm – 4 pm)	2+0
32	Online Course on Mathematical Foundations for Machine Learning (Sat) (2 pm – 4 pm)	2+0
33	Basics of Machine Learning (Sat) (2 pm – 4 pm)	2+0
34	Online Course on Basics of Machine Learning (Sat) (2 pm – 4 pm)	2+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 a 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 CIR CUMSTANCES.

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 work station 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 can avail 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 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.ernet.in and also download CCE App from Google Playstore. 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 online portal of CCE. Please read all the instructions provided at our portal before applying. Payment of course fee is through 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: Week days 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

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 minimum 3-4 weeks.

CLASSES

Classes will be held in the Lecture Hall Complex of IISc. 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 Saturday's

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 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 for August - December 2020

Sl. No.	Name of the Course	Credit	Faculty	Department
1	Innovative Product Development and Design Methods (Mon) (6 pm – 8 pm)	2+0	Dr. J E Diwakar (Retd.) & Prof. P. Achutha Rao (Retd.)	CPDM & NID R&D Campus
2	Online Course on Innovative Product Development and Design Methods (Mon) (6 pm – 8 pm)	2+0	Dr. J E Diwakar (Retd.) & Prof. P. Achutha Rao (Retd.)	CPDM & NID R&D Campus
3	Online Course on Introduction to Data Structures and Algorithms (Mon) (6 pm – 8 pm)	2+0	Prof. Y N Srikant	CSA
4	Online Course on Principles and Advances in Genetic Engineering (Mon-Wed) (6 pm – 7.30)	3+0	Prof. N Ravi Sundaresan	MCB
5	Online Course on Product Prototyping in IoT (Tue) (6 pm – 8 pm)	2+0	Mr. Ganesh Hassan Shankar & Dr. Pavan Kumar Tallapragada	Founder & MD Flux Gen Engg. Tech Pvt. Ltd. B'luru., EE
6	Optical Communications and Networks (Tue-Thur) (6 pm – 7.30 pm)	3+0	Prof. Srinivas Talabattula	ECE
7	Online Course on Optical Communications and Networks Tue-Thur) (6 pm – 7.30 pm)	3+0	Prof. Srinivas Talabattula	ECE
8	Internal Combustion Engines (Tue-Thur) (6 pm – 7.30 pm)	3+0	Dr R Thirumaleswara Naik	ME
9	Online Course on Internal Combustion Engines (Tue-Thur) (6 pm – 7.30 pm)	3+0	Dr R Thirumaleswara Naik	ME
10	Online Course on Vibration and Noise: Theory and Practice (Wed) (6 pm – 8 pm)	2+0	Dr. S B Kandagal	AE
11	AI for UI/UX Design(Wed) (6 pm – 8 pm)	2+0	Dr. Pradipta Biswas	CPDM
12	Online Course on AI for UI/UX Design(Wed) (6 pm – 8 pm)	2+0	Dr. Pradipta Biswas	CPDM
13	Basics of Data Analytics (Sat) (10 am – 12 noon)	2+0	Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati & Prof. M Sekhar	Fiserv India Ltd., Altair Engineering, & Civil Engg.
14	Online Course on Basics of Data Analytics (Sat) (10 am – 12 noon)	2+0	Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati & Prof. M Sekhar	Fiserv India Ltd., Altair Engineering, & Civil Engg.
15	Online Course on Computational Thinking in India: Insights from the Indic Tradition (Sat) (10 am -12 noon)	2+0	Prof. Gopinath Kanchi & Dr. Shalija D Sharma	CSA
16	Vacuum Thin Film Technology (Sat) (10 am -12 noon)	2+0	Dr. G Mohan Rao	IAP
17	Online Course on Vacuum Thin Film Technology (Sat) (10 am -12 noon)	2+0	Dr. G Mohan Rao	IAP
18	Reinforcement Learning (Sat) (10 am – 1 pm)	3+0	Prof. Shalabh Bhatnagar	CSA
19	Online Course on Reinforcement Learning (Sat) (10 am – 1pm)	3+0	Prof. Shalabh Bhatnagar	CSA
20	Online Course on Engineering Optimization (Sat) (10 am – 1 pm)	3+0	Prof. Kunal Narayan Chaudhury	EE
21	Online Course on Data Mining (Sat) (10 am – 1 pm)	3+0	Dr. V Susheela Devi	CSA
22	Protect Your IP (PIP) (Sat) (10 am – 1 pm)	3+0	Dr. R N Narahari	CeNSE
23	Online Course on Protect Your IP (PIP) (Sat) (10 am – 1 pm)	3+0	Dr. R N Narahari	CeNSE
24	Online Course on Structural Analysis and Design Optimization: Theory and Practice (Sat)(12 noon - 2.00 pm)	2+0	Dr. S B Kandagal	AE
25	Machine Learning (Sat) (1 pm – 4 pm)	3+0	Prof. M Narasimha Murty	CSA

26	Online course on Machine Learning (Sat) (1 pm – 4 pm)	3+0	Prof. M Narasimha Murty	CSA
27	Introduction to Robotics (Sat) (1 pm – 4 pm)	3+0	Dr. Abhra Roy Chowdhury	CPDM
28	Online Course on Introduction to Robotics (Sat) (1 pm – 4 pm)	3+0	Dr. Abhra Roy Chowdhury	CPDM
29	Business Analytics with Management Science Models and Methods (Sat) (1 pm – 4 pm)	3+0	Dr. M Mathirajan	MS
30	Deep Reinforcement Learning (Sat) (2 pm – 4 pm)	2+0	Prof. Shalabh Bhatnagar	CSA
31	Online Course on Deep Reinforcement Learning (Sat) (2 pm – 4 pm)	2+L	Prof. Shalabh Bhatnagar	CSA
32	Mathematical Foundations for Machine Learning (Sat) (2 pm – 4 pm)	2+0	Mr. M Krishna Kumar, (Retd), & Dr. Arulalan	DESE & NIT, Surathkal.
33	Basics of Machine Learning (Sat) (2 pm – 4 pm)	2+0	Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati & Prof. M Sekhar	Fiserv India Ltd., Altair Engineering, & Civil Engg.
34	Online Course on Basics of Machine Learning (Sat) (2 pm – 4 pm)	2+0	Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati & Prof. M Sekhar	Fiserv India Ltd., Altair Engineering, & Civil Engg.

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 = Lecture Hours per week

$C Stands for Computer Laboratory

$L Stands for Online Course

1. Innovative Product Development and Design Methods (2+0)

Objectives:

The globalization and digital connectivity have forced many organizations to look at the way new products are to be developed for customer acceptance in the changed competitive "global village". Proven methods of the past which made many companies succeed in the "Sellers' Market" are no longer valid. The organizations have to develop new approaches for design and innovation to meet the challenges of technology explosion and to increase the speed of development.

There is an urgent need to adopt integrated innovative product development strategies to meet the ever-changing customer expectations. This Course, through theory classes, aims to look at these issues and create an awareness of innovative product development process and various design methods to achieve success.

Syllabus:

- o Creativity and Innovation
- o Integrated Product Development
- o Product Design
- o Industrial Design
- o Quality Function Deployment
- o Value Engineering
- o Design to Cost
- o Design for Assembly and Manufacture
- o Design for Service
- o Failure Modes and Effects Analysis
- o TRIZ (Systematic Innovation) - Overview
- o Concept Generation Methods
- o Concept Selection Methods

Target Group:

Practicing Engineers, Managers involved in New Product Development, Design and Development in Industries, R & D Organizations etc., Academic Personnel in teaching/practicing Product design, Product engineering, Design and Development and fresh engineers interested in Design and Innovation.

