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<th>Page No.</th>
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<td>Performa for Certificate</td>
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</tbody>
</table>

### REGULAR COURSES

<table>
<thead>
<tr>
<th></th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>Innovative Product Development and Design Methods (Mon)</td>
<td>2+0</td>
</tr>
<tr>
<td>2</td>
<td>Strategic Innovation Through TRIZ (Tue)</td>
<td>2+0</td>
</tr>
<tr>
<td>3</td>
<td>Commercialization of Intellectual Property (CIP) (Tue)</td>
<td>2+0</td>
</tr>
<tr>
<td>4</td>
<td>IoT and Data Science for CleanTech and AgriTech (Tue)</td>
<td>2+0</td>
</tr>
<tr>
<td>5</td>
<td>Project Management (Tue - Thur)</td>
<td>3+0</td>
</tr>
<tr>
<td>6</td>
<td>Business Analytics with Management Science Models and Methods (Tue-Thur)</td>
<td>3+0</td>
</tr>
<tr>
<td>7</td>
<td>Vibration and Noise: Theory and Practice (Wed)</td>
<td>2+0</td>
</tr>
<tr>
<td>8</td>
<td>Analysis and Design of Composite Structures (Thur)</td>
<td>2+0</td>
</tr>
<tr>
<td>9</td>
<td>Internet of Things and Nano Sensors (Thur)</td>
<td>2+0</td>
</tr>
<tr>
<td>10</td>
<td>Mathematics for Data Science (Thur)</td>
<td>2+0</td>
</tr>
<tr>
<td>11</td>
<td>Structural Analysis &amp; Design Optimization: Theory and Practice (Fri)</td>
<td>2+0</td>
</tr>
<tr>
<td>12</td>
<td>Consumer’s Protection Act 1986 (Fri)</td>
<td>2+0</td>
</tr>
<tr>
<td>13</td>
<td>Basics of Data Analytics (Sat)</td>
<td>2+0</td>
</tr>
<tr>
<td>14</td>
<td>Online Course on Basics of Data Analytics (Sat)</td>
<td>2+L</td>
</tr>
<tr>
<td>15</td>
<td>Nonlinear Finite Element Method (Sat) (10 am – 12 Noon)</td>
<td>2+0</td>
</tr>
<tr>
<td>16</td>
<td>DSP-Algorithms, Architecture and Applications (Sat)</td>
<td>2+0</td>
</tr>
<tr>
<td>17</td>
<td>Image Processing and Computer Vision (Sat)</td>
<td>3+0</td>
</tr>
<tr>
<td>18</td>
<td>Reinforcement Learning (Sat)</td>
<td>3+0</td>
</tr>
<tr>
<td>19</td>
<td>Online Course on Reinforcement Learning (Sat)</td>
<td>3+L</td>
</tr>
<tr>
<td>No.</td>
<td>Course Title</td>
<td>Credits</td>
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</tr>
<tr>
<td>20</td>
<td>Introduction to Industrial Design (Sat)</td>
<td>3+0</td>
</tr>
<tr>
<td>21</td>
<td>Deep Reinforcement Learning</td>
<td>2+0</td>
</tr>
<tr>
<td>22</td>
<td>Online Course on Deep Reinforcement Learning</td>
<td>2+L</td>
</tr>
<tr>
<td>23</td>
<td>Basic Concepts of Finite Element Method (Sat)</td>
<td>2+0</td>
</tr>
<tr>
<td>24</td>
<td>Basics of Machine Learning (Sat)</td>
<td>2+0</td>
</tr>
<tr>
<td>25</td>
<td>Power System Protection (Sat)</td>
<td>3+0</td>
</tr>
<tr>
<td>26</td>
<td>Mathematical Foundations for Machine Learning (Sat)</td>
<td>2+0</td>
</tr>
<tr>
<td>27</td>
<td>Start-up Tools (SuT) (Sat)</td>
<td>3+0</td>
</tr>
<tr>
<td>28</td>
<td>AI for UI/UX Design</td>
<td>2+0</td>
</tr>
<tr>
<td>29</td>
<td>Strategic Management</td>
<td>3+0</td>
</tr>
</tbody>
</table>
INTRODUCTION

Indian Institute of Science (IISc) established in 1909, is a Deemed University and Centrally Funded 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 CIRCUMSTANCES.**

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

<table>
<thead>
<tr>
<th>Grade</th>
<th>A+</th>
<th>A</th>
<th>B+</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F (Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Points:</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

