CIRCULAR

Sub: Online selection of Open Elective – II and Professional Elective – II courses of B. Tech. VI semester (III year II semester) through EDUPRIME software – Reg.

All the HODs are requested to inform and direct B. Tech. III year students [A19-2021 Admitted] to perform selection of elective courses through EDUPRIME software as per the schedule given below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date &amp; Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection of Open Elective – II and Professional Elective – II courses of B.Tech. VI semester by B.Tech. III year students</td>
<td>27.12.2023 (04.00 p.m.) to 28.12.2023 (06.00 p.m.)</td>
</tr>
</tbody>
</table>

B. Tech. III year students can perform this activity by logging to their respective login accounts in EDUPRIME software through the following address:

http://automation.vnrvjiet.ac.in/EduPrime3

You are also requested to inform the students to ENSURE THAT THEIR EDUPRIME ACCOUNTS ARE UNLOCKED & PASSWORD PROTECTED AND NOT TO DISCLOSE THEIR EDUPRIME ACCOUNT PASSWORDS TO ANYONE.

Detailed instruction sheet containing the guidelines for performing this activity and list of courses on offer in VI semester is attached to this circular and shall be also available in the Institute website and student login account in EDUPRIME software.

Dr. Y. Shivraj Narayan
Co-ordinator, Academics

Dr. K. Anuradha
Dean, Academics

Copy to:
- Principal for information
- CAMS
- All HODs – with a request to circulate among B.Tech. V semester students and also to visit Institute Website for more information
1. All the students of B.Tech. programmes under A19 academic regulation are informed that there are a total of four Open-Elective (OE) courses to be studied by them one each in V, VI, VII and VIII semester.

2. A student needs to select and pursue one open-elective course of his/her choice in each semester.

3. These courses are designed and grouped as specialized tracks based on emerging technologies called as “Mezzanine Technologies”.

4. There are a total of 12 OE tracks based on Mezzanine Technologies in the curriculum i.e.,
   i) Smart Cities
   ii) Waste Management
   iii) Green Energy
   iv) 3D Printing & Design
   v) Internet of Things
   vi) Augmented Reality (AR) / Virtual Reality (VR)
   vii) Artificial Intelligence
   viii) Blockchain Technologies
   ix) Robotics
   x) Cyber Security
   xi) Data Sciences / Big Data & Analytics
   xii) Autonomous Vehicles

5. Each OE track based on a Mezzanine Technology shall have four courses, one placed in each semester i.e., one each in V, VI, VII and VIII semester respectively as shown below.

<table>
<thead>
<tr>
<th>Name of the OE Track</th>
<th>V semester</th>
<th>VI semester</th>
<th>VII semester</th>
<th>VIII semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Course</td>
<td>Level 2 Course</td>
<td>Level 3 Course</td>
<td>Level 4 Course</td>
<td></td>
</tr>
</tbody>
</table>

In order to pursue a level 2 course, student is expected to complete level 1 course as the pre-requisite.

6. Apart from the above mentioned 12 OE tracks based on Mezzanine Technologies and the courses in it, there is a ‘General Pool’ of open-elective courses consisting of mixed and independent courses without any pre-requisites.

7. Courses to be offered from ‘General Pool’ in each semester shall be decided by the Institute well before the selection of elective courses by the students. Courses from the ‘General Pool’ may be offered multiple times depending upon the need.

8. A student before joining V semester may opt to study EITHER open-elective course that is based on a Mezzanine Technology track OR an open-elective course from General pool.
9. A student completing all the 4 open-elective courses (Level 1 to Level 4) from the chosen single Mezzanine Technology track successfully, as mentioned in the A19 Academic Regulation, shall be awarded a separate PROFICIENCY CERTIFICATE IN THAT SPECIALIZED TECHNOLOGY from the Institute.

**Ex. B.Tech. (Mechanical Engineering) with Proficiency in “Internet of Things”**

10. By default, an open-elective course from a specialized OE track selected by the student in V semester shall be his / her preferred OE track for the remaining 3 semesters. It shall be deemed that the student is willing to continue to study the remaining 3 OE courses (level 2, 3 & 4) from the same track in the subsequent semesters unless the student wishes to exit from the track and opt for another OE track or course from General pool. Those students who would like to go for change of OE track need to submit a request in writing to Dean, Academic through HoD.

11. Students dropping out of the OE track may opt to choose and pursue a course either from the General pool OR from any other OE track subjected to the offering and availability of seats of that OE track/course in semester.
   a) In the event of student selecting a course from other OE track for studying in VI or VII semester, it shall be the responsibility of the student to fulfill the eligibility conditions (pre-requisite courses) to pursue that course.
   b) That is the student shall complete all the pre-requisite courses on his/her own through MOOC offered by SWAYAM-NPTEL (courses that are atleast 80% equivalent – as decided by the respective Chairman, BoS and Dean, Academic) prior to the start of semester in which the course is to be studied.
   c) Student shall produce a documentary evidence in support of this claim to the Dean, Academic to become eligible for taking the course. In case of the pre-requisite course not on offer in the MOOC platforms, the fulfillment of pre-requisite courses shall be decided through a Diagnostic test conducted by the parent department offering the course. A student completing the diagnostic test successfully shall be deemed to have met the pre-requisite courses criteria and shall be allowed to change the OE track depending upon offering and availability of seats in that track.

12. Changing of an OE track by a student shall be allowed for pursuing OE courses of VI and VII semesters only i.e., a student shall be allowed to change the OE track only twice i.e., before the start of VI and VII semesters in the four semester span. However, this condition shall not be applicable to the students opting for pursuing courses from General pool.

13. In the event of a STUDENT COMING OUT OF THE ALREADY CHOSEN OE track in any semester, due to any reason whatsoever, shall FORFEIT THE CLAIM ON THE PROFICIENCY CERTIFICATE.

14. Open-elective courses offered in General pool may be appended with more number of courses as and when required at the discretion of the Institute and shall be informed well before the selection of electives by the students.

15. It is informed that only a limited number of elective courses shall be offered for selection at the discretion of the offering department and Institute which shall be announced well before the start of the next semester.

16. The list of OE courses under each of the specialized OE tracks is given in next section. For more details please refer to the Institute.
OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

<table>
<thead>
<tr>
<th>OE Tracks (Parent Department)</th>
<th>V Semester</th>
<th>VI Semester</th>
<th>VII Semester</th>
<th>VIII Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Cities (CE)</td>
<td>Smart Cities Planning and Development</td>
<td>Green Building Technology</td>
<td>Smart Materials and Structures</td>
<td>Intelligent Transportation System</td>
</tr>
<tr>
<td>3D Printing &amp; Design (ME)</td>
<td>Elements of CAD</td>
<td>Introduction to 3D Printing</td>
<td>3D Printing - Machines, Tooling &amp; Systems</td>
<td>Reverse Engineering</td>
</tr>
<tr>
<td>Internet of Things (ECE)</td>
<td>Sensors Transducers and Actuators</td>
<td>Introduction to Microcontrollers and Interfacing</td>
<td>Fundamentals of Internet of Things</td>
<td>Wireless Sensor Networks</td>
</tr>
<tr>
<td>Augmented Reality (AR) / Virtual Reality (VR) (ECE)</td>
<td>Introduction to C Sharp</td>
<td>Introduction to Signal Processing</td>
<td>Introduction to Image &amp; Video Processing</td>
<td>Fundamentals of Augmented Reality &amp; Virtual Reality</td>
</tr>
<tr>
<td>Robotics (EIE)</td>
<td>Fundamentals of Robotics</td>
<td>Kinematics and Dynamics of Robots</td>
<td>Drives and Control System for Robotics</td>
<td>Robot Programming and Intelligent Control Systems</td>
</tr>
<tr>
<td>Data Sciences / Big Data &amp; Analytics (IT)</td>
<td>Statistical Methods for Data Science</td>
<td>Computational Thinking using Python</td>
<td>Fundamentals of Data Mining</td>
<td>Data Analysis and Visualization</td>
</tr>
</tbody>
</table>
**GENERAL POOL OF OE COURSES:**

<table>
<thead>
<tr>
<th>General-Computing (CSE / IT)</th>
<th>General (H&amp;S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Programming through Java</td>
<td>• Smart Cities</td>
</tr>
<tr>
<td>• Relational Data Base Management Systems</td>
<td>• Trends in Energy Sources for Sustainable Development</td>
</tr>
<tr>
<td>• Computational Thinking using Python</td>
<td>• 3D Printing and Design</td>
</tr>
<tr>
<td>• Introduction to Data Analytics</td>
<td>• Embedded Systems for IoT</td>
</tr>
<tr>
<td>• Fundamentals of Computer Algorithms</td>
<td>• Artificial Intelligence - A Beginner’s Guide</td>
</tr>
<tr>
<td>• Professional Ethics &amp; Human Values</td>
<td>• Blockchain Technology Essentials</td>
</tr>
<tr>
<td>• Entrepreneurship</td>
<td>• Fundamentals of Robotics and Drones</td>
</tr>
<tr>
<td>• Personality Development &amp; Public Speaking</td>
<td>• Fundamentals of Cyber Security</td>
</tr>
<tr>
<td>• Foreign Language (French / German / Spanish)</td>
<td>• Fundamentals of Data Science</td>
</tr>
<tr>
<td>• Introduction to Data Analytics</td>
<td>• Introduction to Advanced Vehicle Technologies</td>
</tr>
<tr>
<td>• Fundamentals of Computer Algorithms</td>
<td>• Introduction to Application Development with C#</td>
</tr>
<tr>
<td>• Introduction to Application Development with Java</td>
<td>• Introduction to Application Development with Python</td>
</tr>
<tr>
<td>• Introduction to Application Development with Python</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**

(i) Students belonging to Parent Department shall not be able to select the OE tracks/courses offered by the Parent Department.

(ii) Students are **NOT ALLOWED TO REPEAT COURSES** to be pursued through ‘Open Elective’ and ‘Professional Elective’ tracks.

(iii) In case of a student selecting similar course in both open elective or professional elective track, selection of **SUCH COURSE SHALL BE TREATED AS NULL SELECTION.** Student shall then be allotted course based on the available courses. Similarity of the course shall be defined by the respective Chairman, Board of Studies.

(iv) Courses that are offered under H&S department shall be available for selection to students of all the departments subjected to their offering by the H&S department.

**DECISION OF THE INSTITUTE IN OFFERING THE OE COURSES SHALL BE FINAL AND ABIDING.**
NOTE:
STUDENTS MUST PROTECT THEIR LOGIN ACCOUNTS BY CHANGING THE ACCOUNT PASSWORDS (UNIQUE) AND NOT TO DISCLOSE IT TO ANYONE.

Students must note that the **elective course selection** is based on 'FIRST-COME FIRST-SERVE' basis.