Faculty:

Dr. J E Diwakar (Retd.)
CPDM.,
IISc., Bengaluru.
Email: jed@iisc.ac.in

Faculty:

Prof. P Achutha Rao
Retired from NID R & D Campus,
Bengaluru.
E-Mail: raopanambur@gmail.com

Reference Books:

1. Merle Crawford, Anthony Di Benedetto
   New Products Management, Tata McGraw Hill
   Education Private Limited, 2011.
2. Robert G Cooper;
   Winning at New Products, Basic Books, 2011.
3. Jonathan M. Cagan, Craig M. Vogel
   Creating Breakthrough Products: Innovation from Product Planning to Program Approval;
   FT Press, 2010.
4. Karl Ulrich and Steven Eppinger,
   Product Design and Development, McGraw- H ill/ Irwin; 5 Editions, May 2011.

Who Can apply?

Graduation in Engineering, Design (B.Des) &

Post-Graduation in Management

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

Off Line Seats are limited to 20

Schedule: Monday's   6.00 pm. to 8.00 pm.

✱ Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

2.   Online Course on Innovative Product Development and Design Methods (2+0)

Objectives:

The globalization and digital connectivity have forced many organizations to look at the way new products are to be developed for customer acceptance in the changed competitive "global village". Proven methods of the past which made many companies succeed in the "Sellers' Market" are no longer valid. The organizations have to develop new approaches for design and innovation to meet the challenges of technology explosion and to increase the speed of development.

There is an urgent need to adopt integrated innovative product development strategies to meet the ever-changing customer expectations. This Course, through theory classes, aims to look at these issues and create an awareness of innovative product development process and various design methods to achieve success.

Syllabus:

- Creativity and Innovation
- Integrated Product Development
- Product Design
- Industrial Design
- Quality Function Deployment
- Value Engineering
- Design to Cost
- Design for Assembly and Manufacture
- Design for Service
- Failure Modes and Effects Analysis
- TRIZ (Systematic Innovation) - Overview
- Concept Generation Methods
- Concept Selection Methods

Target Group:

Practicing Engineers, Managers involved in New Product Development, Design and Development in Industries, R & D Organizations etc., Academic Personnel in teaching/practicing Product Design, Product Engineering, Design and Development and fresh engineers interested in Design and Innovation.

Faculty:

Dr. J E Diwakar (Retd.)
CPDM.,
IISc., Bengaluru.
Email: jed@iisc.ac.in

Faculty:

Prof. P Achutha Rao
Retired from NID R & D Campus,
Bengaluru.
E-Mail: raopanambur@gmail.com

Reference Books:

1. Merle Crawford, Anthony Di Benedetto
   New Products Management, Tata McGraw Hill Education Private Limited, 2011.
2. Robert G Cooper;
   Winning at New Products, Basic Books, 2011.
3. Jonathan M. Cagan, Craig M. Vogel
   Creating Breakthrough Products: Innovation from Product Planning to Program Approval;
   FT Press, 2010.
4.   Karl Ulrich and Steven Eppinger,
   Product Design and Development, McGraw- H ill/ Irwin; 5 Editions, May 2011.

Who Can apply?

Graduation in Engineering, Design (B.Des) &

Post-Graduation in Management

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Monday's   6.00 pm. to 8.00 pm.

3. Online Course on Introduction to Data Structures and Algorithms (2+0)

Objectives:

Students with a good background in programming would be taught the more involved data structures, algorithms and their analysis. Such a course would be useful to both professionals and students. Emphasis will be on time complexity and correctness of algorithms.

Syllabus:

Complexity of algorithms. Algorithm analysis.
Abstract data types and data structures.
Lists: Stacks, Queues, implementation, garbage collection.
Dictionaries: Hash tables, Binary search trees, AVL trees, Red-Black trees, Splay trees, Skip-lists, B-Trees.
Priority queues.
Graphs: Shortest path algorithms, minimal spanning tree algorithms, depth-first and breadth-first search.
Sorting: Advanced sorting methods and their analysis, lower bound on complexity, order statistics.
Algorithm Design Paradigms.
Extra topics (time permitting): String matching, bipartite graphs and graph matching, network flows, a few parallel algorithms, etc.

Target Group:

Persons involved in developing non-trivial software in industries and students.

Faculty:

Prof. Y.N. Srikant,
Dept. of CSA,,
IISc., Bengaluru.
Email: srikant@iisc.ac.in

Reference Books:

1. A.V. Aho, J.E. Hopcroft, and J.D. Ullman, **Data Structures and Algorithms, Addison Wesley**, Reading Massachusetts, USA, 1983.

2. T.H. Cormen, C.E. Leiserson, and R.L. Rivest, **Introduction to Algorithms, The MIT Press, Cambridge,** Massachusetts, USA, 1990.

3. M.A. Weiss, **Data Structures and Algorithms Analysis in C++, Benjamin/Cummins,** Redwood City, California, USA, 1994.

Who Can apply?

Completed BTech/M.Sc (any branch).
Persons who already have completed a computer science degree may not benefit much from the course.

Pre-requisites:

Good programming background and mathematical maturity.

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Monday's - 6.00 pm. to 8.00 pm.

4. Online Course on Principles and Advances in Genetic Engineering (3+0)

Objectives:

Genetic Engineering is 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 the field of biotechnology. I will also focus on 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 nonradioactive labelling of nucleic acids and proteins, and its detection. Nucleic acids hybridization methods. Gene and cDNA cloning methods. Construction of genomic DNA and cDNA libraries. Detection and characterization methods for genes and chromosomes. Nucleic acids 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, 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 the modeling of human diseases, including cardiovascular disease, 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 M C B.,
IISc, Bengaluru.
Email: rsundaresan@iisc.ac.in

Reference Books:

1. Sambrook and D.W. Russell, ed.
   Molecular Cloning, A Laboratory Manual,
   Cold Spring Harbor Laboratory Press.

2. S. B. Primrose and R. M. Twyman.
   Principles of Gene Manipulation and Genomics,
   7thEdn, Blackwell Publishing.

3. J. J. Greene and V. B. Rao.
   Recombinant DNA Principles and Methodologies.
   CRC Press.

Who Can apply?

Graduation in Engineering, Design (B.Des) &

Post-Graduation Management

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: **Monday's - Wednesday's -** 6.00 pm. to 7.30 pm.

5. Online Course on Product Prototyping in IoT (2+0)

Objectives:

Prototyping is one of the most essential skills in this generation. Let it be fixing your table or building your own system at home to make a toy for your child. It doesn't matter if you are an innovator, an engineering student, an entrepreneur or someone with an idea that could help solve the problems of humankind. An Idea alone cannot take you anywhere, but quickly building it and showing out to the world that your idea really works and has the potential to scale is what matters. This course will give you a head start into the world of Product Prototype development in Internet of Things (IoT).

The course is a blend of engineering and business of IoT. It deals with connectivity, building systems to enable delivery of software services networked to the cloud platforms. At the end of the course the students will be in a position to launch an IoT product prototype and a business in IoT.

Syllabus:

The course familiarizes the students to handle INTELLIGENT CYBER-PHYSICAL SYSTEMS. Course unfolds as: IoT–Introduction- Distinction from IoT sphere – Sensors and Actuators - Embedded Systems - Wireless Technology – Mobile application platform - Cloud access and control – Packaging – UI/UX of IoT products - Business models with IoT products – Design Thinking – Analytics, Machine Learning and AI for IoT systems – Security in IoT systems - Case studies of IoT applications – Launching an IoT product/service – MVP-Entrepreneurship in IoT.