**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
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Course</th>
<th>Credit</th>
<th>Faculty</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Innovative Product Development and Design Methods (Mon)</td>
<td>2+0</td>
<td>Dr. J E Diwakar (Retd.) &amp; Prof. P. Achutha Rao (Retd.)</td>
<td>CPDM &amp; NID R&amp;D Campus</td>
</tr>
<tr>
<td>2.</td>
<td>Strategic Innovation Through TRIZ (Tue)</td>
<td>2+0</td>
<td>Dr. J E Diwakar (Retd.) &amp; Prof. P. Achutha Rao (Retd.)</td>
<td>CPDM &amp; NID R&amp;D Campus</td>
</tr>
<tr>
<td>3.</td>
<td>Commercialization of Intellectual Property (CIP) (Tue)</td>
<td>2+0</td>
<td>Dr. R N Narahari &amp; Mr. M Kalyana Kumar Rao</td>
<td>CeNSE</td>
</tr>
<tr>
<td>4.</td>
<td>IoT and Data Science for CleanTech and AgriTech (Tue)</td>
<td>2+0</td>
<td>Dr. Vijay Mishra &amp; Mr Ganesh Hassan Shankar</td>
<td>CeNSE &amp; Founder &amp; MD Flux Gen Engg. Tech Pvt. Ltd. B`luru.</td>
</tr>
<tr>
<td>5.</td>
<td>Project Management (Tue - Thur)</td>
<td>3+0</td>
<td>Dr. H N Chanakya &amp; Prof. TVP Chowdry</td>
<td>CST</td>
</tr>
<tr>
<td>6.</td>
<td>Business Analytics with Management Science Models and Methods (Tue-Thur)</td>
<td>3+0</td>
<td>Dr. M Mathirajan</td>
<td>MS</td>
</tr>
<tr>
<td>7.</td>
<td>Vibration and Noise: Theory and Practice (Wed)</td>
<td>2+0</td>
<td>Dr. S B Kandagal</td>
<td>AE</td>
</tr>
<tr>
<td>8.</td>
<td>Analysis and Design of Composite Structures (Thur)</td>
<td>2+0</td>
<td>Dr. G Narayana Naik</td>
<td>AE</td>
</tr>
<tr>
<td>9.</td>
<td>Internet of Things and Nano Sensors (Thur)</td>
<td>2+0</td>
<td>Dr. Vijay Mishra</td>
<td>CeNSE</td>
</tr>
<tr>
<td>10.</td>
<td>Mathematics for Data Science (Thur)</td>
<td>2+0</td>
<td>Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati &amp; Prof. M Sekhar</td>
<td>Fiserv India Ltd., Altair Engineering, &amp; Civil Engg.</td>
</tr>
<tr>
<td>11.</td>
<td>Structural Analysis &amp; Design Optimization: Theory and Practice (Fri)</td>
<td>2+0</td>
<td>Dr. S B Kandagal</td>
<td>AE</td>
</tr>
<tr>
<td>12.</td>
<td>Consumer’s Protection Act 1986 (Fri)</td>
<td>2+0</td>
<td>Dr. M Mathirajan &amp; Mr. N Nagaraja Rao</td>
<td>MS &amp; Advocate (High Court of Karnataka)</td>
</tr>
<tr>
<td>13.</td>
<td>Basics of Data Analytics (Sat)</td>
<td>2+0</td>
<td>Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati &amp; Prof. M Sekhar</td>
<td>Fiserv India Ltd., Altair Engineering, &amp; Civil Engg.</td>
</tr>
<tr>
<td>14.</td>
<td>Online Course on Basics of Data Analytics (Sat)</td>
<td>2+L</td>
<td>Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati &amp; Prof. M Sekhar</td>
<td>Fiserv India Ltd., Altair Engineering, &amp; Civil Engg.</td>
</tr>
<tr>
<td>15.</td>
<td>Nonlinear Finite Element Method (Sat)</td>
<td>2+0</td>
<td>Prof. P C Pandey (Retd.)IISc.</td>
<td>Distinguished Prof. Gitam Univ.</td>
</tr>
<tr>
<td>16.</td>
<td>DSP-Algorithms, Architecture and Applications (Sat)</td>
<td>2+0</td>
<td>Mr. M Krishna Kumar, (Retd.) &amp; Dr. Arulalan Rajan</td>
<td>DESE &amp; NITK, Surathkal</td>
</tr>
<tr>
<td>17.</td>
<td>Image Processing and Computer Vision (Sat)</td>
<td>3+0</td>
<td>Dr. Kunal Narayan Choudhury</td>
<td>EE</td>
</tr>
<tr>
<td>18.</td>
<td>Reinforcement Learning (Sat)</td>
<td>3+0</td>
<td>Prof. Shalabh Bhatnagar</td>
<td>CSA</td>
</tr>
<tr>
<td>19.</td>
<td>Online Course on Reinforcement Learning (Sat)</td>
<td>3+L</td>
<td>Prof. Shalabh Bhatnagar</td>
<td>CSA</td>
</tr>
<tr>
<td>No.</td>
<td>Course Title</td>
<td>Credits</td>
<td>Instructor(s)</td>
<td>Department/Institute</td>
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</tr>
<tr>
<td>20.</td>
<td>Introduction to Industrial Design (Sat)</td>
<td>3+0</td>
<td>Dr. J E Diwakar, (Retd.) Prof. P. Achutha Rao, (Retd.) &amp; Prof. TVP Chowdry</td>
<td>CPDM, NID R&amp;D Campus &amp; CST</td>
</tr>
<tr>
<td>21.</td>
<td>Deep Reinforcement Learning (Sat)</td>
<td>2+0</td>
<td>Prof. Shalabh Bhatnagar</td>
<td>CSA</td>
</tr>
<tr>
<td>22.</td>
<td>Online Course on Deep Reinforcement Learning (Sat)</td>
<td>2+L</td>
<td>Prof. Shalabh Bhatnagar</td>
<td>CSA</td>
</tr>
<tr>
<td>23.</td>
<td>Basic Concepts of Finite Element Method (Sat)</td>
<td>2+0</td>
<td>Prof. P C Pandey (Retd.)IISc.</td>
<td>Distinguished Prof. Gitam Univ.</td>
</tr>
<tr>
<td>24.</td>
<td>Basics of Machine Learning (Sat)</td>
<td>2+0</td>
<td>Dr. Gopal Krishna Sharma, Dr. Badarinath Ambati &amp; Prof. M Sekhar</td>
<td>Fiserv India Ltd., Altair Engineering, &amp; Civil Engg.</td>
</tr>
<tr>
<td>25.</td>
<td>Power System Protection (Sat)</td>
<td>3+0</td>
<td>Dr. Sarasij Das</td>
<td>EE</td>
</tr>
<tr>
<td>26.</td>
<td>Mathematical Foundations for Machine Learning (Sat)</td>
<td>2+0</td>
<td>Mr. M Krishna Kumar, (Retd.) Dr. Ashok Rao &amp; Dr. Arulalan Rajan</td>
<td>DESE &amp; NITK Surathkal</td>
</tr>
<tr>
<td>27.</td>
<td>Start-up Tools (SuT) (Sat)</td>
<td>3+0</td>
<td>Dr. R N Narahari &amp; Prof. S A Shivashankar (Visiting Prof.)</td>
<td>CeNSE</td>
</tr>
<tr>
<td>28.</td>
<td>AI for UI/UX Design</td>
<td>2+0</td>
<td>Dr. Pradipta Biswas</td>
<td>CPDM</td>
</tr>
<tr>
<td>29.</td>
<td>Strategic Management</td>
<td>3+0</td>
<td>Prof. R Srinivasan</td>
<td>MS</td>
</tr>
</tbody>
</table>
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:**
- 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:**