1. Students are advised to go through the syllabus of the open elective and professional elective courses available in the Institute website before selecting the elective course.
2. Students must login to their account by entering ‘**Username**’ and ‘**Password**’ in Eduprime Software through the following link: [https://automation.vnrvjiet.ac.in/EduPrime3](https://automation.vnrvjiet.ac.in/EduPrime3)
3. Click on ‘**Student**’ in the left panel followed by ‘**Student Elective**’. Screen titled ‘**Elective Course Management**’ containing Elective course groups would appear. Click on the **edit** button on the left of elective course group name.
4. Pop-up containing **detailed instructions** would appear. Read the instructions carefully and then click on ‘**Proceed**’.
5. A screen containing the list of either open elective courses or professional elective courses depending upon the elective group selected will be displayed. This screen consist of **6** columns.
• First column indicates the **names of courses on offer**.
• Second column indicates the **maximum number of seats in each course**.
• Third column indicates the **number of seats already allotted** to the students.
• Fourth column indicates the **number of seats now available**.
• Fifth column provides the option of **selecting your preferred course**. Students are advised that the elective course which they would like to study must be selected by selecting in this column.
• Sixth and last column indicates the **status of course** selected.

6. Status of course: There are 3 statuses for an elective course.

i) **Course not yet confirmed**: It means the **number of students selecting an elective course is less than 20 hence the course will not be run during the semester**. Such students will have to choose another elective course.

ii) **Course is confirmed**: It means the **number of students selecting an elective course is equal to or more than 20 hence the course will be run during the semester**.

iii) **Seats are not available**: It means the **maximum number of seats defined for an elective course are exhausted or over**. Students will not be able to choose such courses and shall select another course of their choice.
OPEN ELECTIVE TRACK BASED CATEGORY:

7. Students who want to pursue an OE Course based on Open Elective Track in V semester shall be able to see the following screen consisting of Level-1 course defined in V semester. After selection of the displayed open elective course, press Save.

8. A message regarding confirmation of selection would appear on screen. Press OK.

9. Click on Freeze button for course confirmation.

10. A message regarding confirmation of selection would appear on screen, then press OK.
11. Upon pressing ‘Close’ button displayed on the screen, student would be taken back to the first screen wherein against the open elective group name, title of the open elective course selected by the student would be shown along with the status of course.

12. Students who want to pursue an OE Course from General Pool in V semester shall be able to see the screen consisting of General Pool Courses offered in V semester as shown below. After selection of an open elective course of your choice, press **Save**.

13. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press **OK**, otherwise press **Cancel** and make selection of another open elective course.
14. If the student is satisfied with the selected open elective course then click on Freeze button for course confirmation.

15. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press OK, otherwise press Cancel and make selection of another open elective course.

16. Upon pressing ‘Close’ button displayed on the screen, student would be taken back to the first screen wherein against the open elective group name, title of the elective course selected by the student would be shown along with the status of course.
PROFESSIONAL ELECTIVE GROUP:

17. In the screen titled ‘Elective Course Management’ containing Open Elective and Professional Elective course group, Click on the edit button on the left of Professional Elective course group name.

18. Pop-up containing detailed instructions would appear. Read the instructions carefully and then click on ‘Proceed’.

19. A screen containing the list of Professional Elective courses will be displayed.

20. After selection of professional elective course of your choice, press Save.

21. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press OK, otherwise press Cancel and make selection of another professional elective course.
22. If the student is satisfied with the selected professional elective course then click on **Freeze** button for course confirmation.

23. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press **OK**, otherwise press **Cancel** and make selection of another professional elective course.

24. Upon pressing ‘**Close**’ button displayed on the screen, student would be taken back to the first screen wherein against the Professional Elective group name, title of the elective course selected by the student would be shown along with the status of course.
NOTE:
(i) FOR AN ELECTIVE COURSE TO BE ALLOTTED, IT IS COMPULSORY TO SAVE THE SELECTED COURSE BY PRESSING ‘SAVE’ AND FOLLOWED BY FREEZING THE CHOICE BY PRESSING ‘FREEZE’.
(ii) STUDENT WILL NOT BE ABLE TO CHANGE HIS / HER SELECTION OF COURSE(S) UPON PRESSING ‘FREEZE’ BUTTON.
IF THE COURSE IS NOT FREEZED, THEN THAT COURSE SHALL NOT BE ALLOTTED.

25. A student can change his/her selection of Professional Elective course / Open Elective General Pool course any number of times during the time the elective selection window is open, provided the student has not freezed his course. Note that if the preferred elective course is already FREEZED through ‘FREEZE’ button, then student will not be able to change his/her selection of course.

26. As the elective course selection is dynamic in nature, status of course may change at any point of time depending upon selection of elective courses by the students. Hence, STUDENTS ARE ADVISED TO CHECK THE STATUS OF THE ELECTIVE COURSE SELECTED BY THEM ON THE CLOSING DATE OF ELECTIVE SELECTION WINDOW.

27. If the status changes from ‘confirmed’ to ‘not confirmed’, student may opt for another elective course of his/her choice on the last date.

28. If a student does not perform this activity during the elective selection window, then the student shall be allotted an elective course by the concerned HoD. For such students, a message regarding non-selection of elective course shall be displayed in the student login dashboard.

29. A student may select / change his / her Professional Elective course / Open Elective General Pool course (only if not freezed) upto the closing date of the window.

30. ONLINE SELECTION OF PROFESSIONAL ELECTIVE COURSE IN EDUPRIME SOFTWARE BY A STUDENT WHO HAS OPTED FOR PURSUING PROFESSIONAL ELECTIVE COURSE THROUGH NPTEL-SWAYAM PLATFORM SHALL NOT BE CONSIDERED.

DO NOT FORGET TO PRESS ‘SAVE’ & ‘FREEZE’ BUTTONS UPON FINALIZED SELECTION OF ELECTIVE COURSES
<table>
<thead>
<tr>
<th>OE Track</th>
<th>Name of the Open Elective – II</th>
<th>Course code</th>
<th>Number of Sections to be offered in 2023-2024</th>
<th>Maximum Seats available for selection</th>
<th>Courses available to B.Tech.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Cities</td>
<td>GREEN BUILDING TECHNOLOGY (CE)</td>
<td>A19OE1CE02</td>
<td>1</td>
<td>80</td>
<td>EEE, ME, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>Waste Management</td>
<td>HAZARDOUS WASTE MANAGEMENT (CE)</td>
<td>A19OE1CE06</td>
<td>2</td>
<td>160</td>
<td>EEE, ME, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>Green Energy</td>
<td>RENEWABLE ENERGY TECHNOLOGIES (EEE)</td>
<td>A19OE1EE02</td>
<td>2</td>
<td>160</td>
<td>EEE, ME, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>3D Printing &amp; Design</td>
<td>INTRODUCTION TO 3D PRINTING (ME)</td>
<td>A19OE1ME02</td>
<td>2</td>
<td>158</td>
<td>EEE, ME, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>Internet of Things</td>
<td>INTRODUCTION TO MICROCONTROLLERS AND INTERFACING / ARTIFICIAL INTELLIGENCE - A BEGINNER’S GUIDE (ECE)</td>
<td>A19OE1EC02 / A19OE1CS09</td>
<td>1</td>
<td>67</td>
<td>EEE, ME, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>Augmented Reality (AR) / Virtual Reality (VR)</td>
<td>INTRODUCTION TO SIGNAL PROCESSING (ECE)</td>
<td>A19OE1EC05</td>
<td>1</td>
<td>77</td>
<td>EEE, ME, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (CSE)</td>
<td>A19OE1CS01</td>
<td>1</td>
<td>60</td>
<td>EEE, ME, ECE, EIE, AE</td>
</tr>
<tr>
<td>Robotics</td>
<td>KINEMATICS AND DYNAMICS OF ROBOTS (EIE)</td>
<td>A19OE1EI02</td>
<td>1</td>
<td>31</td>
<td>EEE, ECE, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>Cyber Security</td>
<td>CRYPTOGRAPHY AND NETWORK SECURITY (IT)</td>
<td>A19OE1CS06</td>
<td>1</td>
<td>25</td>
<td>EEE, ECE, CSE, EIE, AE</td>
</tr>
<tr>
<td>Data Sciences/Big Data Analytics</td>
<td>COMPUTATIONAL THINKING USING PYTHON (IT)</td>
<td>A19OE1IT03</td>
<td>1</td>
<td>80</td>
<td>EEE, ME, ECE, EIE, AE</td>
</tr>
<tr>
<td>Autonomous Vehicles</td>
<td>MODERN AUTOMOTIVE TECHNOLOGIES (AE)</td>
<td>A19OE1AE02</td>
<td>1</td>
<td>65</td>
<td>EEE, ECE, CSE, EIE, IT, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td>OE Track</td>
<td>Course &amp; Offering Department</td>
<td>Course code</td>
<td>Number of Sections to be offered in 2023-2024</td>
<td>Maximum Seats available for selection</td>
<td>Courses available to B.Tech.</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
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<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>General-Computing</td>
<td>RELATIONAL DATA BASE MANAGEMENT SYSTEMS (CSE/IT)</td>
<td>A19OE1CS08</td>
<td>1</td>
<td>21</td>
<td>CE, EEE, ME, ECE, EIE, AE</td>
</tr>
<tr>
<td>General</td>
<td>ENTREPRENEURSHIP (H&amp;S)</td>
<td>A19OE1HS02</td>
<td>3</td>
<td>240</td>
<td>CE, EEE, ME, ECE, CSE, IT, EIE, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td></td>
<td>SMART CITIES (CE)</td>
<td>A19OE1CE09</td>
<td>1</td>
<td>80</td>
<td>CE, ME, ECE, CSE, CIE, IT, EIE, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td></td>
<td>TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVELOPMENT (EEE)</td>
<td>A19OE1EE05</td>
<td>1</td>
<td>80</td>
<td>CE, EEE, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td></td>
<td>3D PRINTING AND DESIGN (ME)</td>
<td>A19OE1ME05</td>
<td>2</td>
<td>160</td>
<td>CE, EEE, ME, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td></td>
<td>EMBEDDED SYSTEMS FOR IOT (ECE)</td>
<td>A19OE1EC09</td>
<td>1</td>
<td>80</td>
<td>CE, EEE, ME, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td></td>
<td>ARTIFICIAL INTELLIGENCE - A BEGINNER’S GUIDE (CSE)</td>
<td>A19OE1CS09</td>
<td>1</td>
<td>80</td>
<td>CE, EEE, ME, ECE, EIE, AE</td>
</tr>
<tr>
<td></td>
<td>FUNDAMENTALS OF ROBOTICS AND DRONES (EIE)</td>
<td>A19OE1EI05</td>
<td>1</td>
<td>80</td>
<td>CE, EEE, ME, ECE, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
<tr>
<td></td>
<td>FUNDAMENTALS OF CYBER SECURITY (IT)</td>
<td>A19OE1IT08</td>
<td>1</td>
<td>80</td>
<td>CE, EEE, ME, ECE, EIE, AE</td>
</tr>
<tr>
<td></td>
<td>FUNDAMENTALS OF DATA SCIENCE (IT)</td>
<td>A19OE1IT09</td>
<td>1</td>
<td>80</td>
<td>CE, EEE, ME, ECE, EIE, AE</td>
</tr>
<tr>
<td></td>
<td>INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES (AE)</td>
<td>A19OE1AE05</td>
<td>2</td>
<td>160</td>
<td>CE, EEE, ME, ECE, CSE, EIE, IT, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&amp;DS</td>
</tr>
</tbody>
</table>

Maximum strength of each section in an elective course shall be 80.