Target Group:

Working professionals in Embedded, Automation, R&D, Resource Management, Professionals, Engineering College faculty, Smart Cities and Villages developers, Mobile app developers, Business Development Managers, Technical Sales Engineers, Policy makers, Entrepreneurs and Aspiring Entrepreneurs

Faculty:

Mr. Ganesh Hassan Shankar
Founder & Managing Director of FluxGen Engg.Tech. Pvt. Ltd. Bengaluru.
E-mail: sganesh@alum.iisc.ac.in

Faculty:

Dr. Pavan Kumar Tallapragada
Dept. of EE.,
IISc., Bengaluru.
Email: vijaymishra@iisc.ac.in

Reference Books:

1. Dirk Slama, Frank Puhimann, Jim Morrish & Rishi M Bhatnagar,
   Enterprise IoT.

2. Rafiq Nanroni,
   Rapid Prototyping Principles and Applications

3. Daniel Obodovski, Daniel Kellmereit,
   The Silent Intelligence – The Internet of Things

Who can apply?

B.E / B.Tech. MCA, & MSc.
(Physics, Electronics, Computer Science)

Pre-requisites:

Basic Knowledge in Electronics and C Programming

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Tuesday's 6.00 pm - 8.00 pm

6. Optical Communications and Networks (3+0)

Objectives:

The main objective of the course is to introduce the learner to basics of optical communications and networks, with more depth, including recent developments. This will help faculty who wish to teach the course, those who want to do Ph D and senior students who wish to take up higher studies. R and D Scientists and engineers from industry may also benefit by refreshing their basics and learning recent developments.

Syllabus:

1. **Optical Communications**

   ➢ Introduction,
   ➢ Light propagation in optical Networks,
   ➢ Optical sources and transmitters,
   ➢ Optical detectors and receivers,
   ➢ Optical system design

2. **Optical Networks**

   ➢ Optical network architectures
   ➢ Design of optical networks and routing and switching
   ➢ WDM networks
   ➢ Network management
   ➢ Survivability and fault tolerance

3. **Advanced Topics**
   ➢ Terabit optical communications and networks
   ➢ Photonic Integrated Circuits
   ➢ Optical sensors and biosensors
   ➢ Micro-opto-electro mechanical systems
   ➢ Quantum Communications and Computing

4. **Review and Revision**

Target Group:

College Faculty, Senior B.Tech Students, Industry R&D Scientists.

Faculty:

Prof. Srinivas Talabattula
Dept. of ECE, IISc.
E-mail: tsrinu@iisc.ac.in

Reference Books:

1. Keiser G.,
   Optical Fiber Communication
   Tata McGrawHill.

2. Rajiv Ramaswamy, Kumar N Sivarajan
   Optical Networks, Morgan Kaufmann.

3. IEEE Journal Papers.
   .

Who can apply?

BE, B.Tech., (ECE, EE), MSc. (Physics)

Pre-requisites:

Advise Participants to brush up Engg. Mathematics

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

Off Line Seats are limited to 20

Schedule: Tuesday - Thursday 6.00 pm to 7.30 pm

*Note: If situation on pandemic continues same way, class room course may be converted to online course   depending on situation.

7. Online Course on Optical Communications and Networks (3+0)

Objectives:

The main objective of the course is to introduce the learner to basics of optical communications and networks, with more depth, including recent developments. This will help faculty who wish to teach the course, those who want to do Ph D and senior students who wish to take up higher studies. R and D Scientists and engineers from industry may also benefit by refreshing their basics and learning recent developments.

Syllabus:

1. **Optical Communications**

   - Introduction,
   - Light propagation in optical Networks,
   - Optical sources and transmitters,
   - Optical detectors and receivers,
   - Optical system design

2. **Optical Networks**

   - Optical network architectures
   - Design of optical networks and routing and switching
   - WDM networks
   - Network management
   - Survivability and fault tolerance

3. **Advanced Topics**

   - Terabit optical communications and networks
   - Photonic Integrated Circuits
   - Optical sensors and biosensors
   - Micro-opto-electro mechanical systems
   - Quantum Communications and Computing

4. **Review and Revision**

Target Group:

College Faculty, Senior B.Tech Students, Industry R&D Scientists.

Faculty:

Prof. Srinivas Talabattula
Dept. of ECE, IISc.
E-mail: tsrinu@iisc.ac.in

Reference Books:

1. Keiser G.,
   Optical Fiber Communication
   Tata McGrawHill.

2. Rajiv Ramaswamy, Kumar N Sivarajan
   Optical Networks, Morgan Kaufmann.

3. IEEE Journal Papers.
   .

Who can apply?

BE, B.Tech., (ECE, EE), MSc. (Physics)

Pre-requisites:

Advise Participants to brush up Engg. Mathematics

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Tuesday - Thursday 6.00 pm to 7.30 pm

8. Internal Combustion Engines (3+0)

Objectives:

The objective of this course is to cover the fundamental aspects of Internal Combustion Engines and share the developments with interested scientists, engineers, students and academicians by enhancing their knowledge for the aim of keeping the clean environment from the engine exhaust emissions as per the pollution norms for the benefit of entire world.

Syllabus:

Over view on IC engines, engine classifications, basic engine components, thermodynamic cycles, performance tests in engines, pollution formation and measurements in SI and CI engines, duel fuel engines, Bharat and Euro norms, combustion process in petro-diesel engines, combustion chambers, phenomenon of knock, ignition, spray process, multi-point fuel electronic injection system, flame prorogation, engine emissions control, alternate fuel and properties, hydrogen engines, supercharging, turbo charging and some aspects of the engine electronics and advanced Engines.

Target Group:

Scientists, Engineers, Faculty and Students from various Engineering Colleges, Research Development Organizations, Industries, Research Institutes, Post Graduates, Undergraduates.

Faculty:

Dr. R Thirumaleswara Naik

B.E, M.E, PhD (IIT- Delhi)
Dept. of ME.,
IISc. Bengaluru.
Email: rtnaik@iisc.ac.in
Tel:+91-80-2293- 2960

Reference Books

1. Heywood. J B,
   Internal Engine Fundamentals Combustion,, MIT-USA
   McGraw-Hill, 1998, India

2. Ganeson. V,
   Internal Combustion Engines
   Tata McGraw Hill, 1999, India

3. **Review Papers from SAE/ASME Journals etc.**

Who can apply?

Those with B.E/B.Tech.MS/MSc (Engg.)./ME/M.Tech / AMIE or equivalent in the Mechanical Engineering/Automobile Engineering/Any Interested people.

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

Off Line Seats are limited to 20

Schedule: Tuesday - Thursday 6.00 pm to 7.30 pm

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* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

9. Online Course on Internal Combustion Engines (3+0)

Objectives:

The objective of this course is to cover the fundamental aspects of Internal Combustion Engines and share the developments with interested scientists, engineers, students and academicians by enhancing their knowledge for the aim of keeping the clean environment from the engine exhaust emissions as per the pollution norms for the benefit of entire world.

Syllabus:

Over view on IC engines, engine classifications, basic engine components, thermodynamic cycles, performance tests in engines, pollution formation and measurements in SI and CI engines, duel fuel engines, Bharat and Euro norms, combustion process in petro-diesel engines, combustion chambers, phenomenon of knock, ignition, spray process, multi-point fuel electronic injection system, flame prorogation, engine emissions control, alternate fuel and properties, hydrogen engines, supercharging, turbo charging and some aspects of the engine electronics and advanced Engines.

Target Group:

Scientists, Engineers, Faculty and Students from various Engineering Colleges, Research Development Organizations, Industries, Research Institutes, Post Graduates, Undergraduates.