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

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

**Reference Books:**

**Who can apply?**
Graduation in Engineering & Post-Graduation Management

**Course Fee:** Rs. 10,000/-

**Schedule:** Monday's 6.00 p.m. to 8.00 p.m.
2. Strategic Innovation Through TRIZ (2+0)

Objectives:
Innovation is no more a luxury in a dominant knowledge economy; it is mandatory to survive. The organizations are ill-equipped to manage innovation. Innovation has to happen across the organization.

Systematic Innovation (TRIZ) offers different tools to define, select, generate, evaluate and innovate. Technological evolution trends and the concept of Ideal Final Result (IFR) enable the organizations to strategize innovation.

This introductory course is focused on creating an awareness of various tools/methods of TRIZ to strategize innovation.

Syllabus:
- Creativity and Innovation
- Ten Types of Innovation, Knowledge Economy
- TRIZ Philosophy, Problem definition tools.
- Technical & Physical Contradiction Resolution
- Technology Evolution Trends.
- Ideal Final Result (IFR)
- Su Field Analysis
- Strategizing Innovation

Target Group:

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

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

Reference Books:
1. Ellen Domb and Kalevi Rantanen,
   Simplified TRIZ: New Problem-Solving
   Applications for Engineers and Manufacturing Professionals, Second Edition,
   Auerbach Publications
2. Victor Fey,
   Innovation on Demand: New Product Development Using TRIZ, Eugene Rivin,
3. Lilly Haines-Gadd,
   TRIZ for Dummies, Paperback – 2016,
   John Wiley & Sons.

Who Can apply?
Graduation in Engineering & Post-Graduation Management

Course Fee: Rs. 10,000/-
Schedule: Tuesday’s 6.00 p.m. to 8.00 p.m.
### 3. Commercialization Intellectual Property (IP) (2+0)

#### Objectives:
Introduction to the broad field 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.

#### Syllabus:
Scouting for IP in the research work; Discovery V/s invention. Inventive ideas to vendible products with IP Protection. Various types of IP; patent drafting, strategic decision of filing PCT application, creation of business proposal-stages of product development of finances, startup initiatives, registration of company and so on.

#### Target Group:
All interested in creating and commercializing IP.

<table>
<thead>
<tr>
<th>Faculty:</th>
<th>Faculty:</th>
</tr>
</thead>
</table>
| Dr. R.N. Narahari  
CeNSE  
IISc., Bengaluru  
Email: naraharirn@iisc.ac.in | Mr. M Kalyana Kumar Rao  
Technology Manager,  
CeNSE.,  
IISc., Bengaluru  
Email: maratirao@iisc.ac.in |

#### 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  
3. Prabuddha R Ganguli,  

#### Who Can apply?
BE/B.Tech./Master in Science/Commerce.

#### Course Fee:
Rs. 10,000/-

#### Schedule:
Tuesday’s - 6.00 p.m. to 8.00 p.m.
4. **IoT and Data Science for CleanTech and AgriTech (2+0)**

**Objectives:**
The objective of the course is to utilize advanced technologies like IoT and AI to improve the efficiencies of CleanTech and AgriTech which are very important for country’s growth and sustainability of humans on planet earth.

**Syllabus:**

**Case Studies**

**Target Group:**

<table>
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<th>Faculty:</th>
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</thead>
</table>
| **Mr. Ganesh Hassan Shankar**  
Bengaluru.  
E-mail: sganesh@alum.iisc.ac.in | **Dr. Vijay Mishra**  
CeNSE.,  
IISc., Bengaluru.  
Email: vijaymishra@iisc.ac.in |

**Reference Books:**

1. Dirk Slama, Frank Puhlmann, Jim Morrish, Rishi M Bhatnagar,  
   Enterprise IoT:
2. Rafiq Mamrpmo  
   Rapid Prototyping: Principles and Applications
3. Daniel Obodovski, Daniel Kellmereit,  
   The Silent Intelligence – The Internet of Things
4. Hadley Wickham and Garrett Grolemund  
   R for Data Science

**Who can apply?**
B.E / B.Tech. (All Circuit Branches )  
MSc. (Electronics)

**Pre-requisites:**
Basic Knowledge in Electronics and C Programming

**Course Fee:** Rs. 10,000/-

**Schedule:** Tuesday’s  6.00 pm - 8.00 pm
### 5. Project Management (3+0)

#### Objective
This course is envisaged to develop the competences and skills for planning, scheduling and controlling projects. This course provides a systematic and thorough introduction to all aspects of project management.