Minimum strength required for running an elective course shall be 20.
CIVIL ENGINEERING

A19 - B.TECH. VI SEM - PROFESSIONAL ELECTIVE-II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 – 2024)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Elective Group</th>
<th>Name of the Professional Elective - II</th>
<th>Course Code</th>
<th>Number of Sections to be offered in 2023-2024</th>
<th>Maximum Seats available for selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Elective – II</td>
<td>WATER SUPPLY ENGINEERING</td>
<td>A19PE1CE10</td>
<td>2</td>
<td>160</td>
</tr>
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Maximum strength of each section in an elective course shall be 80.

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Maximum strength of each section in an elective course shall be 80.

Minimum strength required for running an elective course shall be 20.
### MECHANICAL ENGINEERING

**A19 - B.TECH. VI SEM - PROFESSIONAL ELECTIVE-II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 - 2024)**

<table>
<thead>
<tr>
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<tr>
<td>1</td>
<td>Elective – II</td>
<td>UNCONVENTIONAL MACHINING PROCESSES</td>
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### COMPUTER SCIENCE AND ENGINEERING

#### A19 - B.TECH. VI SEM - PROFESSIONAL ELECTIVE-II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 – 2024)

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<td>DISTRIBUTED SYSTEMS</td>
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Minimum strength required for running an elective course shall be 20.
## ELECTRONICS & INSTRUMENTATION ENGINEERING

A19 - B.TECH. VI SEM - **PROFESSIONAL ELECTIVE-II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 – 2024)**

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<td>AERODYNAMICS OF ROAD VEHICLES</td>
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<td>FINITE ELEMENT METHODS</td>
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### COMPUTER SCIENCE ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

**A19 - B.TECH. VI SEM - PROFESSIONAL ELECTIVE-II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 – 2024)**

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Maximum strength of each section in an elective course shall be 80.

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Maximum strength of each section in an elective course shall be 80.

Minimum strength required for running an elective course shall be 20.
### COMPUTER SCIENCE ENGINEERING (DATA SCIENCE)

**A19 - B.TECH. VI SEM - PROFESSIONAL ELECTIVE-II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 – 2024)**

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<td>Elective – II</td>
<td>DATA SCIENCE FOR ENGINEERS</td>
<td>A19PE1CS48</td>
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Maximum strength of each section in an elective course shall be 80.

Minimum strength required for running an elective course shall be 20.
**COMPUTER SCIENCE ENGINEERING (CYBER SECURITY)**

A19 - B.TECH. VI SEM - **PROFESSIONAL ELECTIVE-II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 – 2024)**

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<tr>
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<td>Elective – II</td>
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Minimum strength required for running an elective course shall be 20.
Offered by: CIVIL ENGINEERING

Courses in the OE Track:

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<tr>
<th>OE Tracks</th>
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<th>VII Sem (OE-III)</th>
<th>VIII Sem (OE-IV)</th>
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<tbody>
<tr>
<td>Smart Cities</td>
<td>Smart Cities Planning and Development</td>
<td><strong>Green Building Technology</strong></td>
<td>Smart Materials and Structures</td>
<td>Intelligent Transportation System</td>
</tr>
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</table>
OE TRACK :: SMART CITIES

In the twenty-first century, engineers are being tasked with solving ever more complex and subtle societal challenges—from climate change to unprecedented urbanisation that is materially affecting the lives of many urban populations. As engineers become ever more interdisciplinary and the boundaries of disciplines soften, they need to reflect as a community as to the appropriateness of the engineering paradigm to address these needs. Currently the engineering community is pointing to the digital technologies and the ‘smart city’ as a deliverer of efficiency and resilience without fully acknowledging the intricate socio-political context in which it is situated.

The domain of EIE was developed to modernise and automate these operations using the technological advancements in the realm of electronics. Even outside the industry, common household appliances—such as washing machine, air-conditioner, geyser, and microwave oven—cannot attract customers without features such as auto cut-off after certain time or temperature, which is again an example of instrumentation. The field of Instrumentation Engineering is also core to the recent advances such as smart home appliances, smart cities and automobiles. It is thus not far from the truth to claim that the fourth industrial revolution.

The world population is continuously growing and reached a significant evolution of the society, where the number of people living in cities surpassed the number of people in rural areas. This puts national and local governments under pressure because the limited resources, such as water, electricity, and transports, must thus be optimized to cover the needs of the citizens. Therefore, different tools, from sensors to processes, service, and artificial intelligence, are used to coordinate the usage of infrastructures and assets of the cities to build the so-called smart cities.

Different definitions and theoretical models of smart cities are given in literature. However, smart city can usually be modelled by a layered architecture, where communication and networking layer plays a central role. In fact, smart city applications lay on collecting field data from different infrastructures and assets, processing these data, taking some intelligent control actions, and sharing information in a secure way. Thus, a two-way reliable communications layer is the basis of smart cities. This chapter introduces the basic concepts of this field and focuses on the role of communication technologies in smart cities. Potential technologies for smart cities are discussed, especially the recent wireless technologies adapted to smart city requirements.

What is the concept of a smart city?

There is no universally accepted definition for a smart city because people can interpret different meanings for it. Hence, it means different things to different people. Here, you will get a basic definition that captures the essence of what a smart city is and what it does. While the concept varies from area to area depending on the resources, the basic idea behind it remains the same. A smart city aims to bring various components together to live harmoniously and attempts to do with the least environmental damage or impact. In other words, a smart city is a place with high standards of living, which survives and thrives on eco-friendly means. The size and
amenities within a smart city vary according to geography, resources available, geopolitical scenario and investment received.

Growth in Global population continues to drive citizens from rural areas to cities. With rapid expansion of urban areas, cities need to become intelligent to handle this large scale urbanization. This is driving city operators to look at smarter ways to manage complexities, increase efficiencies and improve quality of life. Today we need cities that monitor & integrate infrastructure to better optimize resources while maximizing service to its citizens. So to meet all the needs we need our cities to be smarter which brings a concept “Smart cities” Smart cities optimize the use of technology in the design & operation of infrastructure and buildings in such a way which meets the current and future needs of their citizens. To be truly smart they also require consideration of governance & growth, urban development and infrastructure, the environment & natural resources, society and community.

Smart city programs provide a range of technologies that can be applied to solve infrastructure problems associated with ageing infrastructure and increasing demands. The potential for infrastructure and urban improvement remains unrealized, however, due to technical, financial, and social constraints and criticisms that limit the implementation of smart cities concepts for infrastructure management. The discussion presented here provides a review of smart technologies including sensors, crowdsourcing and citizen science, actuators, data transmission, Internet of Things, big data analytics, data visualization, and blockchain, which can be used for infrastructure management. Smart infrastructure programs are reviewed to explore how enabling technologies have been applied across civil engineering domains, including transportation systems, water systems, air quality, energy infrastructure, solid waste management, construction engineering and management, structures, and geotechnical systems.

Making cities “smarter” by efficient management of resources and infrastructure, greener environment, and smart governance resulting in a better quality of living of its citizens. This can be enabled by the effective use of information and communication technologies (ICTs) tools, which have the ability to provide eco-friendly and economically viable solutions for cities.

Setting up a smart city is more than improving the old system with technology by simply adding sensors, remote supervision, and control to essential city services. It should be a complete shift of a paradigm in daily life when using new technologies, especially new ICT leading to smart outcomes.

**Smart solutions**

Another important feature of smart cities is that they will provide smart solutions to modern problems. These include:
- Public information systems
- Redressal of grievances
- Electronic service delivery
- Maximum engagement of citizens
- Reduced energy and fuel usage
- Reduces the development of wastes
- Smart water monitoring
- Treatment of wastewater
- Sustainable monitoring water quality
- Maximum utilization of renewable energy sources
- Usage of green building techniques
- Smart parking to reduce clutter
- Intelligent traffic management system.

**Advantages of a smart cities:**

1. Promotion of mixed land usage resulting in higher efficiency and reduced wastage of land.
2. Expanded housing opportunities.
3. Reduced congestion, air pollution and resource depletion.
4. Helps to boost local economies by promoting localized trade and interactions.
5. Efficient use of public transport to reduce fuel wastage.
6. Safe and secure localities.
8. Reduction in urban heating.

Here’s a look at some projects that have taken inspiration from the concepts used for the design of smart cities. These projects will help you build energy-efficient systems that will help heal the world.

1. **Home Automation using IoT**
2. **Smart Irrigation System**
3. **Smart Building using IoT**
4. **Smart Energy Meter using GSM**
5. **Solar and Smart Energy Systems**
6. **Smart Water Monitoring**
7. **Automated Street Lighting**
8. **Automated Railway Crossing**
9. **Intelligent Transportation Systems**
10. **Smart Sewage Maintenance Systems.**

To develop new smart cities and to transform our cities into smart cities the engineers in particular are stepping up as leaders.

**Civil & Environmental Engineers** are working to harness the potential of latest technologies and data for our urban infrastructure, which is among the most complex system in the world. They provide sustainable, resilient and advanced means of
transportation system, green building, better water management system and better waste management system. This not only develop physical infrastructure but also develop institutional & social infrastructure that enable our societies to function. Modelling these systems of systems will require managing data at an unprecedented scale.

To support them Computer and Electronics & Communication Engineers help in creating future cities that are digital, build and operate cities ICT landscape across application and infrastructure like IOT (Internet of Things), e-payment, e-market, the latest communication devices etc which is leveraging next generation technologies. They create a platform for conveyance of different city services, leverage big data analytics to manage city performance and proactive crisis management.

Electrical Engineers developing new renewable source of energy to meet ever increasing power demands. They also develop methods of effective power transmission with minimum losses which is more economical and safer. They also work on developing microchips to micro sensors which are helping in making our households, institution efficient and safer.