Faculty:

Dr. R Thirumaleswara Naik
B.E, M.E, PhD (IIT- Delhi)
Dept. of ME.,
IISc. Bengaluru.
Email: rtnaik@iisc.ac.in
Tel:+91-80-2293- 2960

Reference Books

4. Heywood. J B,
   Internal Engine Fundamentals Combustion,, MIT-USA
   McGraw-Hill, 1998, India

5. Ganeson. V,
   Internal Combustion Engines
   Tata McGraw Hill, 1999, India

6. **Review Papers from SAE/ASME Journals etc.**

Who can apply?

Those with B.E/B.Tech.MS/MSc (Engg.)./ME/M.Tech / AMIE or equivalent in the Mechanical Engineering/Automobile Engineering/Any Interested people.

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

Seats are Limit to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Tuesday's – Thursday's - 6.00 pm to.7.30 pm

10. Online Course on Vibration & 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 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 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:

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Wednesday's - 6.00 pm. to 8.00 pm.

11. AI for UI/UX Design (2+0)

Objectives:

- Introducing importance and applications of Intelligent User Interface (IUI)
- Discussing basics of Artificial Intelligence and its application in user interface design
- Developing intelligent user interface using multiple input and output modalities
- Augmented, Virtual and Mixed Reality Systems
- Evaluating user interfaces through user trials and Statistical Hypothesis Testing
- Undertaking representative IUI project

Syllabus:

- Using AI to develop intelligent interface and interaction
- Idea of user modelling and interface personalization
- Exposure to state-of-the-art eye gaze, hand, head and finger movement and EEG trackers
- Developing new input modalities tracking eye gaze, hand, finger, head movement of users
- Developing AR/VR systems
- Case Studies on CNN models for developing autonomous vehicle
- Human Robot interaction, Cobot development
- Hands on training on Expert System and Machine Learning toolbox
- Conducting usability evaluation and reporting results

Target Group:

Industry, R&D Units.

Faculty:

Dr. Pradipta Biswas
Asst. Professor, Dept. of CPDM, IISc.
E-mail: pradipta@iisc.ac.in

Reference Books:

1. Russell, S. J., Norvig, P., & Davis, E. (2010)
   Artificial intelligence: a modern approach. 3rd ed.
   Upper Saddle River, NJ: Prentice Hall.

2. Shneiderman B.
   "Designing The User Interface - Strategies for
   Effective Human-Computer Interaction."
   Pearson Education

3. Norman K (Ed),
   Wiley Handbook of Human Computer Interaction,
   Wiley 2017

4. Field A
   "Discovering Statistics Using SPSS."
   SAGE Publications Ltd., 2009.

Who can apply?

BE, B.Tech., MCA

Pre-requisites:

Basic Knowledge of Computer Programming &
Mathematics

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

Seats are Limited to 20

Schedule: Wednesday's 6 pm to 8 pm

٭ Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

12. Online Course on AI for UI/UX Design (2+0)

Objectives:

- Introducing importance and applications of Intelligent User Interface (IUI)
- Discussing basics of Artificial Intelligence and its application in user interface design
- Developing intelligent user interface using multiple input and output modalities
- Augmented, Virtual and Mixed Reality Systems
- Evaluating user interfaces through user trials and Statistical Hypothesis Testing
- Undertaking representative IUI project

Syllabus:

- Using AI to develop intelligent interface and interaction
- Idea of user modelling and interface personalization
- Exposure to state-of-the-art eye gaze, hand, head and finger movement and EEG trackers
- Developing new input modalities tracking eye gaze, hand, finger, head movement of users
- Developing AR/VR systems
- Case Studies on CNN models for developing autonomous vehicle
- Human Robot interaction, Cobot development
- Hands on training on Expert System and Machine Learning toolbox
- Conducting usability evaluation and reporting results

Target Group:

Industry, R&D Units.

Faculty:

Dr. Pradipta Biswas
Asst. Professor, Dept. of CPDM, IISc.
E-mail: pradipta@iisc.ac.in

Reference Books:

1. Russell, S. J., Norvig, P., & Davis, E. (2010)
   Artificial intelligence: a modern approach. 3rd ed.
   Upper Saddle River, NJ: Prentice Hall.
2. Shneiderman B.
   "Designing The User Interface - Strategies for
   Effective Human-Computer Interaction."
   Pearson Education
3. Norman K (Ed),
   Wiley Handbook of Human Computer Interaction,
   Wiley 2017
4. Field A
   "Discovering Statistics Using SPSS."
   SAGE Publications Ltd., 2009.

Who can apply?

BE, B.Tech., MCA

Pre-requisites:

Basic Knowledge of Computer Programming &
Mathematics

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Wednesday's 6 pm to 8 pm

13. Basics of Data Analytics (2+0)

Objective

To introduce Data Analytics to a person new to the field and make him/her ready for advanced courses.

Syllabus:

Introduction to Data Science, Review of Probability theory – Axioms of probability, mutually exclusive events, Conditional Probability and Bayes' theorem, Independence, Concept of Random Variables, discrete and continuous random variables, distribution and density functions, some standard discrete and continuous distributions, moments, statistics, mean and variance, unbiased estimates.

Bivariate data, Scatter plot, Trend, converting non-linear trend into a linear one, Co-variance and correlation coefficient, least square minimization of errors, residues and their properties, ANOVA, Hypothesis testing for the model and for parameters, confidence intervals.

Multivariate data, partial correlation coefficient, concept of dimensionality reduction, parameter estimation by minimizing the squared errors.

Smoothing techniques - moving averages and exponential smoothing.

Overview of time Series Analysis, Machine Learning, Internet of Things, Neural Networks, Data Visualization and associated topics..

Software development project using Python consisting of all the topics learnt.

Target Group:

Any Industry that deals with data analysis and management and academicians interested in data science.

	Faculty **Dr. Gopal Krishna Sharma** Fiserv India Ltd., Bengaluru. Email : gopalaks@yahoo.com		**Faculty** **Dr. Badarinath Ambati** Altair Engineering, Bengaluru. Email : abadarinath@yahoo.com		**Faculty** **Prof. Muddu Sekhar** Dept. of Civil Engineering, IISc., Bengaluru. Email : madhu@iisc.ac.in

Reference Books:

1. Spyros Makridakis et. al.
   Forecasting Methods and Applications
   Wiley, 2005.

2. Bovas Abraham and Johannas Lodolter
   Statistical Methods for forecasting
   Wiley, 1983.

3. Kishor S. Trivedi
   Probability and Statistics with Reliability,
   Queuing and Computer Science Applications.
   Wiley, 2002

Who Can apply?

Any Engineering Degree with Mathematics Background

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

Off Line Seats are limited to 20

Schedule: **Saturday's**- 10.00 am. to 12.00 noon

* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

14. Online Course on Basics of Data Analytics (2+0)

Objective

To introduce Data Analytics to a person new to the field and make him/her ready for advanced courses.

Syllabus:

Introduction to Data Science, Review of Probability theory – Axioms of probability, mutually exclusive events, Conditional Probability and Bayes' theorem, Independence, Concept of Random Variables, discrete and continuous random variables, distribution and density functions, some standard discrete and continuous distributions, moments, statistics, mean and variance, unbiased estimates.

Bivariate data, Scatter plot, Trend, converting non-linear trend into a linear one, Co-variance and correlation coefficient, least square minimization of errors, residues and their properties, ANOVA, Hypothesis testing for the model and for parameters, confidence intervals.

Multivariate data, partial correlation coefficient, concept of dimensionality reduction, parameter estimation by minimizing the squared errors.

Smoothing techniques - moving averages and exponential smoothing.

Overview of time Series Analysis, Machine Learning, Internet of Things, Neural Networks, Data Visualization and associated topics..

Software development project using Python consisting of all the topics learnt.