Students explore project management with a practical, hands-on approach through case studies and class exercises. The knowledge and skills gained in this course will help in Project Management Institute’s (PM) Project Management Professional (PMP) Program.

#### Syllabus:
- What is Project Management
- Organizing Project Management Office & Term
- Project Planning
  - Work Break Down Structure
- Project Budgeting
  - Cost Estimation
- Project Scheduling
  - Gantt Chart
  - PERT/CPM
- Project Resource Allocation
  - Fast Tracking-Crashing
  - Resource Loading & Leveling
- Project Management & Controlling
  - Earned Value
  - Scope Creep and Change Control
- Project Evaluation & Termination

#### Target Group:
Practicing Engineers, Scientists, R&D Managers, Construction Managers, Architects, Designers, Professionals from knowledge & IT Industries, Entrepreneurs.

#### Faculty:
- **Dr. H N Chanakya**
  CST, IISc., Bengaluru.
  Email: hoysull@gmail.com

- **Prof. TVP Chowdry**
  Project Scientist,
  CST, IISc., Bengaluru.
  E mail: tvpchowdry@gmail.com

#### Reference Books:

#### Who Can apply?
Graduation in Engineering/Architecture/Design or Post Graduation in Management.

**Course Fee:** Rs. 15,000/-

**Schedule:** Tuesday-Thursday : 6.00 pm to 7.30 pm
6. 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 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, which 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:

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

Reference Books:
1. U Dinesh Kumar,

2. William P Fox,

3. Abben Asllani,

4. Stephen G Powell and Kenneth R Baker,

Who Can apply?

Course Fee: Rs. 15,000/-

Schedule: Tuesday & Thursday - 6.00 p.m. to 7.30 p.m.
## 7. 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 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.

#### Structural Vibration control elements:
- Isolation, damping, balancing, resonators, absorption, barriers and enclosures.
- Vibration and noise standards.
- NVH measurement tools and techniques.
- Modal parameter (natural frequency, mode shape and damping) estimation techniques.
- Signal and system analysis.

#### Demonstration of vibration and noise experiments
- Beam, plates, impulse excitation, electrodynamic shaker excitation, FFT analyzer, stroboscope and mode shape animation, sound level meter, microphones.
- Vibration transfer function (VTF) and noise transfer function (NTF)

#### Noise and its effects on man.
- Acoustic and sound field.
- Enclosures, shields and barriers-design.
- Silencer and suppression systems.
- Noise level interpolation and mapping.
- Harshness effects and measurements and solutions.
- NVH Parameters related to vehicle dynamics.

#### Case studies discussion
- Vibration reduction in passenger car, tiller, tractors, steering column/wheel vibration diagnosis, Modal analysis of Helicopter, Vibration diagnosis in diesel engine power plant, rotodynamic analysis of DWR and tracking antenna and engine and compressor noise attenuation and vibration isolation, engine-compressor mount design, vibration diagnosis in power plants, gear shift harshness, newspaper printing cylinder vibration diagnosis, engine filter bracket dynamic analysis, noise reduction for mixer grinders, field audit of industrial chimney for wind induced vibration, stability studies of sports bike, aerodynamic stability derivatives of scaled model of aerospace vehicles.

### Target Group:
Mechanical, Civil, Aerospace, Automotive, Industrial Engineers, Construction Technologists, R & D Labs, New product Design and Development Groups, Entrepreneurs and Engineering College Instructors, Professionals to pursue Postgraduate and Higher Studies

### Faculty:

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

### Reference Books:

### Who Can apply?
B.E / ME / MSc./ AMIE OR equivalent

### Course Fee: Rs. 10,000/-

### Schedule: Wednesday’s - 6.00 p.m. to 8.00 p.m.
8. Analysis & Design of Composite Structures (2+0)

Objectives:

Composites are future materials which are finding applications in all fields of Engineering. Many FEM software packages are available for Analysis & Design. One should first understand the Mechanical behavior of the Composite Structures before using FEM 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,
Macromechanics of Lamina: The theory of elasticity, Constitutive equations of a lamina, transformations, numerical examples.
Failure theories for composite lamina, numerical examples.
Mechanics of Laminated Composites: ABD matrices, numerical examples.
Hygrothermal Analysis, numericals.
Bending Analysis of Beams, numerical examples.
Analysis of Laminated composite plates: Classical and first order theories, Energy Method, numerical examples.
Buckling analysis of plates, numerical examples.
Design of laminates using Carpet plots, AML plots and numerical examples on design of composite laminates.

Target Group:

1. Faculty/Technologists/ Engineers/ Scientists/ Trainees/ Project Staff/ etc. from Industries, R & D Organizations, Institutions, Colleges etc.
2. Fresh Graduates, Post Graduates, Ph.D. Students, Research Fellows, SRFs, JRFs, Project Associates, Project Assistants etc.

Faculty:

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

Reference Books:

1. Robert M. Jones,
   McGRAW-Hill Kogakusha, Ltd. – Year 1999.

2. J.N.Reddy,

3. Madhujit Mukhopadhyay,

Who Can apply?