Conclusion:

By going through above article, it is clear that Dreaming of a smart city without active contribution of engineers is a myth. So, there will always be demand of Engineers and because of which even after crises in the placement scenario still the maximum science students choose Engineering as their first career choice in hope of a better future.
COURSE PRE-REQUISITES: Smart Cities Planning and Development

COURSE OBJECTIVES:
- To expose the students to green buildings, their features and importance in the present context of sustainable development
- To introduce various sustainable building materials for green buildings
- To acquire knowledge on various design concepts and construction aspects of green buildings
- To learn the various policies and incentives for green buildings and also different green building rating systems and codes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the importance, features and requisites of a green building
CO-2: Identify suitable sustainable building materials for construction of green building
CO-3: Plan and design various systems for green buildings
CO-4: Explain various codal provisions of green buildings and accordingly rate a building

UNIT – I:

UNIT – II:
Green Building Materials: Introduction to sustainable building materials – Sustainable Concrete – Partial replacements in concrete - Natural building materials - Bio materials - Mycelium - Engineered Wood - Structural insulated panels (SIPs) - Natural Fiber - Nontoxic materials: low VOC paints, organic paints, coating and adhesives - Use of waste materials such as paper, Cellulose, glass bottles, tires, shipping containers - Use of industrial waste such as fly-ash, bags, building demolition waste.

UNIT – III:
UNIT – IV:

UNIT – V:
**Green Building Policies and Incentives:** Green products and material certification - parameters making products green - products transparency movement - Cradle to cradle certification - Product emission testing - Carbon trust - carbon credit - returns on investments - savings Policies towards electrical power in India – Case study - Tax credits & Grants - Green construction guide.

UNIT – VI:

TEXT BOOKS:

REFERENCES:
1. Green Building Fundamentals-II, Mike Montoya, Pearson, USA, 2010
4. Introduction to Environmental Economics, Nick Hanley, Jason, F. Shogren and Ben White, Oxford University Press, 2001
Offered by: CIVIL ENGINEERING

Courses in the OE Track:

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OE TRACK :: WASTE MANAGEMENT

The courses such as solid waste management (SWM), hazardous waste management (HWM), waste to energy (WTE) and intelligent waste management and recycling system (IWM&RS) are the courses available in the waste management track stream which having a potential syllabus content to meet out the industrial and research needs. Solid waste management is an interesting track course which actual highlights the day-to-day problems where everybody is facing due to the improper management of industrial, domestic and household waste. Further, the enthusiastic aspects involved in the track courses such as: awareness on its impact over on environment, formal or scientific way of handling and management of waste and disposal scenarios.

In hazardous waste management course, handling and management of nuclear waste at national and international level have been highlighted. Further, the content enlightens about the legal process of state, central and industrial responses toward any emergency situations arise by hazardous waste. Finally, it deals about natural resource damage assessment and restoration.

Waste to energy is a pioneering course available in the track; it is one of the interesting and mindboggling course in the track which highlights the importance of converting the waste materials into wealth. It gives enough space to understand the basic process technologies in a theoretical and industrial way such as: thermal, chemical and biological conversion process. From the above, biological conversion process is in its embryonic state and having potential to expands its technological wings in the near future and having enormous scope of industrial applications where students can be benefited. Finally, conversion devices is an innovative module have been framed to explore the young minds in the line of designing and creating a demand based conversion device products which even lays an entrepreneurial pathway to them.

First of its kind, even at both international and national level a dedicated and extensive course for intelligent waste management and recycling system have been framed with conventional and advanced modules. It is really an interesting course where a student can apply his/her innovative creations to solve the existing and futuristic problems in a smart way with the help of smart tools. Optimistic modules such as: life cycle assessment and carbon-footprint-based IWMS, principles of systems engineering and regulatory frameworks have been incorporated to meet out the international requirements.

In the pathway of exploring the fundamentals and basic knowledges about the course, the six units of all the courses have been formulated keeping in the mind that the students can be able to competitive among the international community at the end of semester. In this context, comprehensive theoretical and industrial processes have been incorporated in each and every module of courses. Further, it is highly believed that the framed syllabus modules having 100% industrial applications which can make the students to feel motivated, satisfied and confidence to compete with the international community.
COURSE PRE-REQUISITES: Solid Waste Management

COURSE OBJECTIVES:
• To understand the concepts of hazardous waste management
• To understand the principle of waste characterization, storage, transport and processing
• To understand the principles of nuclear waste and Hazardous Management (HM) and emergency Response
• To understand the principle and process of landfills and natural resource Damage Assessment & Restoration

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamental concepts of hazardous waste management
CO-2: Apply the knowledge to resolve the problems on storage, transport and processing
CO-3: Apply the knowledge to resolve the practical problems on nuclear waste and HM & emergency response
CO-4: Impart the gained knowledge and skills to resolve the practical problems on landfills and natural resource damage assessment & restoration on field

UNIT – I:

UNIT – II:

UNIT – III:
Management of nuclear wastes – Decommissioning of Nuclear power reactors – Health and environmental effects.

UNIT – IV:

UNIT – V:

UNIT – VI:

TEXT BOOKS:

REFERENCES:
2. Guidelines and Criteria for Hazardous Waste Landfills and Hazardous Waste Treatment Disposal Facilities, Central Pollution Control Board, New Delhi, 2010
3. Hazardous Waste Management, Prof. Anjaneyulu
Offered by: ELECTRICAL AND ELECTRONICS ENGINEERING

Courses in the OE Track:

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OE TRACK :: GREEN ENERGY

RENEWABLE ENERGY SOURCES:

What we are studying?
The climate landscape is changing rapidly, and new technologies and solutions keep arising to respond to global and local challenges.
Renewable energy sources course makes you discover how Solar Thermal Energy conversion system works. It makes you understand how a Solar Photovoltaic generation system generates electricity. Scope of the course also includes wind energy generation. It also navigates you through Biomass and geothermal energy generation systems.

Job opportunities:
When it comes to the hottest and most buzzing careers in the 21st century, the majority of people think of hardcore technical domains such as data science, machine learning & artificial intelligence. Few people might also come up with biotechnology (or biosciences). But, quite often people forget about one of the dark horses – the Renewable Energy sector. Even Bill Gates lobbied for the Energy sector as one of the top three career choices for making an impactful career.

RENEWABLE ENERGY TECHNOLOGIES:
Within crisis there are seeds of opportunity..! We are at the wedge of fossil fuel end. After few years you can witness fuel crisis all over the world, as an engineer one must aware of the solution. To design sustainable systems those last for decades, one must use renewable energy as main or auxiliary source of energy. The application may be electrical or mechanical or chemical, one must convert energy from renewable source into electricity for ease of use.
Renewable Energy Technologies course will introduce you to Different types of Solar PV systems and their characteristics. Students will know the functionality of Power Converters such as Inverters etc., through block diagram approach. Fuel cell technology, which is one of the solutions for energy crisis will be discussed in detail. Course will conclude by discussing impact of PV panel production on environment and disposal of it.

Job Opportunities:
Green jobs in the renewable energy sector are expected to touch new figures with 6 digit monthly income. Following link may describe the interesting interdisciplinary careers for budding engineers.

ENERGY STORAGE TECHNOLOGIES
Battery technology is an essential skill for every engineer in present scenario. Course on energy storage technologies will enable student to, Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles. It will make student to understand various electrochemical storages such as Lead
acid, Li Ion cell etc. and their characteristics. The course enables student to compare non electric, electric storage systems and analyze application of them to various domains.

Job opportunities:
Upon successful completion of course student will enhance the chances of getting into EV industry, which almost open fact. Job Profiles include
i. Battery algorithms engineer
ii. Battery management engineer
iii. Battery modeling expert
iv. Design engineer – EV

ENERGY MANAGEMENT AND CONSERVATION

Energy Management And Conservation course is mainly intended to monitor energy consumption of industries and to manage energy systems. This course also deals with methods of improving efficiency of electric machinery and to design a good illumination system. It also teaches student calculate pay back periods for energy saving equipment.
COURSE PRE-REQUISITES: Renewable Energy Sources

COURSE OBJECTIVES:
- To provide necessary knowledge about the modeling, design and analysis of various PV systems
- To show that PV is an economically viable, environmentally sustainable alternative to the world’s energy supplies
- To understand the power conditioning of PV and WEC system’s power output

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model, analyze and design various photovoltaic systems
CO-2: Know the feasibility of PV systems as an alternative to the fossil fuels
CO-3: Design efficient stand alone and grid connected PV and WEC power systems

UNIT – I:

UNIT – II:
Types of PV Systems: Grid connected PV systems - Net-metering - Estimation of actual a.c. output power from PV systems
Stand-alone system - Approach to designing an off-grid PV system with battery - with battery and diesel generator - Stand-alone solar water pumping system - Sizing/designing PV water pumping system - Problems

UNIT – III:
Power Converters for PV and Wind: Basic switching devices, AC-DC Rectifier, DC-AC inverter (Basic operation), DC DC converter - Buck, Boost converters Basic operation, Battery charger (Basic operation), grid interface requirements in Renewable energy integration

UNIT – IV:
Maximum Power Point Tracking: Various Sources of Losses in PV system, Charge Control in Battery Backed PV Systems, Maximum Power Point Tracking (MPPT) - Role of DC-DC converter in MPP tracking - Perturb and Observe Method - pseudo program for P&O method, Advanced Issues & Algorithms - search steps-variable step size algorithm.

UNIT – V:
UNIT – VI:

**Solar Thermal Electricity Generation:** Sterling Engine, Solar Pond, Solar Chimney

**Solar PV System Environment Impact:** Potential Hazards in production of PV cell, Energy payback and CO2 emission of PV systems, Procedure for decommissioning of PV plant, Future Trends of Wind Energy system

**TEXT BOOKS:**


**REFERENCE:**

# 3D Printing and Design

Offered by: MECHANICAL ENGINEERING

Courses in the OE Track:

<table>
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<tr>
<th>OE Tracks</th>
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<th>VI Sem (OE-II)</th>
<th>VII Sem (OE-III)</th>
<th>VIII Sem (OE-IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Printing and Design</td>
<td>Elements of CAD</td>
<td><strong>Introduction to 3D Printing</strong></td>
<td>3D Printing - Machines, Tooling &amp; Systems</td>
<td>Reverse Engineering</td>
</tr>
</tbody>
</table>
3D Printing is a process for making a physical object from a three-dimensional digital model by laying down many successive thin layers of a material. It brings a digital CAD model into its physical form by adding layer by layer of materials. Thus called ‘Additive Manufacturing’. It is the opposite of subtractive manufacturing i.e., removing material from an object using a mechanical machine. It enables to produce complex shapes using less material than traditional manufacturing methods. There are several different techniques to 3D print an object. It saves time through prototyping and is also responsible for manufacturing impossible shapes. Due to these, it has many applications in different fields like consumer products (eyewear, footwear, design, furniture, industrial products (manufacturing tools, prototypes, functional end-use parts, dental products, prosthetics, architectural scale models, reconstructing fossils, replicating ancient artefacts, reconstructing evidence in forensic pathology etc.

3D printing has good prospects from career perspective. Various positions that could be available are CAD designers, engineers, technical developers, software developers, electronics engineers, etc.