Target Group:

Any Industry that deals with data analysis and management and academicians interested in data science.

	Faculty **Dr. Gopal Krishna Sharma** Fiserv India Ltd., Bengaluru. Email : gopalaks@yahoo.com		**Faculty** **Dr. Badarinath Ambati** Altair Engineering, Bengaluru. Email : abadarinath@yahoo.com		**Faculty** **Prof. Muddu Sekhar** Dept. of Civil Engineering, IISc., Bengaluru. Email : madhu@iisc.ac.in

Reference Books:

1. Spyros Makridakis et. al.
   Forecasting Methods and Applications
   Wiley, 2005.
2. Bovas Abraham and Johannas Lodolter
   Statistical Methods for forecasting
   Wiley, 1983.
3. Kishor S. Trivedi
   Probability and Statistics with Reliability, Queuing and Computer Science Applications.
   Wiley, 2002

Who Can apply?

Any Engineering Degree with Mathematics Background

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

Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's- 10.00 am. to 12.00 noon

15. Online Course on Computational Thinking in India: Insights from the Indic Tradition (2+0)

Objectives:

To introduce the computational perspectives/ thinking in the Indic tradition (such as Drkganitaikya) in diverse areas, and the current relevance of such insights pedagogic and philosophical.

Syllabus:

1. Overview of Indic computational thinking with interesting examples
2. Computational Positivism and the Indic Tradition
3. Significant Indic algorithms along with original sources
4. In depth study of one calculation across the ages and their interconnected ideas in the context of computation as a metaphor

Target Group:

Anyone who is interested in understanding Indian perspectives on enquiry in science and computation such as a) students doing master's level work in engineering or science b) engineers in industry (esp, IT field) c) philosophers and other curious citizens

Faculty:

Prof. Gopinath Kanchi
Professor,
Dept. of CSA.,
IISc., Bengaluru.
Email: gopi@iisc.ac.in

Faculty:

Dr. Shailaja D Sharma
Adj Prof. (NIAS),
Bengaluru.
Email: shailajadsharma@gmail.com

Reference Books

1. K. Gopinath, Shailaja D Sharma (eds.)
   "**Computation as a Meme in Indic Thinking".**
   IISc. Press, 2020

2. P. P. Divakaran,
   **"The Mathematics of India: Concepts,
   Methods, Connections,"** Hindustan Book
   Agency 2018

3. C.K. Raju,
   "**Cultural Foundations of Mathematics,"**
   Pearson Longman, 2007.

Who Can apply?

(Basic bachelor's degree in Maths or Science.)

Pre- Requisites:

Good knowledge of atleast one Indic language (eg. Kannada, Telugu, Malayālam, Sanskrit)

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's - 10.00 am. to 12.00 noon.

16. Vacuum Thin Film Technology (2+0)

Objectives:

To Train Practicing Scientists And Engineers In The Area With Relevant Background And Latest Developments. The Course Will Be Practical Oriented And Touches Real Time Issues Faced By The Practitioner.

Syllabus:

Basic concepts of vacuum technology - Gas flow dynamics – Conductance effects – Pumps for production of different degrees of vacuum – Vacuum measurement techniques – System design concepts and fabrication – Leak detection – Applications – Thin film concepts – PVD and CVD processes including evaporation, sputtering in different configurations – Thickness measurement and monitoring – Some case studies on the development of thin film devices

Target Group:

Hind High vacuum Co (P) Ltd, Bangalore, Applied Materials inc , Lam Research, Global Foundry, BEL, BHEL, ISRO, Any industry using vacuum Techniques for Processing.

Faculty:

Dr. G. Mohan Rao
Dept.of Instrumentation and Applied Physics
IISc., Bengaluru.
Email: gmrao@iisc.ac.in,
          gmrao2001@yahoo.com

Reference Books:

1. Ward and Bunn,
   Introduction to vacuum science and technology,
   Butterworth publications.

2. A.Guthrie
   High vacuum Technology,
   John Wiley and Sons

3. Milton Ohring,
   The materials science of Thin films,
   Academic publishers

Who Can apply?

Any graduate in science or engineering

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

Off Line Seats are limited to 20

Schedule: Saturday's - 10.00 am. to 12.00 Noon.

* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

17. Online Course on Vacuum Thin Film Technology (2+0)

Objectives:

To Train Practicing Scientists And Engineers In The Area With Relevant Background And Latest Developments. The Course Will Be Practical Oriented And Touches Real Time Issues Faced By The Practitioner.

Syllabus:

Basic concepts of vacuum technology - Gas flow dynamics – Conductance effects – Pumps for production of different degrees of vacuum – Vacuum measurement techniques – System design concepts and fabrication – Leak detection – Applications – Thin film concepts – PVD and CVD processes including evaporation, sputtering in different configurations – Thickness measurement and monitoring – Some case studies on the development of thin film devices

Target Group:

Hind High vacuum Co (P) Ltd, Bangalore, Applied Materials inc , Lam Research, Global Foundry, BEL, BHEL, ISRO, Any industry using vacuum Techniques for Processing.

Faculty:

Dr. G. Mohan Rao
Dept.of Instrumentation and Applied Physics
IISc., Bengaluru.
Email: gmrao@iisc.ac.in,
         gmrao2001@yahoo.com

Reference Books:

1. Ward and Bunn,
   Introduction to vacuum science and technology, Butterworth publications.

2. A.Guthrie
   High vacuum Technology, John Wiley and Sons

3. Milton Ohring,
   The materials science of Thin films, Academic publishers

Who Can apply?

Any graduate in science or engineering

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's - 10.00 am. to 12.00 Noon.

18. Reinforcement Learning (3+0)

Objectives:

Teach Students about this emerging field of Reinforcement Learning because of its wide applicability.

Syllabus:

Introduction to Reinforcement learning, Multi-armed bandits, Finite Markov decision processes, Dynamic Programming, Monte-Carlo Methods, Temporal difference algorithms, SARSA, Q-learning, Double Q-learning, n-step bootstrapping methods, on-policy and off-policy algorithms, algorithms using function approximation

Target Group:

All People interested in Artificial Intelligence in Industry as well as Academia should find the course useful.

Faculty:

Prof. Shalabh Bhatnagar
Chairman, Dept. of CSA, IISc.
E-mail: shalabh@iisc.ac.in

Reference Books

1. R. S. Sutton and A. G. Barto
   Reinforcement learning: An Introduction,
   MIT Press, 2018

Who can apply?

BE, B.Tech., MCA

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

Off Line Seats are limited to 20

Schedule: Saturday's 10 am to 1 pm

* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

19. Online Course on Reinforcement Learning (3+0)

Objectives:

Teach Students about this emerging field of Reinforcement Learning because of its wide applicability.

Syllabus:

Introduction to Reinforcement learning, Multi-armed bandits, Finite Markov decision processes, Dynamic Programming, Monte-Carlo Methods, Temporal difference algorithms, SARSA, Q-learning, Double Q-learning, n-step bootstrapping methods, on-policy and off-policy algorithms, algorithms using function approximation

Target Group:

All People interested in Artificial Intelligence in Industry as well as Academia should find the course useful.

Faculty:

Prof. Shalabh Bhatnagar
Chairman, Dept. of CSA, IISc.
E-mail: shalabh@iisc.ac.in

Reference Books

1. R. S. Sutton and A. G. Barto
   Reinforcement learning: An Introduction,
   MIT Press, 2018

Who can apply?

BE, B.Tech., MCA

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's 10 am to 1 pm

20. Online Course on Engineering Optimization (3+0)

Objectives:

The focus of the course is on the theory of continuous optimization (models and algorithms) and its applications in engineering. We will start with foundational topics and toy examples and then gradually move on to modern applications in machine learning and data sciences. To better appreciate the topics, the participants will be handed out assignments involving problem solving and coding.