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

Course Fee: Rs. 10,000/-

Schedule: Thursday’s - 6.00 p.m. to 8.00 p.m.
9. Internet of Things and Nano Sensors (2+0)

Objectives:

- To teach advanced concepts and practices in development of IoT prototypes to be transformed as Cyber Physical Systems

Syllabus:

- Introduction to IoT and IoT Business Scenario
- IoT Architecture and concepts
- IoT prototypes for real world applications with special reference to Nano sensors
- Biochips, biosensors, implantable systems, and other emerging IoT technology
- Signal processing, as well as other aspects of digital and wireless communication systems
- Circuit design and performance
- The components of embedded systems
- 3D Systems Scaling and their impact on IoT Industry
- Cloud Computing

Target Group:

All Engineers and Scientists in Industry and Research Organizations, who have a state in Charting the Organizational Strategy. Young Entrepreneurs willing to Build IoT based Startups, fresh Engineering/Science Graduates.

Faculty:

Dr. Vijay Mishra  
CeNSE., IISc., Bengaluru.  
Email: vijaymishra@iisc.ac.in

Reference Books:

2. G K Ananthasuresh et al., Micro and Smart Systems, 2011, Wiley India

Who Can apply?

BE, B.Tech., M.Sc., MCA or Equivalent Experience in Industry.

Course Fee: Rs. 10,000/-

Schedule: Thursday’s - 6.00 p.m. to 8.00 p.m.
10. Mathematics for Data Science (2+0)

Objective
To Prepare Students in mathematical concepts required for studying data science.

Syllabus:

**Basics of Calculus** – limits, derivative, derivative of basic functions, function of a function, product rule, functions of multiple variables – partial derivatives; maxima and minima, geometrical and physical interpretation of derivatives.

Integration – indefinite integral, methods of integration – product rule and integration by substitution; definite integrals, integral as area under a curve, some simple applications – finding area and volume; integration of functions of multiple variables, introduction to differential equations and partial differential equations.

**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, methods to find the inverse of a matrix, Eigen values and Eigen vectors, dimensionality reduction – Principle Component Analysis (PCA).

**Probability Theory** – sample and event space, 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, sampling and sampling distributions, hypothesis testing, multivariate distributions.

Basic concepts of stochastic processes, stationary process, introduction to Markov process.

**Target Group:** All Industries.

Reference Books:
1. Erwin Kreyszig,
   Advanced Engineering Mathematics,
   Wiley
2. Kishor Trivedi
   Probability and Statistics with Reliability, Queueing and Computer Science Applications.
   Wiley.

**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

**Who Can apply?**
Any Engineering Degree with Mathematics

**Course Fee:** Rs. 10,000/-

**Schedule:** Thursday’s: 6.00 pm. to 8.00 pm
## 11. 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:

- 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, 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:


### 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”,  
2. Shigley, J.E and Mischke, C.R.,  
   “Mechanical Engineering Design”  
3. Johnson Ray, C.  
   “Optimum Design of Mechanical Elements”,  

### Who Can apply?

BE, ME, MSc , AMIE, or equivalent

### Course Fee:

Rs. 10,000/-

### Schedule:

Friday’s 6.00 p.m. to 8.00 p.m.
### 12. Consumer’s Protection Act 1986

**Objectives:**

To educate the professionals/Individuals about consumerism in accordance with consumer protection Act 1986 prevailing in India along with consumer protection rules 1987 and consumer protection regulation 2005

**Syllabus:**

Deficiency of service and other legal proceedings before the consumer forums, state commission, national consumer forums, Supreme Court of India

**Target Group:**

**HR Professionals, Corporate Managers, and any interested Fresh Graduates**

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</table>
| **Dr. M Mathirajan**  
Chief Research Scientist,  
Dept. of M S., Faculty of Engineering, IISc, Bengaluru.  
Email: msdmathi@iisc.ac.in; drmuthu.mathirajan@gmail.com | **Mr. N Nagaraja Rao,**  
Advocate (High Court of Karnataka)  
Ambuja 110-A, III Main CIL Colony, Sanjay Nagar, Bengaluru.  
Email: nnrao42@yahoo.com |

**Reference Books:**


**Who can apply?**

Working Professionals with any interested fresh Graduation

**Course Fee:** Rs. 10,000/-

**Schedule:** Friday’s – 6.00 pm to 8.00 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.

Univariate data – Trend, Seasonality, Cyclicity, concept of stationarity, auto-correlation function (ACF) and partial autocorrelation function (PACF), making a series stationary, AR, MA and ARIMA models, estimation of p, d and q, estimation of model parameters, Akaike’s information criteria and other goodness of fit metrics, seasonal ARIMA.

Overview of Machine Learning, Internet of Things, Neural Networks and associated topics through student seminars.

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

Target Group:
Any Industry dealing with Data.

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:

Who Can apply?
Any Engineering Degree with Mathematics Background

Course Fee: Rs. 10,000/-

Schedule: Saturday’s- 10.00 am to 12.00 Noon
14. Online Course on Basics of Data Analytics (2+L)

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.

Univariate data – Trend, Seasonality, Cyclicility, concept of stationarity, auto-correlation function (ACF) and partial autocorrelation function (PACF), making a series stationary, AR, MA and ARIMA models, estimation of p, d and q, estimation of model parameters, Akaike’s information criteria and other goodness of fit metrics, seasonal ARIMA.

Overview of Machine Learning, Internet of Things, Neural Networks and associated topics through student seminars.

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

Target Group:
Any Industry dealing with Data.