This OE track consists of 04 courses and is designed with an objective to provide an overview of all the constituents of 3D Printing starting from elements of CAD that are needed to create CAD models, followed by basics of 3D Printing required for setting the parameters, then the machines and tools used in 3D Printing for thorough understanding of systems and processes and finally the reverse engineering of 3D printing models from actual objects.
(A19OE1ME02) INTRODUCTION TO 3D PRINTING
(Open Elective-II)

COURSE PRE-REQUISITES: Elements of CAD

COURSE OBJECTIVES:
- To understand the need of 3D Printing
- To understand about the process chain involved in 3D Printing
- To know about the two-dimensional layer by layer techniques, solid based systems & 3D Printing data exchange formats
- To know the post processing methods involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process chain involved in 3D Printing
CO-3: Explain about two-dimensional layer-by-layer techniques, solid based systems and 3D printing data exchange formats
CO-4: Apply the knowledge gained in the post-processing methods

UNIT – I:
Introduction to 3D Printing: Introduction to 3D Printing, 3D Printing evolution, Classification of 3D Printing, Distinction between 3D Printing & CNC Machining, Advantages of 3D Printing

UNIT – II:

UNIT – III:
Two-Dimensional Layer-By-Layer Techniques: Stereolithography (SL), Selective Laser Sintering (SLS), Selective Powder Building (SPB), Advantages and Applications.

UNIT – IV:

UNIT – V:
3D Printing Data Exchange Formats: STL Format, STL File Problems, Brief Overview of other translations like IGES File, HP/GL File and CT data only.

UNIT – VI:
TEXT BOOKS:

REFERENCES:
INTERNET OF THINGS

Offered by: ELECTRONICS AND COMMUNICATION ENGINEERING

Courses in the OE Track:

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<tbody>
<tr>
<td>Internet of Things</td>
<td>Sensors Transducers and Actuators</td>
<td>Introduction to Microcontrollers and Interfacing</td>
<td>IoT Protocols and its applications</td>
<td>Wireless Sensor Networks</td>
</tr>
</tbody>
</table>
OE TRACK :: INTERNET OF THINGS

The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions. IoT is changing how we live, work, travel, and do business. It is even the basis of a new industrial transformation, known as Industry 4.0, and key in the digital transformation of organizations, cities, and society overall. The IoT track helps students to learn about how to

- Learn different protocols and connectivity technologies used in IOT.
- Expose the various sensors and transducers for measuring mechanical quantities.
- Develop simple applications using 8051 microcontrollers.
- Understand the key routing protocols for sensor networks and their design issues.

Some of the more common career paths in the Internet of Things path are

- IoT Developer. ...
- IoT Architect...
- IoT Embedded Systems Designer...
- IoT Solutions Engineer...
- Professional in Sensors and Actuators...
- Embedded Programs Engineer...
- Safety Engineer...
(A19OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING
(Open Elective-II)

COURSE PRE-REQUISITES: Sensors Transducers and Actuators

COURSE OBJECTIVES:
• To differentiate various number systems
• To understanding programming concepts
• To develop simple applications using 8051 microcontrollers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic computing concepts
CO-2: Know architecture of 8051 microcontrollers
CO-3: Program internal resources of 8051 microcontroller
CO-4: Interface peripherals to 8051 microcontroller

UNIT – I:
Introduction to Computing: Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier, Inside the Computer

UNIT – II:
Embedded System Design: Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration, Design example: Model train controller.

UNIT – III:
8051 Microcontroller: Microcontrollers and Embedded Processors, Architecture and Programming Model of 8051, Special Function Register formats, Memory Organization, Timers and Counters- Operating modes, Serial port, Interrupts

UNIT – IV:
8051 Programming in C: Data types, software delay generation, Logical operations, Accessing code and data space in 8051, I/O port programming, Timer/counter programming.

UNIT – V:
8051 Programming: Serial IO modes and their programming in C, interrupts programming in C: serial, timer and external interrupts.

UNIT – VI:
TEXT BOOKS:

REFERENCES:
Offered by: ELECTRONICS AND COMMUNICATION ENGINEERING

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<tr>
<td>Augmented Reality (AR)/Virtual Reality (VR)</td>
<td>Introduction to C Sharp</td>
<td>Introduction to Signal Processing</td>
<td>Introduction to Image &amp; Video Processing</td>
<td>Applications of AR &amp; VR</td>
</tr>
</tbody>
</table>
OE TRACK :: Augmented Reality (AR) / Virtual Reality (VR)

Augmented reality (AR) and Virtual Reality (VR) bridge the digital and physical worlds. They allow you to take in information and content visually, in the same way you take in the world. AR dramatically expands the ways our devices can help with everyday activities like searching for information, shopping, and expressing yourself. VR lets you experience what it’s like to go anywhere from the front row of a concert to distant planets in outer space.

Job Roles in Augmented reality and virtual reality (AR & VR) Track

- Design Architect. ...
- Software Designer. ...
- System Validation Engineers. ...
- Software Developer. ...
- 3D Artist...
COURSE PRE-REQUISITES: Introduction to C Sharp

COURSE OBJECTIVES:
• To understand various fundamental characteristics of signals and systems
• To analyze signals in frequency domain
• To know principles of signal transmission through systems
• To understand fundamentals of digital signal

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify signals and implement various operations on signals
CO-2: Analyze the characteristics of signals and systems
CO-3: Understand the basics of filter design
CO-4: Appreciate the processes of Multirate systems

UNIT – I:
**Representation of Signals:** Continuous time and Discrete Time signals, Classification of Signals – Periodic and aperiodic, even and odd, energy and power signals, deterministic and random signals, causal and non-causal signals, complex exponential and sinusoidal signals. Concepts of standard signals. Various operations on Signals.

UNIT – II:
**Representation of Systems:** Classification of discrete time Systems, impulse response, Concept of convolution in time domain and frequency domain, response of a linear system, System function, Signal bandwidth, system bandwidth. Ideal filter characteristics.

UNIT – III:
**Sampling Theorem:** Representation of continuous time signals by its samples - Sampling theorem – Reconstruction of a Signal from its samples, aliasing
**Z –Transform:** Basic principles of z-transform, region of convergence, properties of ROC, Inverse z-transform using Partial fraction.

UNIT – IV:
**Introduction to Digital Signal Processing:** Applications of Z-Transforms- Solution of Linear Constant Coefficient Difference equations (LCCD), System function, Frequency Response of the system.

UNIT – V:
**Discrete Fourier Transforms:** Circular convolution, Comparison between linear and circular convolution, Computation of DFT.
**IIR Digital Filters:** Design of IIR Digital filters (H(s) to be given) - Impulse invariance transformation techniques, Bilinear transformation method.
UNIT – VI:

**FIR Digital Filters:** Characteristics of linear phase FIR filters and its frequency response, Comparison of IIR and FIR filters. Design of FIR filters using Fourier Method and Windowing Technique (only Hanning).

**Realization of IIR and FIR Filters:** Direct and Cascade forms.

**TEXT BOOKS:**

**REFERENCES:**
**ARTIFICIAL INTELLIGENCE**

Offered by: **COMPUTER SCIENCE AND ENGINEERING**

Courses in the OE Track:

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<tr>
<td>Artificial Intelligence</td>
<td>Mathematics for Artificial Intelligence</td>
<td><strong>Fundamentals of Artificial Intelligence</strong></td>
<td>Machine Learning Techniques</td>
<td>Deep Learning</td>
</tr>
</tbody>
</table>
Artificial Intelligence (AI) is a cognitive science with highly research activities in the major areas like Machine Learning, Robotics, Natural Language Processing and image processing. This track will cover basic foundations of artificial intelligence it will make the students industry-ready for artificial intelligence and data science job roles. Artificial intelligence is used in wide range of industrial applications such as healthcare, transportation, entertainment, insurance, transport and logistics, and customer service. Future applications of AI would be utilized in automated transportation, cyborg technology, solving problems associated with climate change, deep-sea and space exploration.
COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence

COURSE OBJECTIVES:
- To understand and analyze the importance and basic concepts of artificial intelligence and the use of agents
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the basic concepts of artificial intelligence and the use of agents into the real-world scenario
CO-2: Design and formulate complex problem solutions with the use of various searching techniques
CO-3: Correlate the algorithmic approach of machine learning algorithms for a given case study
CO-4: Analyse the phenomenon of neural networks and apply basic learning laws

UNIT – I:

UNIT – II:

UNIT – III:

UNIT – IV:
UNIT – V:
**Classical Planning**: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT – VI:
**Planning and Acting in the Real World**: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

TEXT BOOKS:

REFERENCES:
3. Artificial Neural Networks, Yegnanarayana B., PHI
BLOCKCHAIN TECHNOLOGIES

Offered by: COMPUTER SCIENCE AND ENGINEERING

Courses in the OE Track:

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<tr>
<td>Blockchain Technologies</td>
<td>Fundamentals of Computer Networks / Relational Database Management Systems</td>
<td>Distributed Data Bases</td>
<td>Cryptography and Network Security</td>
<td>Blockchain Technology</td>
</tr>
</tbody>
</table>
OE TRACK :: BLOCKCHAIN TECHNOLOGIES

The blockchain is one of the fastest growing skills in the IT sector today. This track will help the students to gain knowledge in blockchain technology, it has taken quite a turn in the industry given its popularity in providing safe and secured online transactions. Most individuals and organizations have started adopting blockchain because of the many benefits it offers to the industry today. It is used in many industry applications such as banking sector, voting, health care, real estate, the legal industry and government.
COURSE PRE-REQUISITES: Fundamentals of Computer Networks

COURSE OBJECTIVES:
• To introducing distributed databases and exploring several algorithms for processing queries and be able to use them
• To describe the methods to translate complex conceptual data models into logical and Physical database designs
• To demonstrating query optimization and its algorithms
• To enumerating the concepts behind distributed transaction processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze issues related to distributed database design
CO-2: Apply Partitioning techniques to databases
CO-3: Design and develop query processing strategies
CO-4: Describe transaction processing and concurrency control in distributed databases

UNIT – I:
Introduction: Features of Distributed versus Centralized Databases,

UNIT – II:
Distributed Database Design: A framework, the design of database fragmentation, the allocation of fragments.
Translation of Global Queries to Fragment Queries: Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

UNIT – III:

UNIT – IV:

UNIT – V:
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.
UNIT – VI:
Reliability: Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

TEXT BOOKS:
2. Distributed Databases, Stefano Ceri and Willipse Pelagatti, McGraw Hill

REFERENCES:
1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and Johhanes Gehrke, MGH
Offered by: ELECTRONICS AND INSTRUMENTATION ENGINEERING

Courses in the OE Track:

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<td>Robotics</td>
<td>Fundamentals of Robotics</td>
<td>Kinematics and Dynamics of Robots</td>
<td>Drives and Control System for Robotics</td>
<td>Robot Programming and Intelligent Control Systems</td>
</tr>
</tbody>
</table>
OE TRACK :: ROBOTICS

Robotics is a field of study that involves the design, construction and operation of robots. This field overlaps with electronics, computer science, mechatronics and artificial intelligence. Robotic companies are booming all over the world and are seeking engineers with skills for implementing Next-Level Automation. This Open Elective Track for Robotics consists of four courses and is intended for making students industry ready in the field of robotics.