Syllabus:

Optimization models; unconstrained and constrained programming; linear programming and simplex method, nonlinear programming (mostly convex programming); first and second-order optimality conditions; convex duality and applications; applications in computer vision, machine learning, and data sciences.

Target Group:

Research Scholars, Teachers, Engineers, Scientists and Professionals.

Faculty:

Prof. Kunal Narayan Chaudhury
Associate Professor,
Dept. of Electrical Engineering
IISc., Bengaluru.
Email: kunal@iisc.ac.in

Reference Books:

1. S Rao,
   Engineering Optimization: Theory and Practice,
   John Wiley & Sons, 2019

2. S. Boyd and L. Vandenberghe.
   Convex Optimization.
   Cambridge University Press, 2004

3. **Lecture notes provided by the instructor**.

Who Can apply?

BE/B.Tech.

Pre-requisites:

The candidate should have done a basic course in Calculus and Linear Algebra. Some exposure to numerical optimization would help.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

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

21. Online Course on Data Mining (3+0)

Objectives:

To introduce the fundamental techniques and algorithms of data mining and explore the applications of data mining to web mining, bioinformatics, banking and financial sector.

Syllabus:

Introduction to Data Mining; Data preprocessing, data visualization and explanatory data analysis, data mining techniques like data condensation, feature selection, Principle component analysis; Pattern classification techniques like nearest neighbor classification, decision trees, rule based systems, neural networks, support vector machines. Association rule mining, Apriority algorithm, FP tree, FP growth algorithm. Data clustering; Issues related to large data sets, Class imbalance problem, anomaly detection; Applications to web mining, bioinformatics, data mining in banking and finance, business intelligence, applications like fraud detection, stock market prediction, risk management.

Target Group:

Academic Institutions, Industries, Govt. R&D Organizations, IT professionals.

Faculty:

Dr. V Susheela Devi
Dept. of CSA, IISc.
E-mail: susheela@iisc.ac.in

Reference Books

1. V Susheela Devi & M Narasimha Murty**,**
   Pattern Recognition: An Introduction,
   Univ. Press, 2011.

2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar
   Introduction to Data Mining,
   Addison- Wesley, 2006**.**

3. M Narasimha Murty and V. Susheela Devi,
   Introduction to Pattern Recognition and Machine Learning, World Scientific and IISc Press, 2015 **.**

Who can apply?

BE, MCA, MSc.(CS)

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's 10 am to 1 pm

22. Protect your IP (PIP) (3+0)

Objectives:

The aim of this Course is to introduce aspirants to the broad subject of Intellectual Property Rights (IPR) in brief including Indian IP laws. To train participants - Scouting for IP in research work; patents genesis to current day trend, drafting provisional/final specs. Forms of IP. Strategic decision on PCT filing, creation of business proposal and commercialization of IP/start up.
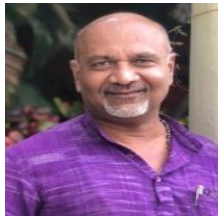
'Start-up' is the buzz word being sprouting now and has a great potential to grow into a big woods in near future. The world at large appears to be tilted towards micro adventures called "Start-ups". The course envisages imparting various skill-sets – English communication, breading IP culture, creation of IP and related aspects, seeking funds, management skills to handle stress to sustain business, sharing live experience from founders of start-ups.

Syllabus:

The Course aims to expose the students to the basic principles and practices in the broad field of "IPR": Communication in general; IP and IP protection; formalities of registration, compliances, seeking funding and so on. It also aims to equip them with the knowledge; skills and attitude they need to overcome problems in the creation & sustaining of Start-up. It is planned to invite founders of Start-ups to relate their own experiences.

Target Group:

All entrepreneurs, as well as students, engineers, and scientists, who aspire to kindle the entrepreneur in her /him

Faculty:

Dr. R.N. Narahari
CeNSE
IISc., Bengaluru.
Email: naraharirn@iisc.ac.in,
          narahari.rn@gmail.com

Reference Books:

1. *John Mullins*
   "The New Business Road Test: What Entrepreneurs and *Investors should do before Launching* a *Lean Start-up*"; *Person India Education Services PL, Noida, 2019.*

2. Taraporevala, V J
   "**Law of Intellectual Property",** Published by Taraporevala. V J, Mumbai, 2005.

3. William Strunk Jr & EB White,.
   "***The Elements of Style*",** Longman Publishers, MA 02494, USA.

Who Can apply?

B.E./ B.Tech./ Masters in Science/Commerce.

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

Off Line Seats are limited to 20

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

٭ Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

23. Online Course on Protect your IP (PIP) (3+0)

Objectives:

The aim of this Course is to introduce aspirants to the broad subject of   of Intellectual Property Rights (IPR) in brief including Indian IP laws. To train participants - Scouting for IP in research work; patents genesis to current day trend, drafting provisional/final specs. Forms of IP. Strategic decision on PCT filing, creation of business proposal and commercialization of IP/start up.
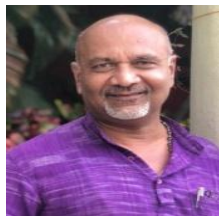
'Start-up' is the buzz word being sprouting now and has a great potential to grow into a big woods in near future. The world at large appears to be tilted towards micro adventures called "Start-ups". The course envisages imparting various skill-sets – English communication, breading IP culture, creation of IP and related aspects, seeking funds, management skills to handle stress to sustain business, sharing live experience from founders of start-ups.

Syllabus:

The Course aims to expose the students to the basic principles and practices in the broad field of "IPR": Communication in general; IP and IP protection; formalities of registration, compliances, seeking funding and so on. It also aims to equip them with the knowledge; skills and attitude they need to overcome problems in the creation & sustaining of Start-up. It is planned to invite founders of Start-ups to relate their own experiences.

Target Group:

All entrepreneurs, as well as students, engineers, and scientists, who aspire to kindle the entrepreneur in her /him

Faculty:

Dr. R.N. Narahari
CeNSE
IISc., Bengaluru.
Email: naraharirn@iisc.ac.in,
        narahari.rn@gmail.com

Reference Books:

1. *John Mullins*
   "The New Business Road Test: What Entrepreneurs and *Investors should do before Launching* a *Lean Start-up"*; *Person India Education Services PL, Noida, 2019.*

2. Taraporevala, V J
   "**Law of Intellectual Property",** Published by Taraporevala. V J, Mumbai, 2005.

3. William Strunk Jr & EB White,.
   "***The Elements of Style",*** Longman Publishers, MA 02494, USA.

Who Can apply?

B.E./ B.Tech./ Masters in Science/Commerce.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

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

24. 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, 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 product 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 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/Google Meet

Schedule: Saturday's 12.00 noon. to 2.00 pm.

25. Machine Learning (3+0)

Objectives:

To introduce the registrants to the basics of various foundational and practical aspects of Machine Learning so that practitioners also can benefit from the course.

Syllabus:

Introduction to Machine Learning (ML). Representation and Search. Learning Paradigms: Rote Learning, Learning by Deduction, Learning by Analogy, Learning by Abduction, Learning by Induction.

Foundations of ML: Role of Linear Algebra in ML; Information Theory in ML, Logic in ML, Probability in ML; and Graphs in ML.

Inductive Learning: Clustering, Supervised and Semi-Supervised Learning, Knowledge-Based Learning.

Deep Learning: Convolution Neural Nets, Recurrent Neural Nets.

Applications: Information Retrieval and Network Embedding in Social and Information Networks.
.