Faculty
Dr. Gopal Krishna Sharma
Fiserv India Ltd., Bengaluru.
Email: gopaltaka@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:

Who Can apply?
Any Engineering Degree with Mathematics Background

Course Fee: Rs. 15,000/-

Schedule: Saturday’s- 10.00 am. to 12.00 Noon
### 15. Nonlinear Finite Element Method (2+0)

**Objectives:**
This is a second level course covering some advanced topics in Finite Element Analysis. In particular, focus would be on Concepts and techniques of Nonlinear Finite element Analysis in this course.

Nonlinear FEM techniques are usually not covered in the first course of FEM. The FEM treatment of Nonlinear problems requires additional background of the inelastic behavior of materials and nonlinear-mechanics for better understanding but, such options are generally not available to graduate engineers or even to post-graduates. However, practicing engineers, especially structural analysts and designers, usually come across many practical problems which require nonlinear finite element analysis. Most of the commercial packages do have nonlinear analysis facilities. However, even to use such packages a good understanding of Nonlinear Finite Element analysis techniques is required. The objective of this course is to introduce basic concept of nonlinear finite element analysis with reference to solid mechanics applications. Bucklings are included.

**Syllabus:**

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**Faculty:**

**Prof. P. C. Pandey (Retd. IISc.)**
Distinguished Professor, GITAM University,
E-mail: profpcpandey@yahoo.com/

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**Reference Books:**

**Who can apply?**
BE/ B.Tech. (Civil/Mechanical/Aerospace), OR equivalent

**Pre-requisites:**
Basic knowledge of Solid Mechanics. An Exposure to Basic Finite Element Method

**Course Fee:** Rs.10,000/-

**Schedule:**
Saturday’s – 10.00 AM to 12.00 Noon
# 16. DSP – Algorithms, Architecture and Applications (2+0)

**Objectives:**
To give insight to Engineers in Digital Signal Processing Fundamentals, Algorithms & Architecture for Contemporary Applications

**Syllabus:**
- Fundamental of DSP
- Fourier Transforms, Z Transforms, DFT and FFTs
- Digital Filters Design
- Algorithms & Architectures for Applications including Image, Compression.

**Target Group:**
All Research and Hardware Organizations like BEL, DRDO, USRO, BHEL, Texas Instruments, ITTIAM etc.

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<tbody>
<tr>
<td>Mr. M Krishna Kumar (Retd.), PRS., Dept. of ESE (CEDT), IISc., Bengaluru&lt;br&gt;Email. <a href="mailto:mkkumarcedt@gmail.com">mkkumarcedt@gmail.com</a></td>
<td>Dr. Arulalan Rajan, Assistant Prof., Dept. of E&amp;C Engg., NITK., Surathkal.&lt;br&gt;Email.</td>
</tr>
</tbody>
</table>

**Reference Books:**
2. Phil Lapsley, “DSP Processors & Fundamentals”.

**Who can apply?**
BE/B.Tech/ AMIE or equivalent.

**Pre Requisites**: Practical knowledge in Electronics

**Course Fee**: Rs. 10,000/-

**Schedule**: Saturday’s - 10.00 am - 12.00 noon.
## 17. Image Processing and Computer Vision (3+0)

### Objectives:
The course is ideally suited for those who wish to learn in depth about some of the core models and algorithms in image processing and computer vision (IP-CV). The first half of the course will focus on mathematical preliminaries and introduce the participants to classical models and algorithms in IP-CV. The second half will be about state-of-the-art filtering and optimization algorithms.

### Syllabus:
Overview of image processing and computer vision. Various models and algorithms. Modern applications.

### Topics:
Sampling and quantization, Fourier and wavelet transforms, compression, statistical and sparse models, linear and nonlinear filters, edge detection, segmentation, image restoration, compressed sensing, ML/deep learning techniques.

### Target Group:
Research Scholars, Teachers, Engineers, Mathematicians, Computer Scientists and Working Professionals.

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<th>Faculty:</th>
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| **Dr. Kunal Narayan Chaudhury**  
Assistant Professor  
Dept. of Electrical Engineering  
IISc., Bengaluru.  
Email: kunal@iisc.ac.in |

### Reference Books
1. R. Szeliski,  
   Computer Vision: Algorithms and Applications,  
2. S. Mallat.  
   A Wavelet tour of signal processing.  
3. Lecture notes provided by the instructor.

### Who Can apply?
BE/B.Tech.

### Pre-requisites:

### Course Fee:  
Rs. 15,000/-

### Schedule:  
Saturday’s - 10.00 a.m. to 1.00 p.m.
### 18. Reinforcement Learning (3+0)

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

**Syllabus:**
Introduction to Reinforcement learn if, Multi-armed bandits, Finite Markov decision processes, Dynamic Programming, Monte-Carlo Methods, Temporal difference methods, on-policy prediction and control.

**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
2. D. P. Bertsekas and J. N. Tsitsiklis  
   Neuro-Dynamic Programming, 1996

**Who can apply?**
BE, B.Tech., MCA  
**Course Fee:** Rs. 15,000/-  
**Schedule:** Saturday’s 10 am to 1 pm
### 19. Online Course on Reinforcement Learning (3+L)

**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 methods
- On-policy prediction and control

**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**
3. R. S. Sutton and A. G. Barto  
   Reinforcement learning: An Introduction,  
   MIT Press, 2018
4. D. P. Bertsekas and J. N. Tsitsiklis  
   Neuro-Dynamic Programming, 1996

**Who can apply?**
BE, B.Tech., MCA

**Course Fee:** Rs. 20,000/-

**Schedule:** Saturday’s 10 am to 1 pm
20. Introduction to Industrial Design (3+0)

Objective

“Industrial Design” is one of the youngest professions gaining recognition as a differentiator to survive and grow in the competitive global market. Professional Industrial Designers are in great demand in all sectors of industry today. Graduate and postgraduate courses are offered in India and abroad on Industrial Design and allied fields. In this Course, the Students are Introduced to what Industrial Designers do, how they contribute to be innovative and create great products. Industrial Designers bring new perspectives based on understanding of the users’ real needs and the context in which they use the products, and help develop products which meet users’ aspirations and contribute for the improvement of quality of life. They follow a proven process to identify opportunities and develop concepts to meet the challenges.