The First course in this track "Fundamentals of Robotics" introduces various physical aspects of building a robot, exploring topics like how a robot perceives its environment using Sensors and how it interacts with its environment through various Actuators & Grippers. This course also inspects a variety of robot applications in different domains. Second Course in this track "Kinematics & Dynamics of robots" delves a level deeper discussing analysis and control of robots. It establishes strong mathematical foundation for describing and controlling robot movement. In this course students will learn in detail about Forward Kinematics, Inverse Kinematics, Workspace Analysis and Trajectory planning for robots.

Third Course in the Robotics track “Drives and Control System for Robots” explores in detail various Drive Mechanisms used in robotics such as Hydraulic, Pneumatic & Electric drives. After completing this course students will be able to analyze operational aspects of a drive system for a given robotic application. Fourth Course in the track “Robot Programming and Intelligent Control System” expands on Robot Programming, discussing various aspects of Robot Programming Languages and their functions. This course also dives deep into advanced topics like Artificial Intelligence, Neural Networks and Fuzzy control for robots.
VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester

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</table>

(A19OE1EI02) KINEMATICS AND DYNAMICS OF ROBOTS
(Open Elective-II)

COURSE PRE-REQUISITES: Fundamentals of Robotics

COURSE OBJECTIVES:
- To understand the basics of robot coordinate frames and their representation
- To obtain knowledge about direct kinematics and inverse kinematics for a robot manipulator
- To examine techniques for planning robot motion in a workspace
- To understand various methods for developing dynamic models for manipulator
- To learn control techniques applied to robot manipulators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Mathematically represent a Robot system
CO-2: Calculate robot hand position and orientation for specific joint angles
CO-3: Calculate joint angles to achieve a particular hand position
CO-4: Plan trajectories for robot tool to do meaningful tasks
CO-5: Analyze different controlling techniques used for robot manipulators

UNIT – I:
Introduction: Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products.

UNIT – II:
Direct Kinematics: Coordinate frames, Rotations, Homogeneous coordinates, Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis SCARA Robot and three, five and six axis Articulated Robots.

UNIT – III:
Inverse Kinematics: The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.

UNIT – IV:
Workspace Analysis and Trajectory Planning: Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT – V:
UNIT – VI:

**Robot Control:** The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD-Gravity Control.

**TEXT BOOKS:**
1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India

**REFERENCES:**
Offered by: INFORMATION TECHNOLOGY

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Cybersecurity is important because it incorporates everything that relates to protecting our sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and industry information systems from stealing and destruction endeavoured. The cyber security track helps students to learn about how to defend networks and data from unapproved access. Enhanced information security and business endurance supervision. Upgraded stakeholder confidence in your information security preparations. Developed company authorizations with the correct security controls in place.

Some of the more common career paths in the cyber security path are:
- Chief Information Security Officer.
- Forensic Computer Analyst.
- Information Security Analyst.
- Penetration Tester.
- Security Architect.
- IT Security Engineer.
- Security Systems Administrator.
- IT Security Consultant.
COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:

UNIT – III:

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication
Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:
Network Security: Email Security and Web Security

UNIT – VI:

TEXT BOOKS:
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:
Courses in the OE Track:

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<tr>
<td>Data Sciences / Big Data &amp; Analytics</td>
<td>Statistical Methods for Data Science</td>
<td>Computational Thinking using Python</td>
<td>Fundamentals of Data Mining</td>
<td>Data Analysis and Visualization</td>
</tr>
</tbody>
</table>
OE TRACK :: DATA SCIENCES / BIG DATA & ANALYTICS

**Data science** helps in risk evaluation and observing, possible deceitful comportment, payments, customer analysis, and experience, among much other exploitation. The capability to make data-driven choices generates a steadier financial situation and data scientists make the strength of the industry.

As such, data science track helps students to apply business concepts in banking, finance, manufacturing, transport, e-commerce, education, etc. that use data science. As a consequence, there are numerous Data Science applications associated to it.

**Job Roles in Data Science Track**
- Data Analyst
- Data Engineers
- Database Administrator
- Machine Learning Engineer
- Data Scientist
- Data Architect
- Statistician
- Business Analyst
- Data and Analytics Manager

**Big Data analytics** track helps the students to learn the process of gathering, establishing and examining large sets of data (called Big Data) to determine patterns and other beneficial information. Analysts occupied with Big Data characteristically want the acquaintance that comes from investigating the data.

Big data analytics is the practice of mining useful information by examining different types of big data sets. Big data analytics is utilized to determine concealed patterns, market developments and consumer favorites, for the advantage of organizational decision making.

**Job responsibilities in a Big Data Analytics Track are**
- To gather and accumulate data from disparate sources, clean it, organize it, process it, and analyse it to extract valuable insights and information.
- To identify new sources of data and develop methods to improve data mining, analysis, and reporting.
- To create data definitions for new database files or alterations made to the already existing ones for analysis purposes.
- To present the findings in reports (in table, chart, or graph format) to help the management team in the decision-making process.
- To apply statistical analysis methods for consumer data research and analysis purposes.
• To keep track of the trends and correlational patterns among complex data sets.
• To perform routine analysis tasks to support day-to-day business functioning and decision making.
• To collaborate with Data Scientists to develop innovative analytical tools.
• To work in close collaboration with both the IT team and the business management team to accomplish company goals.
COURSE PRE-REQUISITES: Statistical Methods for Data Science

COURSE OBJECTIVES:
• To understand why Python is a useful scripting language for developers
• To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
• To learn how to build and package Python modules for reusability
• To learn how to design object-oriented programs with Python classes
• To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction, History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If If- else Nested if-else Looping for While Nested loops Control Statements Break Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:
Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.
Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:
OOPs concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.
Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.
CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:
Database: Introduction, Connections, Executing queries, Transactions Handling error, Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:
1. Learning Python, David Ascher and Mark Lutz, O'Relly

REFERENCES:
Offered by: AUTOMOBILE ENGINEERING

Courses in the OE Track:

<table>
<thead>
<tr>
<th>OE Tracks</th>
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<tr>
<td>Autonomous Vehicles</td>
<td>Principles of Automobile Engineering</td>
<td><strong>Modern Automotive Technologies</strong></td>
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The invention of the wheel marked a large step in the evolution of mankind. With mobility, man experienced a new found freedom that opened the doors for several other inventions. Automobile engineering or automotive engineering is one of the most challenging careers in the field of engineering with a wide scope. This branch deals with the designing, developing, manufacturing, testing and servicing automobiles such as cars, trucks, motorcycles, scooters, etc., and the related engineering sub systems. For the perfect blend of designing and manufacturing automobiles, automobile engineering uses the features of different elements of engineering such as mechanical, electrical, electronic, instrumentation, civil, software and safety engineering. Exploring the topic from an interdisciplinary perspective is indispensable. Globalization and incredible growth of automobile industry have resulted in numerous opportunities for engineers both in India and abroad.

The 17th and 18th centuries were mostly about steam-powered vehicles transporting people and goods. While electric cars enjoyed popularity in the 19th and early 20th centuries, the later period saw the accelerated adoption of the petrol car, due to its advantages of power, mass production, cost and advances in the internal combustion engine. It is only in the 21st century that interest in electric cars has come back, given the need for cleaner, greener modes of transport. The modern period is associated with several path breaking technologies. Over the last couple of decades, there has been an explosion of electronics in vehicles. Connected cars that include technology features are ever more popular. These smart cars come with internet access, GPS, wi-fi, superior infotainment, advanced telematics and navigation capabilities. More innovations in in-vehicle infotainment and electronics promise to give car users even more enhanced capabilities in the near future.

Today, safety has become a larger concern than ever before. While entertainment and infotainment have made car driving a pleasure, this has also given rise to a growing tribe of distracted drivers. Add to this, underdeveloped roads, which take a toll on drivers today. Increased distractions and fatigue can also contribute to human fatalities. The future certainly points in the direction of driverless cars, which promise to alleviate concerns of traffic congestion and road safety. Driverless cars, also known as autonomous cars, will usher in a paradigm shift in the evolution of the modern automobile. Self-driving cars can sense the environment and traffic with the help of RADAR, LIDAR, GPS and computer vision and navigate without human intervention. Autonomous cars are claimed to have greater accuracy, reliability and faster reaction time compared to human drivers. This would lead to fewer traffic collisions and less road congestion.

Autonomous driving is a popular subject of today’s discussion and automakers are developing complex systems that allow cars to drive themselves. If technology continues on its current course, car will do the concentrating for you. Self-parking, automatic emergency braking, adaptive cruise control and lane keeping are just some of the technologies that have leapt into the market in the past few years. Put them all together, get a picture of driving to assisted driving to fully autonomous cars. The open elective track “Autonomous Vehicles” offered by the department of automobile engineering trains the students to meet the technological challenges and diverse needs of the industry and society in various areas of automobile engineering and equips them to excel in a truly competitive industry. With through knowledge in this filed, engineering graduates get opportunity to serve many top-notch automobile companies and IT companies as well.
COURSE PRE-REQUISITES: Principles of Automobile Engineering

COURSE OBJECTIVES:
- To provide an overview on advanced engine control system concepts
- To know the interdisciplinary concepts and intelligent automotive systems
- To understand the interdisciplinary concepts and GPS-enabled applications in automobile
- To present intelligent vehicle technologies like comfort, safety and security systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply advanced engine control system concepts in engineering
CO-2: Discuss the need for implementation intelligent vehicle technologies
CO-3: Address the key technologies in automotive navigation
CO-4: Appreciate the technological advancements driver assistance systems

UNIT – I:
Advanced Engine Controls: Concept of an electronic engine control system, engine control module, powertrain control module, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics.

UNIT – II:
Introduction to Intelligent Vehicles: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT – III:
Telematics: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

UNIT – IV:
Comfort Systems: Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

UNIT – V:
Safety Systems: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti-lock braking systems, traction control system, lane departure warning system.

UNIT – VI:
Security Systems: Anti-theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.
TEXT BOOKS:

REFERENCES:
3. Understanding Automotive Electronics, Bechhold, SAE, 1998
GENERAL-COMPUTING

Offered by: COMPUTER SCIENCE AND ENGINEERING / INFORMATION TECHNOLOGY

Courses in the Pool:

➢ Programming through Java
➢ Relational Data Base Management Systems
➢ Computational Thinking using Python
➢ Introduction to Data Analytics
➢ Fundamentals of Computer Algorithms
1. Programming through Java

Java is an extensively used programming language specifically intended for use in the distributed environment of the internet. Java help students to create wide-ranging applications that possibly will run on a single workstation or be distributed among servers and clients in a network.

Java is an extremely fruitful language and an upper option for many developers for many years. The motive that it has remained so prevalent is since it still happens the needs of functioning across networks.