Target Group:

Industry/R&D Units/ Academic Institutions

Faculty:

Prof. M Narasimha Murty
Dept. of CSA, IISc.
E-mail: mnm@iisc.ac.in

Reference Books:

1. Tom Mitchell,
   Machine Learning, Indian Edition, July 2017.

2. M N Murty and V Susheela Devi,
   Introduction to Pattern Recognition and Machine Learning, IISc Lecture

3. S. J. Russell and P. Norvig,
   Artificial Intelligence: A Modern Approach, Pearson, Delhi, 2016.

Who can apply?

BE/BTech in CS, IT, EC, Telecom, Instrumentation

Pre-requisites:

Good Background in Programming, Discrete Mathematics, Probability and Linear Algebra.

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

Off Line Seats are limited to 20

Schedule: Saturday's 1 pm to 4 pm

* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

26. Online Course on Machine Learning (3+0)

Objectives:

To introduce the registrants to the basics of various foundational and practical aspects of Machine Learning so that practitioners also can benefit from the course.

Syllabus:

Introduction to Machine Learning (ML). Representation and Search. Learning Paradigms: Rote Learning, Learning by Deduction, Learning by Analogy, Learning by Abduction, Learning by Induction.

Foundations of ML: Role of Linear Algebra in ML; Information Theory in ML, Logic in ML, Probability in ML; and Graphs in ML.

Inductive Learning: Clustering, Supervised and Semi-Supervised Learning, Knowledge-Based Learning.

Deep Learning: Convolution Neural Nets, Recurrent Neural Nets.

Applications: Information Retrieval and Network Embedding in Social and Information Networks.
.

Target Group:

Industry/R&D Units/ Academic Institutions

Faculty:

Prof. M Narasimha Murty
Dept. of CSA, IISc.
E-mail: mnm@iisc.ac.in

Reference Books:

1. Tom Mitchell,
   Machine Learning, Indian Edition, July 2017.

2. M N Murty and V Susheela Devi,
   Introduction to Pattern Recognition and Machine Learning, IISc Lecture

3. S. J. Russell and P. Norvig,
   Artificial Intelligence: A Modern Approach, Pearson, Delhi, 2016.

Who can apply?

BE/BTech in CS, IT, EC, Telecom, Instrumentation

Pre-requisites:

Good Background in Programming, Discrete Mathematics, Probability and Linear Algebra.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's 1 pm to 4 pm

27. Introduction to Robotics (3+0)

Objectives:

Introduction to Robotics and Current Trends /Development. Discuss Fundamentals & Techniques in Design, (Techniques) and Analysis of Robots & their motion in 2D and 3D Space.

Syllabus:

1. Introduction to Robotics
2. Spatial Transformations
3. Forward & Inverse Kinematics
4. Jacobian & Singularities
5. Robotic Dynamics
6. Robot Programming System and Path Planning
7. Robot Control

Target Group:

Industry / R&D Units / Post Graduation.

Faculty:

Dr. Abhra Roy Chowdhury
Assistant Professor,
(Robotics and Automation)
CPDM., IISc., Bengaluru.
E-mail: abhra@iisc.ac.in

Reference Books:

1. Sciavicco, L and Sicilliano, B
   Modeling and Control of Robot Manipulators
   2nd Edition, (Springer Verlag, London, 2000.

2. Mark W. Spond and M Vidyasagar
   Robot Dynamics and Control,
   Wiley, Newyork, 2008.

3. Ashitava Ghosal
   Robotics: Fundamentals, Concepts & Analysis,
   Oxford (IISc.) 2006.

Who can apply?

B.E, B.Tech., ME, M.Tech., MCA, MSc.

Pre-requisites:

Basic Knowledge of Mathematics (Algebra, & Geometry), Physics & Computer Programming.

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

Off Line Seats are limited to 20

Schedule: Saturday's 1.00 pm - 4.00 pm

* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

28. Online Course on Introduction to Robotics (3+0)

Objectives:

Introduction to Robotics and Current Trends /Development. Discuss Fundamentals & Techniques in Design, (Techniques) and Analysis of Robots & their motion in 2D and 3D Space.

Syllabus:

1. Introduction to Robotics
2. Spatial Transformations
3. Forward & Inverse Kinematics
4. Jacobian & Singularities
5. Robotic Dynamics
6. Robot Programming System and Path Planning
7. Robot Control

Target Group:

Industry / R&D Units / Post Graduation.

Faculty:

Dr. Abhra Roy Chowdhury
Assistant Professor,
(Robotics and Automation)
CPDM., IISc., Bengaluru.
E-mail: abhra@iisc.ac.in

Reference Books:

1. Sciavicco, L and Sicilliano, B
   Modeling and Control of Robot Manipulators
   2nd Edition, (Springer Verlag, London, 2000.

2. Mark W. Spond and M Vidyasagar
   Robot Dynamics and Control,
   Wiley, Newyork, 2008.

3. Ashitava Ghosal
   Robotics: Fundamentals, Concepts & Analysis,
   Oxford (IISc.) 2006.

Who can apply?

B.E, B.Tech., ME, M.Tech., MCA, MSc.

Pre-requisites:

Basic Knowledge of Mathematics (Algebra, & Geometry), Physics & Computer Programming.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's 1.00 pm - 4.00 pm

29. 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 needed to understand prescriptive-analytics and implement 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:

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

Faculty:

Dr. M Mathirajan

Chief Research Scientist,
Dept. of M S.,
Faculty of Engineering,
IISc, Bengaluru.
Email: msdmathi@iisc.ac.in;
       drmuthu.mathirajan@gmail.com

Reference Books:

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

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

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

4. Stephen G Powell and Kenneth R Baker,
   Business Analytics: The Art of Modelling with Spreadsheets. John Wiley & Sons. 2017.

Who Can apply?

BE/B.Tech., ME/M.Tech. MBA, and Master in Operations Research, Computer Science, Computer Applications, Mathematics, Statistics, and Economics.

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

Off Line Seats are limited to 20

Schedule: Saturday's - 1.00 pm. to 4.00 pm.

٭ Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

30. Deep Reinforcement Learning (2+0)

Objectives:

Deep RL is a Combination of RL and Deep Learning. This area has become hot because of the wide range of Complex Decision Making tasks that area now solvable using Deep RL. Techniques.. The course will provide introduction to Deep RL, Models, and Technologies.

Syllabus:

Introduction to Reinforcement Learning, Basics of optimization search algorithms, Value based methods for Deep RL, Neural network based approximation architectures, Policy gradient methods, Deep Q Network, TD (lambda) and LSTD algorithms, Trust Region Policy Optimization, Proximal policy optimization, Q-PROP algorithm, Other recent advances.

Target Group:

Industry Professionals, College Teachers, Project Assistants Etc.

Faculty:

Prof. Shalabh Bhatnagar
Chairman, Dept. of CSA, IISc.
E-mail: shalabh@iisc.ac.in

Reference Books

1. *V. François-Lavet, P. Henderson, R. Islam, M. G. Bellemare & J. Pineau*
   ***An Introduction to Deep Reinforcement* Learning, Foundations and Trends® in Machine Learning,** Now Publishes, Boston, 2018.

2. R Sutton and A Barto
   Reinforcement Learning,
   MIT Press, 2018.
3. **Selected Research Papers.**

Who can apply?

BE, B.Tech., MSc., MCA

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

Off Line Seats are limited to 20

Schedule: Saturday's 2 pm to 4 pm

* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

31. Online Course on Deep Reinforcement Learning (2+0)

Objectives:

Deep RL is a Combination of RL and Deep Learning. This area has become hot because of the wide range of Complex Decision Making tasks that area now solvable using Deep RL. Techniques.. The course will provide introduction to Deep RL, Models, and Technologies.

Syllabus:

Introduction to Reinforcement Learning, Basics of optimization search algorithms, Value based methods for Deep RL, Neural network based approximation architectures, Policy gradient methods, Deep Q Network, TD (lambda) and LSTD algorithms, Trust Region Policy Optimization, Proximal policy optimization, Q-PROP algorithm, Other recent advances.

Target Group:

Industry Professionals, College Teachers, Project Assistants Etc.

Faculty:

Prof. Shalabh Bhatnagar
Chairman, Dept. of CSA, IISc.
E-mail: shalabh@iisc.ac.in

Reference Books

1. *V. François-Lavet, P. Henderson, R. Islam, M. G. Bellemare & J. Pineau*
   An Introduction to Deep Reinforcement **Learning, Foundations and Trends® in Machine Learning,** Now Publishes, Boston, 2018.

2. R Sutton and A Barto
   Reinforcement Learning,
   MIT Press, 2018.
3. **Selected Research Papers.**

Who can apply?

BE, B.Tech., MSc., MCA

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's 2 pm to 4 pm

32. Online Course on Mathematical Foundations for Machine Learning (2+0)

Objectives:

To provide Mathematical Foundations for Machine Learning Applications like Medical Imaging, Face Recognition, Object Recognition.

Syllabus:

Unit 1. Linear Algebra: Vector Spaces, Subspaces Basics
Unit 2. Eigenvalues, Eigenvectors, Projection, Orthogonolization, GS Algorithm
Unit 3. Matrices, Matrix Factorization, LU, QR, SVD Solving Systems Equations
Unit 4. Machine Learning as a Pattern Recognition Problem, Design of Classifiers, Training and Testing
Unit 5. Subspace Methods in Machine Learning for the Face and Object Recognition.

Target Group:

Samsung, Microsoft and Companies Working on Data Analytics & Machine Learning.

	Faculty: **Mr. M Krishna Kumar (Retd.), PRS.,** Dept. of ESE (CEDT), IISc.., Bengaluru Email. mkkumarcedt@gmail.com		**Faculty:** **Dr. Arulalan Rajan,** Formerly, Assistant Prof., Dept. of E& C Engg., NITK.., Surathkal.. Email: perarulalan@gmail.com		**Faculty:** **Dr. Ashok Rao,** Formerly Head, Networking Project, Dept. of ESE (CEDT), IISc.., Bengaluru Email: ashokrao.mys@gmail.com

Reference Books:

1. Gilbert Strang,
   "**Introduction to Linear Algebra",**
   Wellesley Cambridge Press, 5th Ed. 2016.

2. Gilbert Strang,
   "Linear Algebra and Learning from Data",
   Wellesley Cambridge Press, 2019.

3. Christopher M Bishop,
   "Pattern Recognition & Machine Learning",
   Springer, 2016.

Who can apply?

BE/B.Tech/ AMIE or equivalent.

Pre- Requisites:

MATLAB Programming will be useful.

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's – 2.00 pm to 4.00 pm

33. Basics of Machine Learning (2+0)

Objective

To introduce concepts of Machine Learning and prepare him/her for advanced courses.

Syllabus:

Review of Probability theory, Axioms of probability, mutually exclusive events, Conditional probability and Bayes' theorem, Independence, concept of Random Variables, discrete and continuous random variables, distribution and density functions, some standard discrete and continuous distributions, moments Statistics, mean and variance, unbiased estimates.

Review of Linear Algebra- Vectors and matrices, rank of a matrix, transpose of a matrix, determinant of a matrix, Matrix multiplication-inner and outer products; inverse of a matrix, Eigen values and Eigen vectors.

Definition of Machine learning, supervised and unsupervised machine learning, Classification and Regression, learning multiple classes, Dimensionality reduction - Principal component analysis. Clustering, Decision Trees, Linear Discriminant, introduction to Neural Networks, perceptron, Learning Boolean functions, multi-layer perceptron, training a neural network for pattern recognition, Back propagation, Naïve Bayes' classifier, Hidden Markov Model.

Software development project using Python consisting of all the topics learnt.

Target Group:

Any Industries that deals with data analysis and management and academicians interested in data science.

	Faculty		**Faculty**		**Faculty**
	Dr. Gopal Krishna Sharma Fiserv India Pvt. Ltd., Bengaluru. Email : gopalaks@yahoo.com		**Dr. Badarinath Ambati** Altair Engineering, Bengaluru. Email : abadarinath@yahoo.com		**Prof. Muddu Sekhar** Dept. of Civil Engineering, IISc., Bengaluru. Email : madhu@iisc.ac.in

Reference Books:

1. Ethem AIpaydin,
   Introduction to Machine Learning,
   MIT Press, 2010.

2. Laurene V Fausett
   Fundamentals of Neural Networks
   Pearson Education

3. Kishor Trivedi
   Probability and Statistics with Reliability, Queuing and Computer Science Applications.
   John Wiley Sons, 2002.

Who Can apply?

Any Engineering Degree with Mathematics Background

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

Off Line Seats are limited to 20

Schedule: Saturday's: 2.00 pm. to 4.00 pm

* Note: If situation on pandemic continues same way, class room course may be converted to online course depending on situation.

34. Online Course on Basics of Machine Learning (2+0)

Objective

To introduce concepts of Machine Learning and prepare him/her for advanced courses.

Syllabus:

Review of Probability theory, Axioms of probability, mutually exclusive events, Conditional probability and Bayes' theorem, Independence, concept of Random Variables, discrete and continuous random variables, distribution and density functions, some standard discrete and continuous distributions, moments Statistics, mean and variance, unbiased estimates.

Review of Linear Algebra- Vectors and matrices, rank of a matrix, transpose of a matrix, determinant of a matrix, Matrix multiplication-inner and outer products; inverse of a matrix, Eigen values and Eigen vectors.

Definition of Machine learning, supervised and unsupervised machine learning, Classification and Regression, learning multiple classes, Dimensionality reduction - Principal component analysis. Clustering, Decision Trees, Linear Discriminant, introduction to Neural Networks, perceptron, Learning Boolean functions, multi-layer perceptron, training a neural network for pattern recognition, Back propagation, Naïve Bayes' classifier, Hidden Markov Model.

Software development project using Python consisting of all the topics learnt.

Target Group:

Any Industries that deals with data analysis and management and academicians interested in data science.

	Faculty		**Faculty**		**Faculty**
	Dr. Gopal Krishna Sharma Fiserv India Pvt. Ltd., Bengaluru. Email : gopalaks@yahoo.com		**Dr. Badarinath Ambati** Altair Engineering, Bengaluru. Email : abadarinath@yahoo.com		**Prof. Muddu Sekhar** Dept. of Civil Engineering, IISc., Bengaluru. Email : madhu@iisc.ac.in

Reference Books:

1. Ethem AIpaydin,
   Introduction to Machine Learning,
   MIT Press, 2010.

2. Laurene V Fausett
   Fundamentals of Neural Networks
   Pearson Education

3. Kishor Trivedi
   Probability and Statistics with Reliability, Queuing and Computer Science Applications.
   John Wiley Sons, 2002.

Who Can apply?

Any Engineering Degree with Mathematics Background

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

Online Seats are Limited to 100

Online Classes using Microsoft Teams/Google Meet

Schedule: Saturday's: 2.00 pm. to 4.00 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 ……………………… 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

Download application forms from CCE Web Site		**18th June 2020**	Thursday
Receipts of application along with fees (upto)	From To	**18th June 2020** **26th July 2020**	Thursday Sunday
Classes Commence	To	**03rd August 2020**	Monday
Final Exams	From To	**30th November 2020** **05th December 2020**	Monday 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/proficience

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