This course serves as an introduction to the world of industrial design and its wide-ranging applications. The students will learn about the history of design, design methodology, product ergonomics, developing successful products through lectures, discussions. The students are expected to do a lot of exercises in the classes and at home to get a good understanding of the topics. Ability in free hand sketching is necessary.

Syllabus:

- Innovation, Creativity, Embedded Mindset to Creative Thinking. Barriers to Creativity.
- History of Design
- Industrial Design—Yesterday, Today and Tomorrow.
- Design Communication
- Product Design Process/ Methodology
- Elements of Design
- Principles of Design
- Materials & Manufacture
- Product Ergonomics
- UX
- Design Strategy and Management

Target Group:

Practicing Engineers, Managers Responsible for developing engineering services, Professional in Design and Development in Industries, R & D Organizations etc., Academic Personal in teaching/practicing Product design/Service design, Product engineering, Design and Development and fresh engineers interested in Design and Innovation; Start up entrepreneurs.

Faculty:

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<tbody>
<tr>
<td>Dr. J. E. Diwakar</td>
<td>Prof. P. Achutha Rao (Retd.)</td>
<td>Prof. TVP Chowdry</td>
</tr>
<tr>
<td>Dept. of CPDM., IIsc., Bengaluru.</td>
<td>NID R &amp; D Campus.</td>
<td>Project Scientist CST</td>
</tr>
<tr>
<td>Email: <a href="mailto:jed@iisc.ac.in">jed@iisc.ac.in</a></td>
<td>E-Mail: <a href="mailto:reopanambur@gmail.com">reopanambur@gmail.com</a></td>
<td>E-mail: <a href="mailto:tvpchowdry@gmail.com">tvpchowdry@gmail.com</a></td>
</tr>
</tbody>
</table>

Reference Books:


Who Can apply?

Graduation in Engineering/Management with a flair for arts and free hand sketching.

Course Fee: Rs. 15,000/-

Schedule: Saturday’s: 10.00 am. to 1.00 pm
# 21. 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 are now showable. The course will provide introduction to Deep RL, Models, and Technologies.

## Syllabus:
- Introduction, Machine Learning and Deep Learning
- Introduction to Reinforcement Learning
- Value based Methods for Deep RL
- Policy Gradients for Deep RL
- Model based Methods
- Generalization benchmarking Deep RL
- Deep RL beyond MAPs

## 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
2. Selected Research Papers.

## Who can apply?
- BE, B.Tech., MSc., MCA

## Course Fee:
Rs. 10,000/-

## Schedule:
Saturday’s 2 pm to 4 pm
### 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 showable. The course will provide introduction to Deep RL, Models, and Technologies.

### Syllabus:
- Introduction, Machine Learning and Deep Learning
- Introduction to Reinforcement Learning
- Value based Methods for Deep RL
- Policy Gradients for Deep RL
- Model based Methods
- Generalization bench making Deep RL
- Deep RL beyond MAPs
- on Deep RL.

### 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
   Now Publishes, Boston, 2018.

### Who can apply?
BE, B.Tech., MSc., MCA

### Course Fee:
Rs. 15,000/-

### Schedule:
Saturday’s 2 pm to 4 pm
### 23. Basic Concepts of Finite Element Method (2+0)

**Objectives:**
This is a foundation course in Finite Element Method (FEM) aimed at Civil, Mechanical and Aerospace Engineering professionals. In particular, it would be beneficial to engineers who do not have any formal training in FEM, even though; they may have skill to use a FEM package. The course is designed to provide a basic introduction to FEM with emphasis on stress and structural analysis. It is believed that it would be of interest to engineers working in industries, consulting firms and teachers of engineering colleges.

**Syllabus:**
Concept of Stiffness and Flexibility in structural analysis. Basic foundations of elasticity and energy principles. Introduction to displacement based FEM with reference to continuum and skeletal structures. Element formulation and Applications to Plane stress, Plane strain, Axisymmetric and 3-D problems. Isoparametric concept, equation solvers, Post-processing. Adaptivity, Programming and Computational aspects as well as practical applications would be discussed.

<table>
<thead>
<tr>
<th>Faculty:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. P. C. Pandey (Retd. IISc.)</td>
</tr>
<tr>
<td>Distinguished Professor, GITAM University,</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:profpcpandey@yahoo.com">profpcpandey@yahoo.com</a> / <a href="mailto:pcpandey@civil.iisc.ernet.in">pcpandey@civil.iisc.ernet.in</a></td>
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<table>
<thead>
<tr>
<th>Reference Books:</th>
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<table>
<thead>
<tr>
<th>Who can apply?</th>
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</thead>
<tbody>
<tr>
<td>BE/ B.Tech. (Civil/Mechanical/Aerospace), OR equivalent</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Course Fee:</th>
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<tbody>
<tr>
<td>Rs.10,000/-</td>
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<table>
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<tr>
<th>Schedule:</th>
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<td>Saturday’s -2.00 PM to 4.00 PM</td>
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24. Basics of Machine Learning (2+0)

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

Syllabus:

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.