Students will have different roles and responsibilities by learning Java Programming

- Designing, implementing, and maintaining Java applications that are often high-volume and low-latency, required for mission-critical systems.
- Delivering high availability and performance.
- Contributing in all phases of the development lifecycle.
- Writing well-designed, efficient, and testable code.

2. Relational Database Management Systems

A relational database permits you to effortlessly find precise information. It also consents you to sort based on any field and produce reports that comprise only definite fields from each record. With features like, Data Accuracy, Easy Access to Data, Data Integrity, Flexibility, Normalization, High Security, Feasible for Future Modifications

By learning RDBMS Students will have different roles in Database environment

- Data Administrator,
- Database Administrator
- Database Designer
- Application Programmer

3. Computational Thinking using Python

The python language is one of the utmost accessible programming languages available because it has streamlined syntax and not complex, which gives more importance on natural language. Due to its comfort of learning and practice, python codes can be readily written and executed much quicker than former programming languages.

Data Science: The libraries and frameworks Python offers, e.g. PyBrain, PyMySQL, and NumPy are one of the big reasons. Another reason is diversity. Python experience allows you to do a lot more than any other language, e.g. you can create scripts to automate stuff, go into web development, and so much more.
Students will have various Job Profiles by learning Python

- Software Engineer.
- Python Developer.
- Research Analyst.
- Data Analyst.
- Data Scientist.
- Software Developer.

4. Introduction to Data Analytics

Data Scientists and Analysts use data analytics techniques in their research, and businesses also use it to inform their conclusions. Data analysis can assistance corporations healthier comprehend their customers, assess their ad-campaigns, personalize gratified, create content approaches and progress products.

By learning Data Analytics students will get Jobs with different designations

- IT Systems Analyst. Systems analysts use and design systems to solve problems in information technology. ...
- Healthcare Data Analyst. ...
- Operations Analyst. ...
- Data Scientist. ...
- Data Engineer. ...
- Quantitative Analyst. ...
- Data Analytics Consultant. ...
- Digital Marketing Manager.
COURSE OBJECTIVES:

• To introduces object-oriented programming concepts using the Java language
• To introduces the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
• To introduces the implementation of packages and interfaces
• To introduces exception handling, event handling and multithreading

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Develop applications for range of problems using object-oriented programming techniques
CO-2: Design simple graphical user interface applications
CO-3: Explore the design of graphical user interface using applets and swings

UNIT – I:
Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT – II:

UNIT – III:
Exception Handling and Multi-threading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes. String Handling, Exploring Java. Util, Differences between Multi-Threaded and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing
Threads, Interthread Communication, Thread Groups, Daemon Threads, Enumerations, Autoboxing, Annotations, Generics.

UNIT – IV:

UNIT – V:
Applets: Concepts of Applets, Differences between Applets and Applications, Lifecycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

UNIT – VI:

TEXT BOOKS:
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education

REFERENCES:
1. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
2. An Introduction to Java Programming and Object-Oriented Application Development, R.A. Johnson, Thomson
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Ability to identify the data models for relevant problems
CO-3: Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:

Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing integrity constraints, Querying relational data, Logical database design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:

SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Databases, Designing Active Databases.

UNIT – III:
UNIT – IV:

UNIT – V:

UNIT – VI:
Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

TEXT BOOKS:

REFERENCES:
1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education
(A19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction, History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If-else Nested if-else Looping for While Nested loops Control Statements Break Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.
UNIT – IV:
Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.
Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:
OOPs concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

UNIT – VI:
Database: Introduction, Connections, Executing queries, Transactions Handling error, Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

REFERENCES:
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To be exposed to conceptual framework of big data
- To understand different techniques of data analysis
- To be familiar with concepts of data streams
- To be exposed to item sets, clustering, frame works and Visualization

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand big data fundamentals
CO-2: Learn various data analysis techniques
CO-3: Implement various data streams
CO-4: Understand item sets, clustering, frame works & Visualizations

UNIT – I:
Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability, analytic process and tools, Analysis vs Reporting – Modern data analytic tools,

UNIT – II:
Data Analysis: Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and Kernel methods
Analysis of Time Series: Linear systems analysis, nonlinear dynamics – Rule induction – Neural Networks: Learning and and Generalisation, competitive learning, Principal component analysis and neural networks
Fuzzy Logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT – III:

UNIT – IV:
UNIT – V:
Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern-based clustering methods – Clustering in non-Euclidean space – Clustering for streams and Parallelism.

UNIT – VI:
Frameworks and Visualization: MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques,
Interaction Techniques: Systems and Applications

TEXT BOOKS:
1. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007

REFERENCES:
1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To reinforce algorithms analysis methods
- To ability to analyse running time of an algorithm
- To understand different algorithm design strategies
- To familiarity with an assortment of important algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply algorithm design techniques and concepts to solve given engineering problem
CO-2: Analyze running times of algorithms using asymptotic analysis
CO-3: Develop efficient algorithms for computational tasks
CO-4: Computing complexity measures of algorithms

UNIT – I:

UNIT – II:
Divide and Conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters’ theorem.

UNIT – III:
Greedy Method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem, Huffman Codes.

UNIT – IV:

UNIT – V:
Dynamic Programming-II: 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

UNIT – VI:
Backtracking: General method, applications- N-Queen problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

TEXT BOOKS:

REFERENCES:
GENERAL POOL

Offered by: HUMANITIES AND SCIENCES

Courses in the OE Pool:

- Professional Ethics and Human Values
- Entrepreneurship
- Personality Development & Public Speaking
- Foreign Language – French
(A19OE1HS02) ENTREPRENEURSHIP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To impart lean management principles and practices to plan, execute, and convert one’s own idea into a sustainable business model
- To gain practical knowledge to design one’s own lean startup
- To identify and avoid the potential pitfalls in validation, design, production, and marketing phases of an innovative product or service

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy
CO-2: Apply lean methodology to startup ideas using Business Model Canvas and Lean Canvas and be able to create Business Plan
CO-3: Validate ideas, design, production, and marketing systematically using techniques such as 5 Whys, Innovation Accounting, Value and Growth Propositions
CO-4: To strategize during ideation, production, market research, marketing and facing competition

UNIT – I:
Entrepreneurial Skills and Opportunities : Role of Entrepreneurs in Indian and World Economy; Entrepreneurship as a career for engineers, scientists, and technologists; Personality and Skill Set of an Entrepreneur; Need for Ethics and Empathy for Entrepreneurs; Stories of Successful and Failed Enterprises; Current Business Trends; Entrepreneurial Management vs. Corporate Management – Roles and Scope; Concepts of Intrapreneurship, Social Entrepreneurship, Technopreneurship, Studentpreneurship; Opportunities in Telangana State and India – incubators, schemes, accelerators

UNIT – II:
Introduction to Lean Startup Methodology: Overview, Principles of Lean Startup, Lean vs. Traditional Startup; Vision-to-Steering, Start-Define-Learn-Experiment, Leap-Test-Measure-Pivot, Build-Measure-Learn
UNIT – III:
Business Model Concepts: Components of Business Plan; Business Model Canvas (BMC); Lean Canvas (LC); Pitch Deck; Elevator Pitch; Financial Aspects – Financing, Funding Stages, Inflows, Outflows; Market Research and Marketing

UNIT – IV:
Building Your Business Model: Desirability, Feasibility, and Viability; Minimum Viable Product (MVP), Proof of Concept (PoC), Prototype; Early Adopters; Value Proposition; Overview of opportunities in India – Financing and Support Schemes, Online and Offline Resources, Entrepreneurial Networks

UNIT – V:
Evaluating Your Business Model: Three Learning Milestones of Innovation; Root Cause Analysis (RCA) through 5 Whys; Pivot or Persevere; The Engines of Growth: Sticky, Viral, and Paid; Kan-ban Diagram for Project Planning and Resource Allocation

UNIT – VI:
Strengthen Your Business Model: Why startups fail? Value and Waste; Design Thinking for Business; Analogus and Antilogus; Paralysis by Analysis and Extinct by Instinct; The three A’s: Actionable, Accessible, and Auditable Metrics and Vanity Metrics

TEXT BOOKS:

REFERENCES:
GENERAL POOL

Offered by: DEPARTMENTS

Courses in the OE Pool:

- Smart Cities
- Trends in Energy Sources for Sustainable Development
- 3D Printing and Design
- Embedded Systems for IoT
- Artificial Intelligence - A Beginner’s Guide
- Blockchain Essentials
- Fundamentals of Robotics and Drones
- Fundamentals of Cyber Security
- Fundamentals of Data Science
- Introduction to Advanced Vehicle Technologies
- Introduction to Application Development with C#
- Introduction to Application Development with Java
- Introduction to Application Development with Python
COURSE OBJECTIVES:

- **To understand** smart city basic concepts, global standards, and Indian context of smart cities
- **To explain** smart community, smart transportation and smart buildings
- **To understand** Energy demand, Green approach to meet Energy demand and their capacities
- **To identify** Smart Transportation Technologies in cities and concepts towards smart city

COURSE OUTCOMES: After completion of the course, the student should be able to

- **CO-1**: Explain and elaborate smart city concepts and their international and national standards
- **CO-2**: Conceptualize smart community, transportation and building concepts
- **CO-3**: Develop and calibrate energy demand and their capacity limits
- **CO-4**: Predict the various smart urban transportation systems and the transition from existing city towards a smart city

UNIT – I:
**Introduction to Smart Cities**: Introduction to Smart Cities - Understanding Smart Cities - Dimensions of Smart Cities – World urbanization, Global Experience of Smart Cities, Smart City case studies-Indian scenario - India “100 Smart Cities” Policy and Mission.

UNIT – II:

UNIT – III
**Smart Cities Planning and Development**: Introduction to Smart Community; Smart community concepts: Concept of Smart Community - Smart Transportation - Smart Building and Home Device - Smart Health - Smart Government - Smart Energy and Water - Cybersecurity, Safety, and Privacy; Internet of Things, Blockchain, Artificial Intelligence, Alternate Reality, Virtual Reality.

UNIT – IV:
**Smart Urban Energy Systems**: Conventional vs. Smart, City components, Energy demand, Green approach to meet Energy demand, Index of Indian cities towards smartness – a statistical analysis -Meeting energy demand through direct and indirect solar resources- Efficiency of indirect solar resources and its utility, Capacity limit for
the indirect solar resources - Effectiveness in responsive environment in smart city; Smart communication using green resources - Relevant case studies

UNIT – V:
Smart Transportation Systems: Smart Transportation Technologies - Driverless and connected vehicles - ride sharing solutions - The "improve" pathway - The "shift" pathway – Smart Roads and Pavement systems – Relevant case studies

UNIT – VI:
Future of Smart Cities: The transition of legacy cities to Smart - Right transition process - the benefit of citizens, cities have to adopt effective management and governance approaches-factors in the transition phase of legacy cities to Smart cities and their managerial implications.