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

Target Group: IT Industry, Academics Interested in Data Science, any other Industry dealing with Data Analysis.

Faculty
Dr. Gopal Krishna Sharma
Fiserv India Pvt. 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:
2. Laurene V Fausett Fundamentals of Neural Networks Pearson Education

Who Can apply?
Any Engineering Degree with Mathematics Background

Course Fee: Rs. 10,000/-

Schedule: Saturday’s: 2.00 pm to 4.00 pm
# 25. Power System Protection (3+0)

**Objectives:**
To Discuss Basic and Advanced Topics related to Power System Protection.

**Syllabus:**
Overview of Protection Philosophies; over current, Directional, Differential, Distance Protection, CT & CVT; Breaker Failure Protection, Transmission Protection; Transformer , Bus, Generator Protection; Micro grid Protection, Protection; Special Protection Scheme, COMTRADE, IEC 61850; EMTP, Schematic representation of relaying.

**Target Group:**
Academicians and Industry persons (All Bangalore Colleges; Industry such as TCE, CPRI, ABB, PRDC, …etc.

## Faculty:

Dr. Sarasij Das  
Assistant Professor,  
Dept of EE,  
IISc., Bengaluru.  
Email: sarasij@iisc.ac.in

## Reference Books
1. A G Phadke and J S Thorp,  
   “Computer Relaying for Power Systems”  
   Second Edison, John Wiley & Sons Inc.
2. IEEE Standards on Protection
3. Papers by Industries.

## Who Can apply?

BE, B.Tech., in Electrical Engineering  
Course Fee: Rs. 15,000/-  
Schedule: Saturday’s 1.00 p.m. to 4.00 p.m.
# 26. 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, Orthogonalization, 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](mailto:mkkumarcedt@gmail.com)
- **Dr. Arulalan Rajan,** Assistant Prof., Dept. of E& C Engg., NITK., Surathkal.
- **Dr. Ashok Rao,** Formerly Head, Networking Project, Dept. of ESE (CEDT), IISc., Bengaluru

## Reference Books:

## Who can apply?
BE/B.Tech/ AMIE or equivalent.

## Pre Requisites:
MATLAB Programming will be useful.

## Course Fee:
Rs. 10,000/-

## Schedule:
Saturday’s -2.00 pm - 4.00 pm.
27. Start-up Tools (SuT) (3+0)

Objectives:
The aim of this Course is to introduce aspirants to the broad subject of Start-up Initiatives. “Start-up” is a buzz word sprouting now and has great potential to grow into thick woods in the near future. The world at large appears to be tilted towards micro adventures called “Start-ups”. The course envisages imparting various skill sets – breeding IP culture, creation of IP and related aspects, seeking/raising funds, management skills to handle stress to sustain business; Communication, learning from the experience of founders of start-ups.

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

Target Group:
All students, engineers and scientists who aspires to kindle entrepreneur in her/him.

Faculty:
Dr. R.N. Narahari
CeNSE
IISc., Bengaluru.
Email: naraharirn@iisc.ac.in

Faculty:
Prof. S A Shivashankar
(Visiting Professor)
CeNSE.,
IISc., Bengaluru
Email: shivu@iisc.ac.in

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
   “Fundamentals of Technical Communication”
   Oxford University Press,
   New Delhi, 2015.

Who Can apply?
BE/B.Tech./Master’s degree holders. in Science/& Management.

Course Fee: Rs. 15,000/-
Schedule: Saturday’s - 1.00 pm. to 4.00 pm.
## 28. 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
- 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
- Autonomous driving system, 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:
   Artificial intelligence: a modern approach. 3rd ed.  
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/-

### Schedule: Wednesday’s 6 pm to 8 pm
29. Strategic Management (3+0)

Objectives:
To Expose the Present day executives to the nuances of Strategic Management which is the most sought offer.

Syllabus:
Strategic Management Process; Challenge of Globalisation; Strategic Planning in India; Corporate Governance; Board of Directors; Role and Functions of top Management; Environmental Scanning Industry Analysis; Internal Scanning; Orgns, Analysis, Strategic Formulation,

Target Group:
Industry - ; R&D Units; Educational Institutions with Management Programm.

Faculty:
Prof. R.Srinivasan
Emeritus Professor,
Dept. of MS.,
IISc., Bengaluru.
Email: sri@mgmt.iisc.ernet.in

Reference Books:
1. R. Srinivasan,
   Strategic Management – The Indian Context,

2. R. Srinivasan,
   Case Studies in Marketing – The Indian Context,

Who can apply?
Executing with Engineering Degree

Course Fee: Rs.15,000/-

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 …………………. 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.
<table>
<thead>
<tr>
<th>Event/Deadline</th>
<th>From Date</th>
<th>To Date</th>
<th>Date</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Download application forms</td>
<td>20th June 2019</td>
<td>20th June 2019</td>
<td>Thursday</td>
<td></td>
</tr>
<tr>
<td>Receipts of application along with fees (upto)</td>
<td>20th June 2019</td>
<td>28th July 2019</td>
<td>Thursday, Sunday</td>
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<tr>
<td>Classes Commence</td>
<td></td>
<td>05th August 2019</td>
<td>Monday</td>
<td></td>
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<tr>
<td>Final Exams</td>
<td>02nd December 2019</td>
<td>07th December 2019</td>
<td>Monday, Saturday</td>
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</tbody>
</table>

**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](http://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.