TEXT BOOKS:
2. Society 5.0: A People-Centric Super-Smart Society, Hitachi-UTokyo Laboratory (H-UTokyo Lab), Springer, 2020
3. The Routledge Companion to Smart Cities, Katharine S. Willis, Alessandro Aurigi, Routledge International Handbooks, 2020

REFERENCES:
2. Urban Systems Design: Creating Sustainable Smart Cities in the Internet of Things Era, Yoshiki Yamagata, Perry P. J. Yang, Elsevier, 2020
3. Smart Cities and Artificial Intelligence: Convergent Systems for Planning, Design, and Operations, Christopher Grant Kirwan, Zhiyong Fu, Elsevier, 2020
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the role of sustainable energy
- To know components of solar PV and wind energy conversion systems
- To understand the principles of Biomass, geo-thermal and wave energy systems
- To learn various energy storage methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand various sources for sustainable energy
CO-2: Understand Solar Photo voltaic and wind energy systems
CO-3: Learn the harnessing techniques of Biomass, geothermal and ocean energy
CO-4: Familiarize with energy storage methods

UNIT – I:

UNIT – II:

UNIT – III:

UNIT – IV:

UNIT – V:
Geothermal Energy: Resources, types of wells, methods of harnessing the energy
**Tidal and Wave Energy:** Potential and conversion techniques, mini-hydel power plants, and their economics.

**UNIT – VI:**

**Energy Storage:**

**Electro Chemical Storage:** lead-acid- nickel cadmium-nickel-metal-hydride and lithium type batteries-Principle of operation, Types, Advantages and disadvantages.


**TEXT BOOKS:**

**REFERENCES:**
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the need and know about the applications of 3D Printing
- To understand the need of liquid and solid based 3D Printing systems
- To know about the laser-based 3D Printing systems and importance of CAD for 3D Printing
- To understand post-processing, inspection and testing involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D Printing Systems
CO-3: Explain about the laser-based 3D Printing systems and CAD for 3D Printing
CO-4: Plan post-processing techniques and perform inspection and testing in 3D Printing

UNIT – I:
Applications: Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

UNIT – II:

UNIT – III:
Solid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Fused Deposition Modeling (FDM) and Laminated Object Manufacturing (LOM).

UNIT – IV:

UNIT – V:
CAD for 3D Printing: CAD data formats, CAD model preparation, Part orientation and support generation, Overview of 3D Printing softwares like MAGICS and MIMICS only.

UNIT – VI:
**Inspection:** Introduction, Significance, Inspection techniques like Dimensional measurement along X, Y and Z axes, visual inspection of the surface finish (overall aesthetics and intact features), flatness or warp check, and FOD (foreign objects or debris) check.

**TEXT BOOKS:**

**REFERENCES:**
COURSE PRE-REQUISITES: Programming through C

COURSE OBJECTIVES:
• To understand the basics of computing with Embedded Systems
• To expose the students to various smart sensors
• To make the students familiar with the programming concepts of Embedded development board
• To understand the basics of Internet of Things and Cloud of things

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Familiar with architectural and programming issues of Embedded Systems
CO-2: Able to select proper smart Sensor for a specific measurement application
CO-3: Analyze various protocols for Internet of Things
CO-4: Apply Internet of Things to different applications in the real world

UNIT – I:
Embedded System Design: Numbering and Coding Systems, Digital Premier, Inside the Computer
Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration.

UNIT – II:
Smart Sensors & Applications: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

UNIT – III:

UNIT – IV:

UNIT – V:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks,
Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

UNIT – VI:
**Domain Specific Applications of IoT:** IoT Design Methodology, Applications of IoT—Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

**TEXT BOOKS:**

**REFERENCES:**
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand and analyze the basic concepts of artificial intelligence
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning and computer vision

COURSE OUTCOMES: After completion of the course, the student should be able to
- CO-1: Understand and apply the basic concepts of artificial intelligence and its use cases, lives
- CO-2: Explore the various search strategies and approaches for problem solving
- CO-3: Correlate the fields related to AI, and articulate various learning paradigms
- CO-4: Describe several issues and ethical concerns surrounding AI

UNIT – I:
Introduction to AI: What is AI-On Overview, History of AI, Applications and Examples of AI, AI Concepts, Terminology, Key fields of AI. AI Issues, Concerns, and Ethical Considerations.

UNIT – II:

UNIT – III:
AI as Knowledge Exploration: Introduction to Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment, Tools to represent knowledge.

UNIT – IV:
AI as a Learning Task: Introduction to Learning, Learning types -Supervised, Unsupervised, Reinforcement Learning, Machine learning, Deep Learning, The link between AI, ML, DL.

UNIT – V:
UNIT – VI:
The future of AI: Computer Vision - Seeing the World Through AI, Bots - Conversation as a Platform, AI and the society, AI in action-the Use Cases, Building AI Projects.

TEXT BOOKS:

REFERENCES:
3. Artificial Neural Networks, Yegnanarayana B., PHI
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce and get the technological overview of blockchain technologies
- To Study the foundation of Blockchain Technology and demonstrate the various types of Blockchain
- To explore the application area of Blockchain Technology
- To introduce smart contract, consensus algorithm and Security Mechanism
- Introduction to available platforms to implement Blockchain Technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the Blockchain Technology
CO-2: Describe smart contract concepts
CO-3: Explore different types of Blockchain
CO-4: Develop the platforms to implement Blockchain Technology

UNIT – I:
**Fundamental of Blockchain Part I:** Introduction to Centralized, Decentralized and Distributed system, computer network peer to peer connection
**Fundamental of Blockchain Part II:** History of Blockchain, Various technical definitions of Blockchain. Generic elements of a blockchain: Block, Transaction, Node, Why It’s Called “Blockchain”, Characteristics of Blockchain Technology, Advantages of blockchain technology, Limitations of blockchain as a technology

UNIT – II:
**Concept of Blockchain Technology Part I:** Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X, smart contract
**Concept of Blockchain Technology Part II:** Types of blockchain: Public blockchain, private blockchain, hybrid blockchain, examples of Public, private, hybrid blockchain and it merit and demerit.

UNIT – III:
**Technical Foundations Part I:** Component of block, Structure of Block chain, Technical Characteristics of the Blockchain, genesis block, Nonce
**Technical Foundations Part II:** Cryptography, Hashing, Distributed database, Consensus mechanisms, and basic of Cryptographic primitives, Technical Characteristics of Secure Hash Algorithms (SHA), Digital signature.

UNIT – IV:
**Consensus Algorithm:** Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of authority (PoA), Confidentiality, Integrity, Authentication,
Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:
E-Governance and other contract enforcement mechanisms, Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

Crypto Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:
Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To classification by coordinate system and control system
- To acquire knowledge on different types Power Sources and Sensors
- To classify different types of Manipulators, Actuators and Grippers
- To acquire knowledge on kinematics and Vision systems used for different Robots
- To acquire knowledge on the basics of Drones

COURSE OUTCOMES: After completion of the course, the student should be able to
- CO-1: Acquire knowledge on different types of Power Sources (actuators) and Sensors, Manipulators, Actuators and Grippers
- CO-2: Acquire knowledge on different applications of various types of robots
- CO-3: Analyze the direct and the inverse kinematic problems and calculate the manipulator dynamics
- CO-4: Acquire knowledge on the applications of Machine Vision in Robotics
- CO-5: Acquire Knowledge on the basics of Drones

UNIT – I:

UNIT – II:
Sensors and Actuators:
Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
Actuators: Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magneto-strictive actuators.

UNIT – III:
Manipulators and Grippers:

UNIT – IV:
UNIT – V:
**Robot Vision:** Low level and High-level vision
Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT – VI:
**Basics of Drones:** Theory behind how drones work, individual components that makeup a drone, basic concepts involved radio-controlled model flying, building a complete quad copter drone from scratch

TEXT BOOKS:

REFERENCES:
1. Robotics Technology and Flexible Automation, Deb S. R, John Wiley
2. Robots and Manufacturing Automation, Asfahl C. R, John Wiley
4. Drones for Beginners, Udemy
COURSE PRE-REQUISITES: Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

COURSE OBJECTIVES:
• To identify the key components of cyber security in network
• To describe the techniques in protecting Information security
• To define types of analyzing and monitoring potential threats and attacks
• To access additional external resources to supplement knowledge of cyber forensics and laws

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand, appreciate, employ, design and implement appropriate security technologies
CO-2: Demonstrate policies to protect computers and digital information
CO-3: Identify & Evaluate Information Security threats and vulnerabilities in Information Systems
CO-4: Understanding computer forensics and analyzing them

UNIT – I:

UNIT – II:
Who are the cyber criminals, Classification of cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-mail Bombing-Mail Bombs, UseNet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft.

UNIT – III:

UNIT – IV:
Security Threats: Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of
attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

UNIT – V:

UNIT – VI:

TEXT BOOKS:
1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunit Belpure, Wiley

REFERENCES:
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
COURSE OBJECTIVES:

- To learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- To exploring data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication
- To understand the basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics
- To identify the importance of recommendation systems and data visualization techniques

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data

CO-2: Discuss the significance of exploratory data analysis (EDA) in data science and to apply basic tools (plots, graphs, summary statistics) to carry out EDA

CO-3: Apply basic machine learning algorithms and to identify common approaches used for Feature Generation

CO-4: Analyze fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine and to Build their own recommendation system using existing components

UNIT – I:
Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT – II:
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms: Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT – III:
One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam

UNIT – IV:
Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user
(customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT – V:

UNIT – VI:
Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

TEXT BOOKS:

REFERENCES:
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790)
COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities chassis elements
- To provide the concepts of automotive electrical systems and electric & hybrid vehicles
- To present various intelligent automotive systems and levels of vehicle autonomy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Discuss the concepts of automotive electrical systems and electric & hybrid vehicles
CO-3: Describe various intelligent automotive systems and levels of vehicle autonomy

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile and types of bodies.
Automotive Chassis: Introduction to chassis systems - engine, cooling, lubrication, fuel feed, ignition, electrical, driveline - clutch, transmission, propeller shaft, differential, axles, wheels and tyres, steering, suspension and braking.

UNIT – II:

UNIT – III:
Electrical System: Simple automotive wiring diagram and components of electrical system, starting system – starter circuit, standard Bendix and over running clutch drive, charging system – alternator, cut-outs and regulators, ignition system - conventional and electronic ignition system.

UNIT – IV:
Electric and Hybrid Vehicles: Electric vehicle – Layout, components, configurations, advantages and limitations. Hybrid vehicle - Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits.

UNIT – V:
Intelligent Vehicle Systems: Automotive navigation, night vision, head-up display, airbag, seat belt tightening system, immobilizers, adaptive cruise control, forward collision warning, lane departure warning and anti-lock braking system.

UNIT – VI:
Autonomous Vehicles: Levels of automation, research, challenges, commercial
development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

REFERENCES: