VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 135th Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
Telephone No: 040-2304 2758/59/60, Fax: 040-23042761
E-mail: postbox@vnrvjiet.ac.in, Website: www.vnrvjiet.ac.in

Estd.1995

Azadi Ka Amrit Mahotsav

ACADEMIC SECTION

VNR VJIET/ACADEMICS/2021-2022/**C056**   Date: 19.01.2022

CIRCULAR

Sub: **Online selection of Open Elective – IV, Professional Elective – V & VI courses of B. Tech. VIII semester (IV year II semester) through EDUPRIME software – Reg.**

All the HODs are requested to inform and direct B. Tech. IV year students **[R18-2018 Admitted]** to perform selection of elective courses through EDUPRIME software as per the schedule given below.
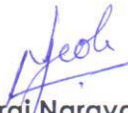
Activity	Date & Time
Selection of Open Elective – IV, Professional Elective – V & VI courses of **B.Tech. VIII semester** by B.Tech. IV year students	20.01.2022 (12.00 p.m.) to 21.01.2022 (06.00 p.m.)

B. Tech. IV 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/EduPrime2

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 VIII 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 19/01/2022
Dean, Academics

Copy to:
- Principal for information
- CAMS
- All HODs – with a request to circulate among B.Tech. VII semester students and also to visit Institute Website for more information

INSTRUCTIONS TO THE STUDENTS FOR ELECTIVE COURSE SELECTION

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/EduPrime2
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.
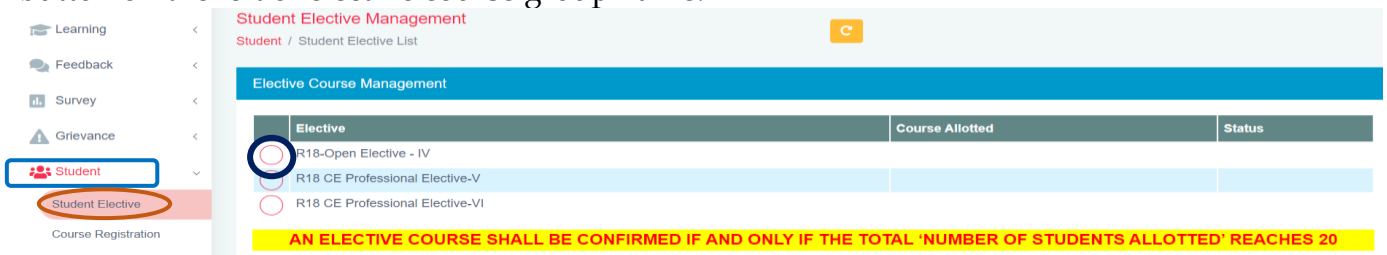
4. Pop-up containing **detailed instructions** would appear. Read the instructions carefully and then click on **'Proceed'.**
5. A screen containing the list of either open elective courses or professional elective courses depending upon the elective group selected will be displayed. This screen consist of **6** columns.

Course [Track]	Maximum number of seats in course	Number of seats allotted	Number of seats available	Select your preferred course	Status
18OE1HS02 - ENTREPRENEURSHIP [GENERAL]	240	1	239	☐	Course not yet confirmed
18OE1ME05 - 3D PRINTING AND DESIGN [GENERAL]	80	0	80	☐	Course not yet confirmed
18OE1EC09 - EMBEDDED SYSTEMS FOR IOT [GENERAL]	80	0	80	☐	Course not yet confirmed
18OE1CS09 - ARTIFICIAL INTELLIGENCE – A BEGINNER'S GUIDE [GENERAL]	80	0	80	☐	Course not yet confirmed
18OE1CS10 - BLOCKCHAIN TECHNOLOGY ESSENTIALS [GENERAL]	80	0	80	☐	Course not yet confirmed
18OE1EI05 - FUNDAMENTALS OF ROBOTICS AND DRONES [GENERAL]	80	0	80	☐	Course not yet confirmed
18OE1IT08 - FUNDAMENTALS OF CYBER SECURITY [GENERAL]	80	0	80	☐	Course not yet confirmed
18OE1IT09 - FUNDAMENTALS OF DATA SCIENCE [GENERAL]	80	1	79	☑	Course not yet confirmed
18OE1AE05 - INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES [GENERAL]	80	0	80	☐	Course not yet confirmed

- 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.
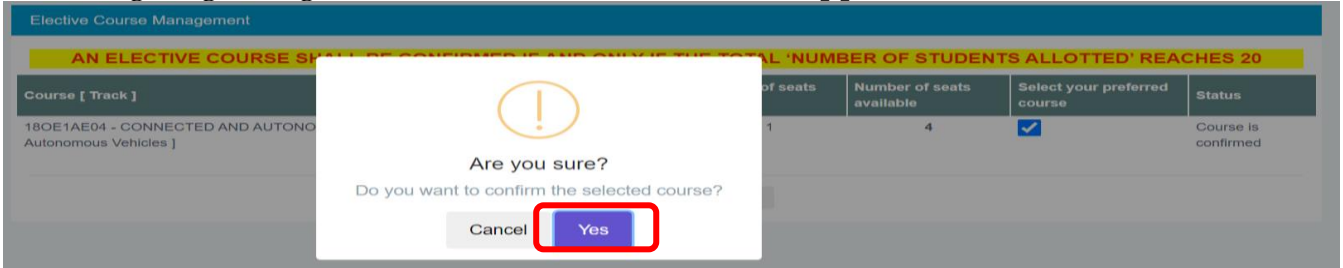
OPEN ELECTIVE TRACK BASED CATEGORY:

7. Students who **selected and pursued an OE Course based on** <u>**Open Elective Track**</u> in **VII semester** shall be able to see the following screen consisting of <u>**NEXT LEVEL COURSE UNDER THE OE TRACK i.e., Level-4 course defined in VIII semester**</u>. After selection of the displayed open elective course, press **Save**.

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

9. Click on **Freeze** button for course confirmation.

10. A message regarding confirmation of selection would appear on screen, then press **Yes**.
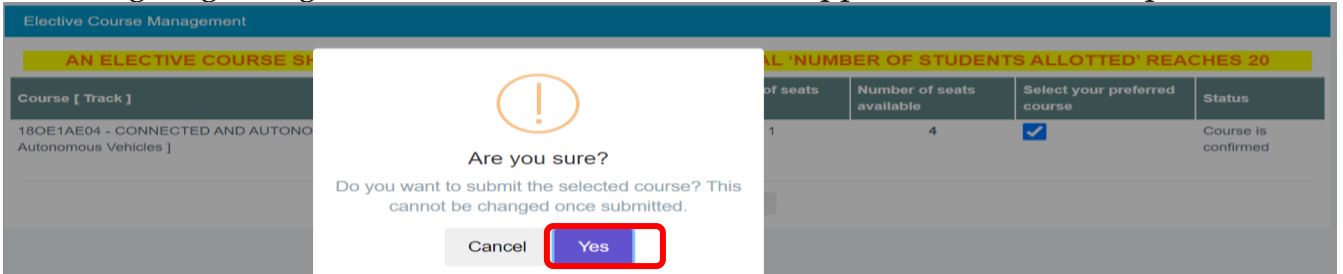
11. Upon pressing '**Close**' button displayed on the screen, student would be taken back to the first screen wherein against the open elective group name, title of the open elective course selected by the student would be shown along with the status of course.
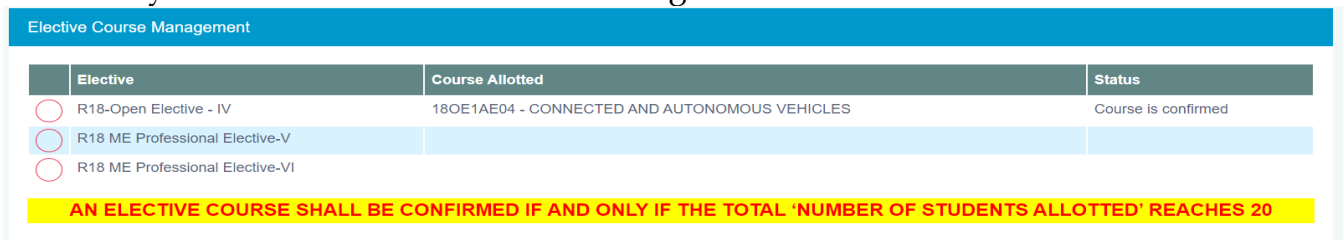
OPEN ELECTIVE GENERAL POOL BASED CATEGORY:

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

Course [Track]	Maximum number of seats in course	Number of seats allotted	Number of seats available	Select your preferred course	Status
18OE1HS04 - FOREIGN LANGUAGE – FRENCH /GERMAN [General]	5	0	5	☐	Course not yet confirmed
18OE1ME05 - 3D PRINTING AND DESIGN [General]	5	5	0		Seats are not available
18OE1EC09 - EMBEDDED SYSTEMS FOR IOT [General]	5	0	5	☑	Course not yet confirmed
18OE1EI05 - FUNDAMENTALS OF ROBOTICS AND DRONES [General]	5	4	1	☐	Course is confirmed

13. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press **Yes**, 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.

Course [Track]	Maximum number of seats in course	Number of seats allotted	Number of seats available	Select your preferred course	Status
18OE1HS04 - FOREIGN LANGUAGE – FRENCH /GERMAN [General]	5	0	5	☐	Course not yet confirmed
18OE1ME05 - 3D PRINTING AND DESIGN [General]	5	5	0		Seats are not available
18OE1EC09 - EMBEDDED SYSTEMS FOR IOT [General]	5	0	5	☑	Course not yet confirmed
18OE1EI05 - FUNDAMENTALS OF ROBOTICS AND DRONES [General]	5	4	1	☐	Course is confirmed

15. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press **Yes**, 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.

Elective	Course Allotted	Status
R18-Open Elective - IV	18OE1EC09 - EMBEDDED SYSTEMS FOR IOT	Course is confirmed
R18 CE Professional Elective-V		
R18 CE Professional Elective-VI		

AN ELECTIVE COURSE SHALL BE CONFIRMED IF AND ONLY IF THE TOTAL 'NUMBER OF STUDENTS ALLOTTED' REACHES 20

17. **PROFESSIONAL ELECTIVE GROUP:**

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 **Yes**, 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 **Yes**, otherwise press **Cancel** and make selection of another professional elective course.
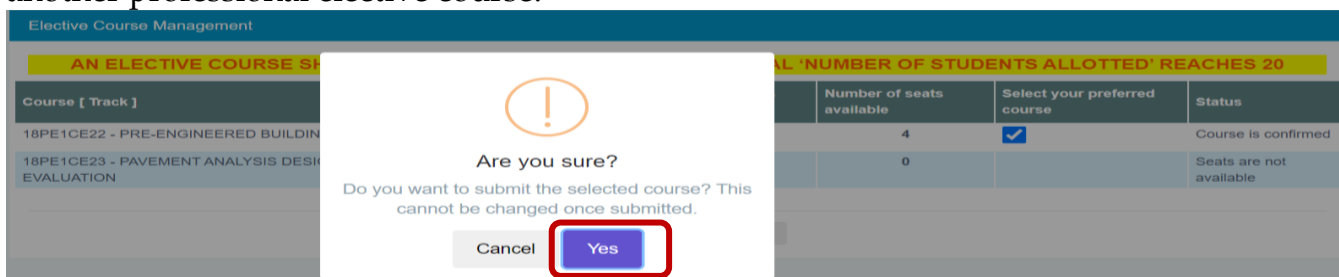
24. Upon pressing **'Close'** button displayed on the screen, student would be taken back to the first screen wherein against the Professional Elective group name, title of the elective course selected by the student would be shown along with the status of course.

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

EEE

ME

ECE

CSE

EIE

IT

CE

AME
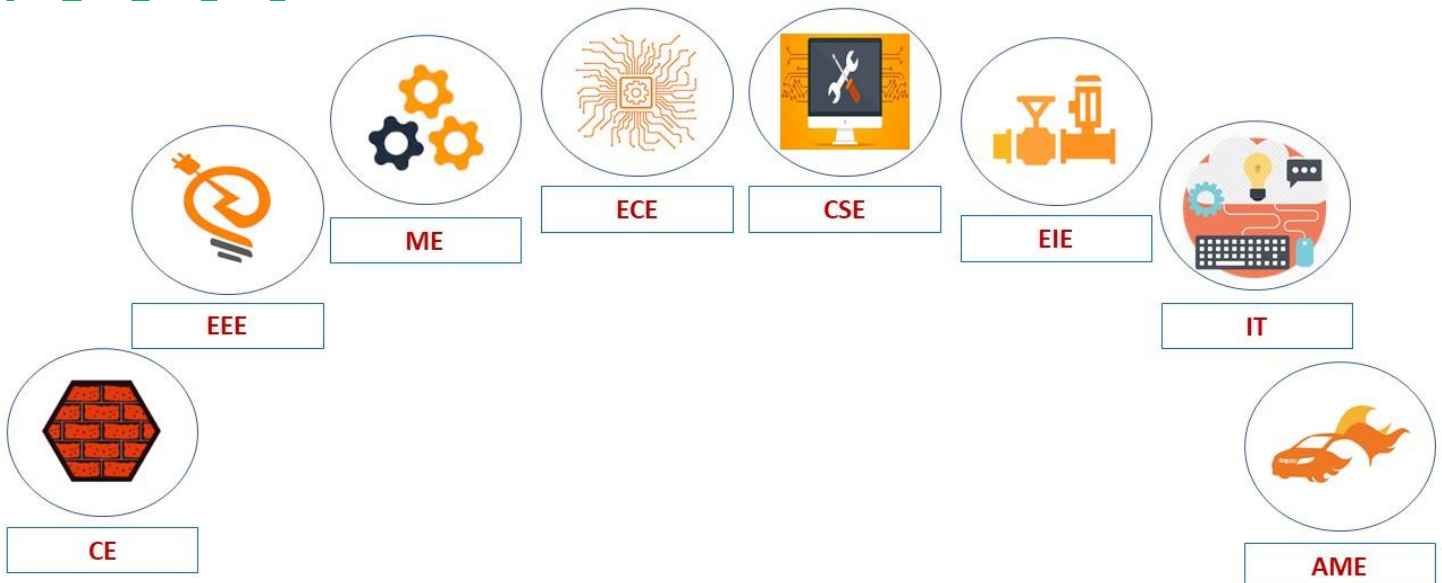
FLYER ON OPEN ELECTIVE COURSES (R18)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for CE, EEE, ME, ECE, CSE, EIE, IT B.Tech. Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH,
NIRF 135th Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O),
Hyderabad – 500 090, Telangana, India

CONTENTS:

❖ **INTRUCTIONS REGARDING OPEN ELECTIVES**

❖ **OPEN ELECTIVE TRACKS – MEZZANINE TECHNOLOGIES**

❖ **GENERAL POOL OF OPEN ELECTIVE COURSES**

❖ **SYLLABI OF VIII SEMESTER OPEN ELECTIVE COURSES**

:: PLEASE READ THE INSTRUCTIONS CAREFULLY ::

1. All the students of B.Tech. programmes under R18 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.

	V semester	VI semester	VII semester	VIII semester
Name of the OE Track	Level 1 Course	Level 2 Course	Level 3 Course	Level 4 Course

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 <u>single Mezzanine Technology track</u> successfully, as mentioned in the R18 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 <u>General pool</u> OR from any other <u>OE track</u> 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 <u>OE track</u> 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 <u>STUDENT COMING OUT OF THE ALREADY CHOSEN</u> OE track in any semester, due to any reason whatsoever, shall <u>FORFEIT THE CLAIM ON THE PROFICIENCY CERTIFICATE.</u>**

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 website.

❖ OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

OE TRACKS (Parent Department)	V SEMESTER	VI SEMESTER	VII SEMESTER	VIII SEMESTER
Smart Cities (CE)	Smart Cities Planning and Development	Green Building Technology	Smart Materials and Structures	Intelligent Transportation System
Waste Management (CE)	Solid Waste Management	Hazardous Waste Management	Waste to Energy	Intelligent Waste Management and Recycling System
Green Energy (EEE)	Renewable Energy sources	Renewable Energy Technologies	Energy Storage Technologies	Energy Management and Conservation
3D Printing & Design (ME)	Elements of CAD	Introduction to 3D Printing	3D Printing - Machines, Tooling & Systems	Reverse Engineering
Internet of Things (ECE)	Sensors Transducers and Actuators	Introduction to Microcontrollers and Interfacing	IoT Protocols and its Applications	Wireless Sensor Networks
Augmented Reality (AR) / Virtual Reality (VR) [ECE]	Introduction to C Sharp	Introduction to Signal Processing	Introduction to Image & Video Processing	Applications of AR & VR
Artificial Intelligence (CSE)	Mathematics for Artificial Intelligence	Fundamentals of Artificial Intelligence	Machine Learning Techniques	Deep Learning
Blockchain Technologies (CSE)	Fundamentals of Computer Networks / Relational Data Base Management Systems	Distributed Databases	Cryptography and Network Security	Blockchain Technology
Robotics (EIE)	Fundamentals of Robotics	Kinematics and Dynamics of Robots	Drives and Control System for Robotics	Robot Programming and Intelligent Control Systems
Cyber Security (IT)	Fundamentals of Computer Networks / Relational Data Base Management Systems	Cryptography & Network Security	Essentials of Cyber Security	Computer Forensics
Data Sciences / Big Data & Analytics (IT)	Statistical Methods for Data Science	Computational Thinking using Python	Fundamentals of Data Mining	Data Analysis and Visualization
Autonomous Vehicles (AME)	Principles of Automobile Engineering	Modern Automotive Technologies	Electric, Hybrid and Fuel Cell Vehicles	Connected and Autonomous Vehicles

❖ **GENERAL POOL OF OE COURSES:**

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

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.

OPEN ELECTIVE TRACKS ::

MEZZANINE TECHNOLOGIES

SMART CITIES

Offered by:　　　　　　**CIVIL ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Smart Cities	Smart Cities Planning and Development	Green Building Technology	Smart Materials and Structures	**Intelligent Transportation System**

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.
7. Preservation of open spaces.
8. Reduction in urban heating.
9. Promotion of transit-oriented development.
10. Making governance more people-friendly and cost-effective.

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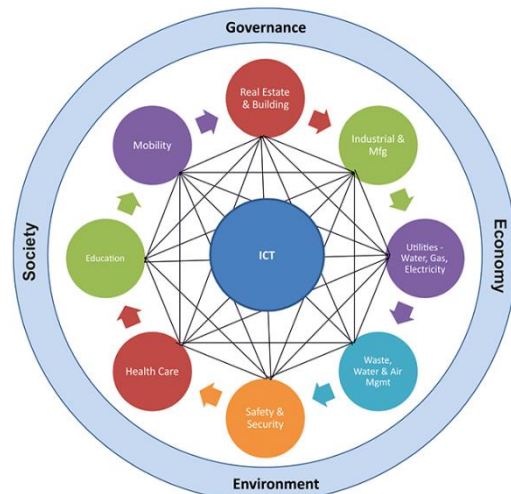
To develop new smart cities and to transform our cities into smart cities the engineers in particular are stepping up as leaders.

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1CE04) INTELLIGENT TRANSPORTATION SYSTEM
(Open Elective -IV)

COURSE PRE-REQUISITES: Smart Cities Planning and Development, Green Building Technology, Smart Materials and Structures

COURSE OBJECTIVES:
- To understand ITS architecture and standards
- To apply appropriate ITS technology depending upon site specific conditions
- To design and implement ITS components
- To understand concept and application of Automated Highway Systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Differentiate different ITS user Services
CO-2: Apply ITS for road user safety
CO-3: Interpret importance of AHS in ITS
CO-4: Extend future research and special project

UNIT – I:
Introduction to ITS: System Architecture, Standards, Database – Tracking Database – Commercial Vehicle Operations – Intelligent Vehicle Initiative - Metropolitan ITS – Rural ITS – ITS for Rail network.

UNIT – II:
ITS Travel Management: Autonomous Route Guidance System – Infrastructure based systems – Telecommunications – Vehicle – Roadside communication – Vehicle Positioning System – Electronic Toll Collection – Electronic Car Parking

UNIT – III:
ITS Designs: Modeling and Simulation Techniques - Peer – to – Peer Program – ITS for Road Network – System Design – Mobile Navigation Assistant – Traffic Information Center – Public Safety Program.

UNIT – IV:
Introduction to Automated Highway Systems: Evolution of AHS and Current Vehicle Trends - Vehicles in Platoons – Aerodynamic Benefits - Integration of Automated Highway Systems – System Configurations - Step by Step to an Automated Highway System.

UNIT – V:
Evaluation and Assessment of AHS: Spacing and Capacity for Different AHS Concepts – Communication Technologies for AHS - The Effects of AHS on the Environment – Regional Mobility - Impact Assessment of Highway Automation.

UNIT – VI:

Implementation of ITS: ITS programs globally- overview of ITS in developed countries and developing countries – ITS at Toll Plazas – Parking lots – Highways.

TEXT BOOKS:

1. Intelligent Transport Systems Handbook 2000: Recommendations for World Road Association (PIARC), Kan Paul Chen, John Miles
2. Intelligent Transport Systems – Cases and Policies, Roger R. Stough, Publisher: Edward Elgar, 2001
3. Intermodal Freight Transport, David Lowe, Elsevier Butterworth-Heinemann Publishers, 2005

REFERENCES:

1. Positioning Systems in Intelligent Transportation Systems, Chris Drane and Chris Rizos, Artech House Publishers, London, 2000
2. Perspectives on Intelligent Transport Systems, Joseph M. Sussman, Springer Publishers, 2000
3. Intelligent Transport System, Intelligent Transportation Primer, Washington, US, 2001

WASTE MANAGEMENT

Offered by: **CIVIL ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Waste Management	Solid Waste Management	Hazardous Waste Management	Waste to Energy	**Intelligent Waste Management and Recycling System**

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1CE08) INTELLIGENT WASTE MANAGEMENT SYSTEM AND RECYCLING SYSTEM
(Open Elective -IV)

COURSE PRE-REQUISITES: Solid Waste Management, Hazardous Waste Management, Waste to Energy

COURSE OBJECTIVES:
- To understand the concepts of Solid waste
- To understand the principle and process of IWMS Tools
- To understand the applications of IoT, ML, DL, BC and LCA & Carbon Foot Print (CFP) based SWM
- To understand the principles of Process Systems Engineering (PSE) and various laws and regulation of SWM

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamental concepts of Solid waste
CO-2: Apply the knowledge to resolve the practical problems with the help of IWMS Tools
CO-3: Apply the knowledge of IoT, ML, DL, BC and LCA & CFP to resolve the practical problems in SWM
CO-4: Impart the PSE knowledge and various laws and regulation to resolve the practical problems in SWM

UNIT – I:
Introduction to Solid Waste: Sources, Generation, Classification and Types of Solid Waste – Biomedical Waste – E-Waste – Construction and Demolition Waste – Plastic Waste – Batteries Waste – Hazardous Waste - Waste Management Through Waste Hierarchy: Reduce, Reuse, Recycle, Recover, and Disposal - Waste Operational Units: Equipment and Facilities: Collection and Transportation - Mechanical Treatment - Biological Treatment - Thermal Treatment – Disposal.

UNIT – II:
Introduction to IWMS Tools: Introduction – Need of the IWMS – functional elements of IWMS – Ultrasonic Sensor, Arduino Board, GSM Module, Bread Board, Power Supply (Battery) – Jump Wires - Navigation system – Cloud Services - Zero Waste Principle.

UNIT – III:
Applications in Intelligent Waste Management System: Introductory Applications of IoT, Machine Learning, Deep Learning and Block Chain Technology in Waste Characterization and Source Reduction, Storage, Collection and Transport of Wastes, Waste Processing Technologies and Waste Disposal.

UNIT – IV:

Life Cycle Assessment and Carbon-Footprint-Based IWMS: Phases of Life Cycle Assessment: Goal and Scope Definition - Life Cycle Inventory - Life Cycle Impact Assessment – Interpretation - LCA Waste Management Software - Umberto Software - SimaPro Software - LCA Assessment Methodology: Life Cycle Inventory Analysis - Life Cycle Impact Assessment – Interpretation - Sensitivity Analysis - Carbon-Footprint-Based SWM - The Global-Warming Potential Impact - GHG Accounting - GWP Assessment for Solid Waste Management.

UNIT – V:

Principles of Systems Engineering: Systems Engineering Principles and Tools for SWM - Planning Regional Material Recovery Facilities - Optimal Planning for Solid Waste Collection, Recycling, and Vehicle Routing - Multiattribute Decision Making with Sustainability Considerations - Decision Analysis for Optimal Balance between Solid Waste Incineration and Recycling Programs - Environmental Informatics for Integrated Solid Waste Management - Future Perspectives.

UNIT – VI:

Regulatory Frameworks: Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics waste, bio-medical waste, construction and demolition waste and fly ash waste.

TEXT BOOKS:
1. Sustainable Solid Waste Management - A Systems Engineering Approach, Ni-Bin Chang and Ana Pires, IEEE & John Wiley & Sons, Inc., Hoboken, New Jersey, 2015
2. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, McGraw Hill International edition, New York, 1993

REFERENCES:
1. Manual on Municipal Solid Waste Management, CPHEEO, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2014
2. Smart Waste Management- Nutshell, Vishal Gupta, Amazon.com Services LLC, September 11, 2017
3. Recyclable Household Waste Management System for Smart Home in IOT, Manpreet Kaur & Dr. Kamaljit Singh Saini, Independently Published, June 12, 2018
4. GoI, Ministry of Environment and Forest and Climate Change, Various Recent Laws and Rules of Solid Waste Management

GREEN ENERGY

Offered by: **ELECTRICAL AND ELECTRONICS ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Green Energy	Renewable Energy Sources	Renewable Energy Technologies	Energy Storage Technologies	**Energy Management and Conservation**

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 Photo voltaic generation system generates electricity. Scope of the course also includes wind energy generation. It also navigates you through Biomass and geo thermal 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 <u>Bill Gates lobbied for the Energy sector as one of the top three career choices for making an impactful career</u>.

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester

	L	T/P/D	C
	3	0	3

(18OE1EE04) ENERGY MANAGEMENT AND CONSERVATION
(Open Elective -IV)

COURSE PRE-REQUISITES: Renewable Energy sources, Renewable Energy Technologies, Energy Storage Technologies

COURSE OBJECTIVES:
* To understand the necessity of conservation of Energy
* To Know the methods of Energy management
* To identity the factors to increase the efficiency of electrical equipment
* To know the benefits of carrying out energy Audits

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To conduct Energy Audit of industries
CO-2: To manage energy Systems
CO-3: To specify the methods of improving efficiency of electric motor
CO-4: To improve power factor and to design a good illumination system
CO-5: To calculate pay back periods for energy saving equipment

UNIT – I:
Basic Principles of Energy Audit: Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit

UNIT – II:
Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manager, Qualities and functions, language, Questionnaire - check list for top management

UNIT – III:
Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

UNIT – IV:
Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, p.f with non-linear loads, effect of harmonics on p.f., p.f motor controllers – simple problems

UNIT – V:
Lighting Energy Audit and Energy Instruments: Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers, application of PLC's

UNIT – IV:
Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis.

UNIT – VI:
Analysis of Energy Efficient Motor: Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:
1. Energy Management, W. R. Murphy & G. Mckay, Butterworth-Heinemann Publications
2. Energy Management, Paul o' Callaghan, 1st Edition, McGraw Hill Book Company, 1998

REFERENCES:
1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker Inc. Ltd., 1995
2. Energy Management Handbook, W. C. Turner, John Wiley and Sons
3. Energy Management and Good Lighting Practice: Fuel Efficiency Booklet12-EEO
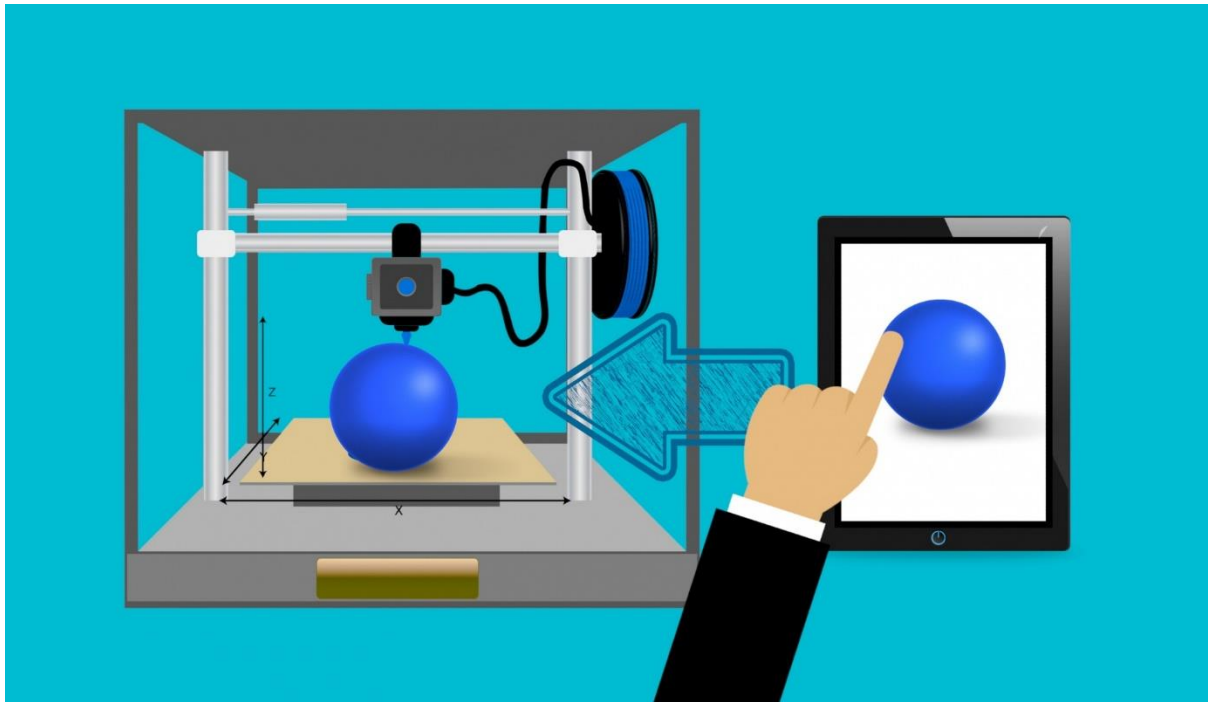
3D PRINTING AND DESIGN

Offered by: **MECHANICAL ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
3D Printing and Design	Elements of CAD	Introduction to 3D Printing	3D Printing - Machines, Tooling & Systems	**Reverse Engineering**

OE TRACK :: 3D PRINTING AND DESIGN

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, techincal 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.

B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(18OE1ME04) REVERSE ENGINEERING
(Open Elective -IV)

COURSE PRE-REQUISITES: Elements of CAD, Introduction to 3D Printing, 3D Printing Machines, Tooling & Systems

COURSE OBJECTIVES:
- To understand the Reverse Engineering (RE) methodology
- To disassemble products and specify the interactions between its subsystems and their functionality
- To understand Computer-Aided RE and Rapid Prototyping technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Basic understanding of engineering systems
CO-2: Understanding the terminologies related to re-engineering, forward engineering, and reverse engineering
CO-3: Understanding of reverse engineering methodologies
CO-4: Understanding of reverse engineering of systems

UNIT-I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Scope and tasks of RE, Brief overview of Applications

UNIT-II:
Methodologies and Techniques - Potential for Automation with 3-D Laser Scanners: Computer-aided Forward Engineering, Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering, Structural-light Range Imaging, Scanner Pipeline

UNIT-III:
Data Acquisition Techniques : Contact Methods - Coordinate Measurement Machine and Robotic Arms; Noncontact Methods - Triangulation, and Structured Light, Destructive Method; Issues involved in data acquisition techniques

UNIT-IV:
Pre-processing Techniques: Need of pre-processing, Data formats, Import of point cloud data, Reduction and filtering of data
Triangular Mesh Modeling: Need, Filtering of triangular mesh model and its definition, Topological characteristics, Euler formula for triangular mesh model, Various methods of construction of triangular mesh model.

UNIT-V:
Segmentation: Definition and need, Methods for segmentation - Edge based and face based.
Integration Between Reverse Engineering and Additive manufacturing: Modeling Cloud Data, Integration of RE and AM for Layer-based Model Generation, Adaptive

Slicing Approach for Cloud Data Modeling, Planar Polygon Curve Construction for a Layer, Determination of Adaptive Layer Thickness

UNIT-VI:
Applications: Automotive, Aerospace, Medical sectors
Legal Aspects: Copyright Law, Reverse Engineering, Recent Case Law, Barriers in adopting RE

TEXT BOOKS:
1. Reverse Engineering: An Industrial Perspective, V. Raja and K. Fernandes, Springer-Verlag
2. Reverse Engineering, K. A. Ingle, McGraw-Hill
3. Reverse Engineering, L. Wills and P. Newcomb, 1st Edition, Springer-Verlag

REFERENCES
1. Smart Product Engineering, Michael Abramovici, Rainer stark, Springer Berlin Heidelberg
2. Product Design: Techniques in Reverse Engineering and New Product Development, K. Otto and K. Wood, Prentice Hall, 2001

INTERNET OF THINGS

Offered by: **ELECTRONICS AND COMMUNICATION ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Internet of Things	Sensors Transducers and Actuators	Introduction to Microcontrollers and Interfacing	IoT Protocols and its applications	**Wireless Sensor Networks**

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…

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester   **L   T/P/D   C**
                                                             3   0   3

(18OE1EC08) WIRELESS SENSOR NETWORKS
(Open Elective -IV)

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing, IoT Protocols and its applications

COURSE OBJECTIVES:
- To expose basic concepts of wireless sensor network technology
- To study medium access control protocols and various issues in a physical layer
- To understand the key routing protocols for sensor networks and their design issues
- To understand sensor management in networks and design requirements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate various design issues of wireless sensor networks
CO-2: Understand the hardware details of different types of sensors and select the application specific sensor
CO-3: Understand radio standards and communication protocols to be used for wireless sensor networks

UNIT – I:
Introduction: Overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT – II:
Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): TinyOS, MANTIS, Contiki, and RetOS.

UNIT – III:
Programming Tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet, NetSim)

UNIT – IV:
Overview of Sensor Network Protocols (Details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi- hop and cluster-based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

UNIT – V:
Data Dissemination and Processing: Differences compared with other database management systems, Query models, In-network data aggregation, data storage; query processing.

UNIT – VI:
Specialized Features: Energy preservation and efficiency; security challenges; Fault tolerance, Issues related to Localization, connectivity and topology, Sensor

deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

TEXT BOOKS:
1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, John Wiley & Sons, India, 2012
3. Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, 1st Indian Reprint, Springer Verlag, 2010

REFERENCES:
1. Wireless Sensor Networks: An Information Processing Approach, F. Zhao and L. Guibas, Morgan Kaufmann, 1st Indian Reprint, 2013
2. Wireless Sensor Network and Applications, Yingshu Li, My T. Thai, Weili Wu, Springer Series on Signals and Communication Technology, 2008
3. Principles of Mobile Communications, Gordon L. Stuber, 2nd Edition, Springer International, 2001
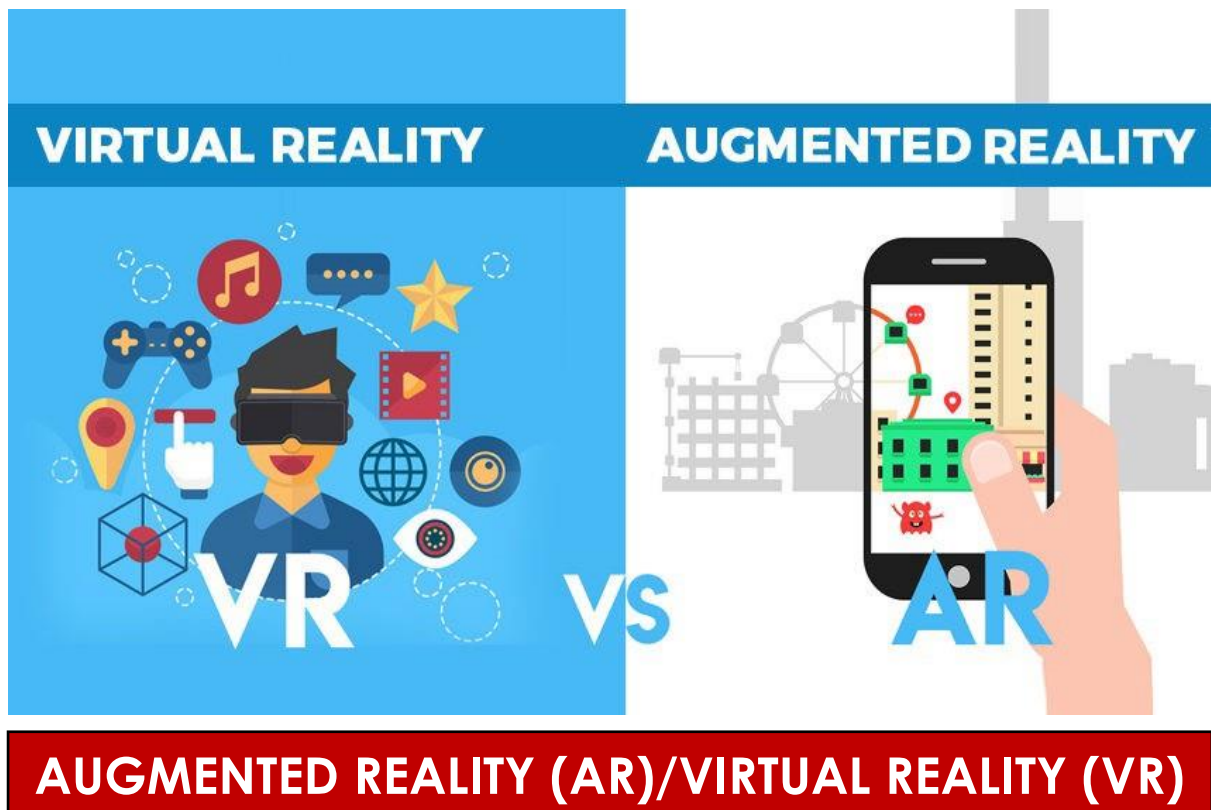
AUGMENTED REALITY (AR)/VIRTUAL REALITY (VR)

Offered by: **ELECTRONICS AND COMMUNICATION ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Augmented Reality (AR)/ Virtual Reality (VR)	Introduction to C Sharp	Introduction to Signal Processing	Introduction to Image & Video Processing	**Applications of AR & VR**

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…

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester

	L	T/P/D	C
	3	0	3

(18OE1EC07) APPLICATIONS OF AR AND VR
(Open Elective -IV)

COURSE PRE-REQUISITES: Introduction to C Sharp, Introduction to Signal Processing, Introduction to Image & Video Processing

COURSE OBJECTIVES: Throughout the course, Students will be expected to develop AR VR applications by being able to do each of the following:
- A review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- The fundamentals of VR/AR modeling and programming
- Provides a detailed analysis of engineering scientific and functional aspects of VR/AR

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge in main applications VR / AR technologies
CO-2: Analyze different tools for VR/AR applications
CO-3: Developing VR/AR applications

UNIT – I:
Augmented Reality and Virtual Reality:
Augmented Reality: Introduction to Augmented Reality (AR), Fundamentals, Chronicle order of AR, features
Virtual Reality: Introduction to Virtual Reality (VR), Features of VR and Chronicle order of VR; Difference between AR and VR.

UNIT – II:
Types of Augmented Reality: Marker based AR, Marker less AR, Projection based AR, Super Imposition based AR, Applications of AR.

UNIT – III:
Types of Virtual Reality: Non- immersive simulation, Semi-immersive simulations, Fully immersive simulations; Applications VR.

UNIT – IV:
Making an AR App with Simple CUBE: Introduction to Unity, Installation steps, Fundamentals while implementing Project, importing a cube, Create an account in Vuforia, license manager, target manager, downloading database and uploading target database in unity.

UNIT – V:
AR App with Interaction: Introduction to C#, Scripting interactive objects, implementation C# Script using unity, uploading target object, deploying application into ANDROID Device.

UNIT – VI:
Creating an Virtual Reality: Creating an Virtual Reality Scene in unity, adding colliders, Settings of Unity to make the application compatible with Google cardboard.

TEXT BOOKS:
1. Virtual Reality & Augmented Reality in Industry, Ma, D., Gausemeier, J., Fan, X., Grafe, M. (Eds.) Springer, 2011

REFERENCES:
1. http://www.realitytechnologies.com/augmented-reality/vitual-reality
2. https://en.wikipedia.org/wiki/Augmented_reality/vitual-reality
3. https://computer.howstuffworks.com/augmented-reality.html
4. https://www.theguardian.com/technology/augmented-reality

ADDITIONAL RESOURCES:
1. https://jasoren.com/making-an-ar-app-with-vuforia-and-unity3d/
2. http://www.psych.purdue.edu/~willia55/120/6.S-PMM.pdf
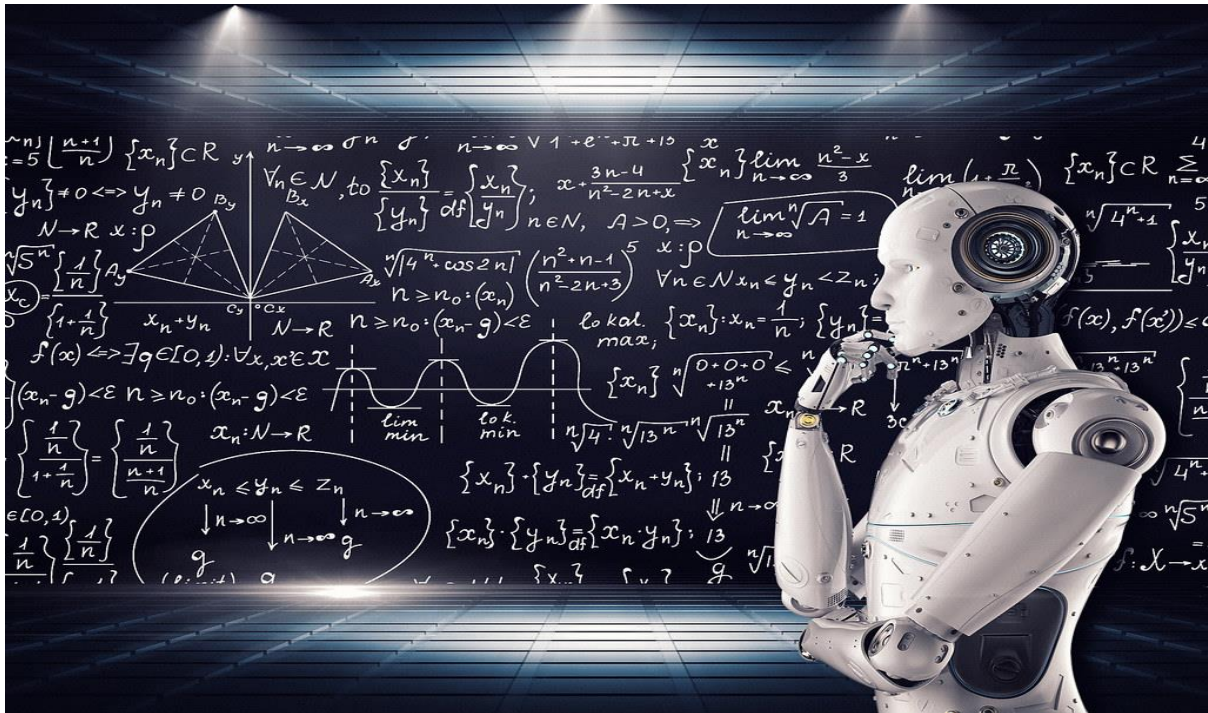
ARTIFICIAL INTELLIGENCE

Offered by: **COMPUTER SCIENCE AND ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Artificial Intelligence	Mathematics for Artificial Intelligence	Fundamentals of Artificial Intelligence	Machine Learning Techniques	Deep Learning

OE TRACK :: ARTIFICIAL INTELLIGENCE

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester   **L   T/P/D   C**
                                                             3   0   3

(18OE1CS03) DEEP LEARNING
(Open Elective -IV)

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence, Machine Learning Techniques

COURSE OBJECTIVES:
- To introduce the foundations of deep learning
- To acquire the knowledge on Deep Learning Concepts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and select appropriate learning network models required for real world problems
CO-2: Design an efficient model with various deep learning techniques
CO-3: Implement deep learning algorithms and solve real-world problems
CO-4: Apply optimization strategies necessary for problem solving required for large scale applications

UNIT – I:
Introduction to Deep Learning: History of Deep Learning, Deep Learning Success Stories, Biological Neuron, Idea of computational units, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence.

UNIT – II:
Feedforward Networks: Multilayer Perceptron, Gradient Descent, Back-propagation, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT – III:
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT – IV:
Optimization for Training Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithm.

UNIT – V:
Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Markov Networks, Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO

UNIT – VI:

Auto-Encoders: Regularization in auto-encoders, De-noising auto-encoders, Sparse auto-encoders, Contractive auto-encoders, Structured probabilistic models of deep learning.

TEXT BOOKS:

1. Deep Learning: An MIT Press Book, Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall

REFERENCES:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

BLOCKCHAIN TECHNOLOGIES

Offered by: **COMPUTER SCIENCE AND ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Blockchain Technologies	Fundamentals of Computer Networks / Relational Database Management Systems	Distributed Data Bases	Cryptography and Network Security	Blockchain Technology

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1CS07) BLOCKCHAIN TECHNOLOGY
(Open Elective -IV)

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases, Cryptography and Network Security

COURSE OBJECTIVES:
- Get the terminologies and overview of blockchain technologies
- Study the concepts and foundation of blockchain technology
- Understand security mechanism and consensus in blockchain
- Design use cases and architecture blockchain technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain a clear understanding of the concepts that underlie digital distributed ledger
CO-2: Understand key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, Highly secure and different types of Blockchain
CO-3: Apply the concept of Hash Function and Related Hash Algorithm
CO-4: Design and implement applications using Blockchain Technology

UNIT – I:
Introduction to Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, History of Blockchain, Various technical definitions of Blockchain.
Introduction to Blockchain Technology Part II: Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology.

UNIT – II:
Concept of Blockchain Technology Part I: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Block chain, Technical Characteristics of the Blockchain.
Concept of Blockchain Technology Part II: Applications of blockchain technology, Tiers of blockchain technology Bolckchain 0, Bolckchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X.

UNIT – III:
Technical Foundations Part I: Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem, Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.

Technical Foundations Part II: Consensus algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT)

UNIT – IV:
Types of Blockchain: Public blockchains, Private blockchains, Semi-private blockchains, Side chains, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:
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:
1. Mastering Blockchain, Imaran Bashir, Second Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:
1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons Inc.

ROBOTICS

Offered by: **ELECTRONICS AND INSTRUMENTATION ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Robotics	Fundamentals of Robotics	Kinematics and Dynamics of Robot	Drives and Control System for Robotics	Robot Programming and Intelligent Control Systems

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. VIII Semester	L	T/P/D	C
	3	0	3

(18OE1EI04) ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEM
(Open Elective -IV)

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics, Drives and Control Systems for Robotics

COURSE OBJECTIVES:
- Understand the fundamentals of robot programming
- Learn robot textual languages that are in common use
- Expose to artificial intelligence in robotics
- Acquire basic Knowledge on neural networks in robotics
- Acquire basic Knowledge on fuzzy logic in robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about different methods of robot programming
CO-2: Examine various robot language elements and their functions
CO-3: Analyze different AI techniques employed in robotics
CO-4: Design basic neuro-controller for robot motion control
CO-5: Apply fuzzy logic to robot control systems

UNIT – I:
Robot Programming: Methods of robot programming, leadthrough programming methods, robot program as a path in space - defining position in space, speed control, motion interpolation, WAIT, SIGNAL, DELAY commands, Branching.

UNIT – II:
Robot Languages: Textual robot language, generations of robot languages, robot language structure, operating systems, Robot language Elements and functions, constraints and variables, aggregates and location variables.

UNIT – III:
Basic Commands and Operations: Motion commands- move and related statements, speed control, points in workspace, paths and frames. End effector and sensor commands- end effector operation, sensor operation, REACT statement. Computations and operation. Program control and subroutines. Communications and data processing. Monitor mode commands.

UNIT – IV:
AI for Robotics: Introduction to Artificial Intelligence, goals of AI research, AI techniques- knowledge representation, problem representation, search techniques. LISP programming. AI and Robotics. LISP in the factory. Robotic Paradigms.

UNIT – V:

Neural Network Approach in Robotics: Introduction, Connectionist Models, Learning Principles and Learning Rules: Supervised, unsupervised, reinforcement learning. Sensor based robot learning, Neural Network in Robotics: Control of robot hands by neural network, neural set approach to robot motion coordination, robotic motor control using reinforcement learning optimization.

UNIT – VI:

Fuzzy Logic Approach in Robotics: Introduction, Fuzzy sets, Operation of Fuzzy sets, Fuzzy relations, Fuzzy rule formation, Control rules, Fuzzy algorithm in robotics, Robot obstacle avoidance using fuzzy logic, Fuzzy logic for robot path tracking and behavior coordination, fuzzy control system in mobile robots, fuzzy controller design for robot systems, Case study of fuzzy logic in robotics.

TEXT BOOKS:

1. Industrial Robotics Technology, Programming and Applications, Mikell. P. Groover, McGraw Hill, 2012
2. Robotics Technology and Flexible Automation, Deb. S. R., Tata McGraw Hill Publishing Company Limited

REFERENCES:

1. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
2. Neural Networks in Robotics, Edited by George Bekey, Kenneth Y. Goldberg, Springer US, 2012
3. Neural Networks, Fuzzy Logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI Publications
4. Introduction to Neural Networks using MATLAB 6.0, S.N. Sivanandam, S. Sumathi, S.N. Deepa, TMH, 2006

CYBER SECURITY

Offered by: **INFORMATION TECHNOLOGY**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Cyber Security	Fundamentals of Computer Networks / Relational Database Management Systems	Cryptography & Network Security	Essentials of Cyber Security	Computer Forensics

OE TRACK :: CYBER SECURITY

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(18OE1IT02) COMPUTER FORENSICS
(Open Elective -IV)

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security, Essentials of Cyber Security

COURSE OBJECTIVES:
- To provide an understanding of computer forensics fundamentals
- To analyze various computer forensics technologies and to provide computer forensics systems
- To identify methods for data recovery
- To apply the methods for preservation of digital evidence

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define and discuss the concepts of computer forensics
CO-2: Explain and apply the concepts of computer investigations
CO-3: Select and apply current computer forensics tools
CO-4: Identify and apply current practices for processing crime and incident scenes

UNIT – I:
Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

UNIT – II:
Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT – III:
Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT – IV:
Computer Forensics Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT – V:
Current Computer Forensic Tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.
Cell Phone and Mobile Device Forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – VI:
Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS:
1. Computer Forensics, Computer Crime Investigation, John R. Vacca, Firewall Media, New Delhi
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, CENGAGE Learning
3. Real Digital Forensics, Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison Wesley, Pearson Education

REFERENCES:
1. Forensic Compiling, A Practitioners Guide, Tony Sammes and Brian Jenkinson, Springer International Edition
2. Computer Evidence Collection & Presentation, Christopher L.T. Brown, Firewall Media
3. Homeland Security, Techniques & Technologies, Jesus Mena, Firewall Media
4. Software Forensics Collecting Evidence from the Scene of a Digital Crime, Robert M. Slade, TMH 2005
5. Windows Forensics, Chad Steel, Wiley India Edition

DATA SCIENCES / BIG DATA ANALYTICS

Offered by: **INFORMATION TECHNOLOGY**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Data Sciences / Big Data & Analytics	Statistical Methods for Data Science	Computational Thinking using Python	Fundamentals of Data Mining	**Data Analysis and Visualization**

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1IT05) DATA ANALYSIS AND VISUALIZATION
(Open Elective -IV)

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python, Fundamentals of Data Mining

COURSE OBJECTIVES:
- To introduce concept and characteristics of probability distribution
- To introduce underlying design principles, properties and assumptions of linear and non-linear regression modelling
- To introduce design principles involved in identifying interesting classification and prediction of data patterns
- To introduce properties of time series data and perform time series analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply probability distribution concepts to identify univariate data patterns
CO-2: Apply regression modelling to build efficient mathematical models for prediction and classification
CO-3: Apply decision and regression trees for supervised learning
CO-4: Visualize time series data by applying time series techniques

UNIT – I:
Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization, Introduction to statistical learning, Descriptive Statistics: Measures of central tendency, Measures of location of dispersions.

UNIT – II:
Basic Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test Analysis of variance, Correlation analysis, Maximum likelihood test.

UNIT – III:
Data Analysis Techniques: Regression analysis and visualization, Classification techniques and visualization, Clustering and visualization, Association rules analysis and visualization

UNIT – IV:
Time-series Analysis and Forecasting – Time-series components, Variation in Time Series, Cyclic Variation, Seasonal Variation, Irregular Variation.

UNIT – V:

Smoothing Techniques: A problem involving all four components of time series, Introduction to forecasting, forecasting models, Trend and Seasonal effects, Trend Analysis

UNIT – VI:

Case-studies and Projects: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.

TEXT BOOKS:
1. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
2. Data Mining: Theories, Algorithms, and Examples, Nong Ye, CRC Press Taylor & Francis Group, 2014
3. Statistics for Management, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui Richard I. Levin, 7th Edition, Pearson Learning

REFERENCES:
1. Probability & Statistics for Engineers & Scientists, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, 9th Edition, Prentice Hall Inc.
2. The Elements of Statistical Learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2nd Edition, Springer, 2014
3. An Introduction to Statistical Learning Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012
4. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer

SELF-DRIVING CAR

AUTONOMOUS VEHICLES

Offered by: **AUTOMOBILE ENGINEERING**

Courses in the OE Track:

OE Tracks	V Sem (OE-I)	VI Sem (OE-II)	VII Sem (OE-III)	VIII Sem (OE-IV)
Autonomous Vehicles	Principles of Automobile Engineering	Modern Automotive Technologies	Electric, Hybrid and Fuel Cell Vehicles	**Connected and Autonomous Vehicles**

OE TRACK :: AUTONOMOUS VEHICLES

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.TECH. VIII Semester

	L	T/P/D	C
	3	0	3

(18OE1AE04) CONNECTED AND AUTONOMOUS VEHICLES
(Open Elective -IV)

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies, Electric, Hybrid and Fuel Cell Vehicles

COURSE OBJECTIVES:
- To understand the fundamentals of vehicle communication and networking
- To provide state-of-the-art in wireless communication technology within and between vehicles
- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes

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

CO-1: Present the fundamentals of vehicle communication and networking
CO-2: Appreciate intra-vehicle and inter-vehicle communication technologies
CO-3: Describe various levels of vehicle autonomy
CO-4: Discuss the driver-assist and self-driving processes

UNIT – I:
Introduction to Vehicle Communications: Intra-vehicle communications - communications protocols, systems and sensors (Braking, steering, power train, chassis systems, body electronics, instrument clusters, infotainment systems), inter-vehicle communications - cooperative driving (accident warning, frontal/rear collision prevention, lane change, assistance). Consumer assistance – traffic information, multimedia support and smart parking

UNIT – II:
Communication Fundamentals and Controller Area Network: Communication fundamentals – Frequency, bandwidth, power measurement, signal to noise ratio, transmission rate constraints, radio frequency spectrum allocation, RADAR operation and types of RADAR. CAN evolution, versions, types of controllers, layered architecture. CAN bus, message frames and error handling.

UNIT – III:
Intra-Vehicle Communications: Wired communication – Network comparison, two tier approach, LIN applications - Localized vehicle area support, general support areas, CAN applications - In vehicle operation, infotainment, wireless communication – Bluetooth vehicle applications, satellite services – satellite radio, vehicle care and traffic status.

UNIT – IV:
Inter-Vehicle Communication: Adhoc Communications –Applications in Vehicle traffic Monitoring, Collision and congestion avoidance, Highway lane reservation, Emission Control, Vehicle Frequency Utilization – AM Radio, Bluetooth, FM Radio, GPS, Short range RADAR, Wireless LAN, Intelligent Roadway-Infrastructure to vehicle and

vehicle to vehicle communications. Evolving smart vehicle – ECU, wireless networking, forward RADAR, side RADAR, GPS, cellular transmission and event Recorder.

UNIT – V:
Autonomous Vehicles: Importance, levels of automation, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

UNIT – VI:
Current State of Autonomous Vehicles: 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:
1. Inter and Intra Vehicle Communications, Gilbert Held Auerbach Publications, 2008
2. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016
3. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, Editors, Springer, 2016

REFERENCES:
1. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Automotive In–vehicle Networks, J. Gabrielleen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI
5. Communication Technologies for Vehicles, Mohamed Kassab Springer, 2015

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

OE POOL :: GENERAL-COMPUTING

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII SEMESTER

L	T/P/D	C
3	0	3

(18OE1IT07) INTRODUCTION TO DATA ANALYTICS

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,
Statistical Concepts: Sampling distributions, resampling, statistical inference, prediction error.

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:
Mining Data Streams: Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform (RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT – IV:
Frequent Itemsets and Clustering: Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means.

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
2. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

REFERENCES:
1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Big Data Glossary, Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008

GENERAL POOL

Offered by: **HUMANITIES AND SCIENCES**

Courses in the OE Pool:

- ➤ Professional Ethics & Human Values

- ➤ Entrepreneurship

- ➤ Personality Development and Public Speaking

- ➤ Foreign Language – French

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1HS04) FOREIGN LANGUAGE – FRENCH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To communicate verbally in a simple way by asking and responding to simple questions related to everyday language needs
- To read and comprehend different kinds of texts (notices, informal letters, catalogues, menus etc.)
- To write clear, concise, and correct sentences and paragraphs on familiar topics.
- To recognize and use basic syntax and structures in French including articles, prepositions and connecting words as well as master basic vocabulary

COURSE OUTCOMES: After completion of the course, the student should be able to
 CO-1: Use vocabulary contextually and effectively
CO-2: Use reading skills to comprehend different kinds of texts
CO-3: Understand everyday expressions dealing with simple and concrete everyday needs, in clear, slow and well-articulated speech and manage very short mini dialogues /conversations
CO-4: Demonstrate basic competence in Written French including grammar, sentence and paragraph structure, coherence

UNIT – I: Introduce oneself and introduce someone:
Reading: Read and understand an introduction about someone
Grammar: Question words, Subject verb agreement, Mas/fem and prepositions with cities and countries
Vocabulary: professions, nationalities, countries numbers, days of the week and verbs
Writing: Build basic sentences and Write about oneself
Life Skills: Greetings, Formal and Informal way of asking questions

UNIT – II: Express likes and dislikes and Talk about your locality:
Reading: Read and understand description of a place
Grammar: Articles, prepositions, possessive adjectives, basic connecting words such as **"like, and, but",** and Negation
Vocabulary: Adjectives, verbs of preference, different places, and basic vocabulary on leisure and sports activities.
Writing: Write about hobbies and pastimes
Life Skills: Conversation fillers

UNIT – III: Take / Fix an appointment with someone:
Reading: Understand propositions and counters
Grammar: How to say time, Interrogative adjectives

Vocabulary: Irregular verbs, days of the week, Fixed expressions with Etre and Avoir and expressions to ask for appointment or refuse/accept a proposed time
Life Skills: Telephone etiquette and colloquial expressions in French

UNIT – IV: Talk about your routine / Invite someone and Accept or refuse an invitation
Reading: Read and understand an invitation on basic info: date and time, venue, occasion, type of invitation etc.
Grammar: Question word Why, Connecting word "because", partitive and contracted articles, reflexive verbs
Vocabulary: Expressions to propose, thank / apologize and accept or refuse an invitation,
Writing: Respond to an invitation (Accept or refuse)
Life Skills: At the table

UNIT – V: Ask for information (timings, price, etc) and Ask for/ Give Directions
Reading: Understand signboards and instructions
Grammar: Imperative mode and prepositions.
Vocabulary: Directions, Expressions to ask information or seek precision
Writing: Give instructions and fill a form

UNIT – VI: Vacation (plan vacation, choose destination, visit, and appreciate)
Reading: Read and understand travel brochures for basic info on offers, locations, touristic attractions hotels and so on
Grammar: demonstrative adjectives and near future tense
Vocabulary: Weather forecast, modes of transport, and vacation activities
Writing: Write a post card
Life Skills: Types of vacation in France

TEXT BOOKS:
1. Painless French, Carol Chitin, M.S., Lynn Gore, Barrons Educational Series, 2016 (ISBN: 978-1438007700)
2. Language Learning University, French: Learn French for Beginners Including French Grammar, French Short Stories and 1000+ French Phrases, Createspace Independent Publications, 2018 (ISBN: 978-1726415002)
3. Language School, French Language for Beginners, 2019 (ISBN: 978-1700175700)

REFERENCES:
1. Practice Makes Perfect: Complete French All-in-One, Annie Heminway, McGraw-Hill Education, 2018 (ISBN: 978-1260121032)
2. Easy French Step-by-Step, Myrna Bell Rochester, McGraw-Hill Education, 2008 (ISBN: 978-0071453875)
3. Contacts: Langue et culture françaises, Jean-Paul Valette, Rebecca Valette, Wadsworth Publishing Co. Inc., 2012 (ISBN: 978-1133309581)

GENERAL POOL

Offered by: **DEPARTMENTS**

Courses in the OE Pool:

➢ 3D Printing and Design

➢ Embedded Systems for IoT

➢ Fundamentals of Robotics and Drones

➢ Introduction to Advanced Vehicle Technologies

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1ME05) 3D PRINTING AND DESIGN

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:
Introduction: Introduction to 3D Printing, Classification, 3D Printing Process Chain, Materials for 3D Printing, Distinction between 3D Printing & Conventional Manufacturing.
Applications: Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Material Jetting and Binder Jetting.

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

UNIT – IV:
Laser Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP).

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:

Post Processing: Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing.

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:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
2. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
3. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000
4. Rapid Prototyping, Gebhardt A., Hanser, Gardener Publications, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1EC09) EMBEDDED SYSTEMS FOR IOT

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:
Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – IV:
Micro Controller Board: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

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:
1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015

REFERENCES:
1. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005
3. Internet of Things with Raspberry Pi and Arduino, Singh, R., Gehlot, A., Gupta, L., Singh, B., Swain, M., Boca Raton, CRC Press, 2020

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	L	T/P/D	C
	3	0	3

(18OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To classify based on coordinate system and control system
- To acquire knowledge on different types of 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:
Basic Concepts & Fundamentals: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

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:
Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

UNIT – IV:
Kinematics: Matrix representation of translational and Rotational motion – Homogeneous Transformation-DH representation of standard configuration Robots-

Inverse Kinematics. Joint space vs. Cartesian space-Basics of Trajectory planning in joint and Cartesian space.

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:

1. Introduction To Robotics: Analysis, Control, Applications, Wiley, Saeed B. Niku, 2nd Edition
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover, Nicholas G Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012

REFERENCES:

1. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
2. Robots and Manufacturing Automation, Asfahl C. R., John Wiley
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin. M, Prentice Hall of India, New Delhi
4. Drones for Beginners, Udemy

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	L	T/P/D	C
	3	0	3

(18OE1AE05) INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES

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:
Engine: Working principle of four stoke and two stroke SI and CI engines, fuel system – layout of petrol and diesel fuel systems, electronic fuel injection - multi-point fuel injection, gasoline direct injection, common rail direct injection.

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:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann, Oxford, 2001
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2004

REFERENCES:

1. Automotive Mechanics, Giri N. K., Khanna Publications, 2006
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw Hill Co., Ltd., New Delhi, 1975
3. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
4. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016

OPEN ELECTIVE – IV COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

OE Track	Name of the Open Elective – IV Course & Offering Department	Course code	Number of Sections to be offered in 2021-2022	Seats already allotted and FREEZED	Courses available to B.Tech.
Smart Cities	INTELLIGENT TRANSPORTATION SYSTEM (CE)	18OE1CE04	1	80	EEE, ME, ECE, CSE, EIE, IT, AE
Waste Management	INTELLIGENT WASTE MANAGEMENT AND RECYCLING SYSTEM (CE)	18OE1CE08	1	75	EEE, ME, ECE, CSE, EIE, IT, AE
Green Energy	ENERGY MANAGEMENT AND CONSERVATION (EEE)	18OE1EE04	2	158	CE, ME, ECE, CSE, EIE, IT, AE
3D Printing & Design	REVERSE ENGINEERING (ME)	18OE1ME04	2	99	CE, EEE, ECE, CSE, EIE, IT, AE
Internet of Things	WIRELESS SENSOR NETWORKS (ECE)	18OE1EC08	1	45	CE, EEE, ME, AE
Artificial Intelligence	DEEP LEARNING (CSE)	18OE1CS03	2	86	CE, EEE, ME, ECE, EIE, AE
Robotics	ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEMS (EIE)	18OE1EI04	2	99	CE, EEE, ME, ECE, CSE, IT, AE
Cyber Security	COMPUTER FORENSICS (IT)	18OE1IT02	2	132	CE, EEE, ME, ECE, EIE, AE
Data Sciences/ Big Data Analytics	DATA ANALYSIS AND VISUALIZATION (IT)	18OE1IT05	1	46	CE, EEE, ME, ECE, EIE, AE
Autonomous Vehicles	CONNECTED AND AUTONOMOUS VEHICLES (AE)	18OE1AE04	3	168	CE, EEE, ME, ECE, CSE, EIE, IT

OE Track	Name of the Open Elective – IV Course & Offering Department	Course code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection	Courses available to B.Tech.
General-Computing	INTRODUCTION TO DATA ANALYTICS **(CSE/IT)**	18OE1IT07	1	62	**CE, EEE, ECE, ME, EIE, AE**
General-	FOREIGN LANGUAGE-FRENCH **(H&S)**	18OE1HS04	3	237	**CE, EEE, ME, ECE, CSE, IT, EIE, AE**
	3D PRINTING AND DESIGN **(ME)**	18OE1ME05	1	80	**CE, EEE, ECE, CSE, EIE, IT, AE**
	EMBEDDED SYSTEMS FOR IOT **(ECE)**	18OE1EC09	2	160	**CE, EEE, ME, AE**
	FUNDAMENTALS OF ROBOTICS AND DRONES **(EIE)**	18OE1EI05	1	80	**CE, EEE, ME, ECE, CSE, IT, AE**
	INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES **(AE)**	18OE1AE05	1	80	**CE, EEE, ME, ECE, CSE, EIE, IT**

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

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1	Elective – V	Pre-Engineered Buildings	18PE1CE22	1	80
2		Pavement Analysis Design and Evaluation	18PE1CE23	2	160
1	Elective – VI	Ground Improvement Techniques	18PE1CE26	1	80
2		Construction Technology and Project Management	18PE1CE29	2	160

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

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

ELECTRICAL & ELECTRONICS ENGINEERING

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1	Elective – V	HVDC Transmission	18PE1EE14	2	160
1	Elective – VI	Power Quality	18PE1EE15	2	160

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

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1	Elective – V	Advances in CAD/CAM	18PE1ME23	1	80
2		Metal Casting Technology	18PE1ME25	1	80
1	Elective – VI	Power Plant Engineering	18PE1ME26	1	80
2		Advanced Machine Design	18PE1ME28	1	80

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

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

ELECTRONICS AND COMMUNICATION ENGINEERING

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1	Elective – V	Advanced Communications	18PE1EC14	1	80
2		Biomedical Signal Processing	18PE1EI07	1	80
3		Mobile Computing	18PE1CS01	1	80
4		Cloud Computing	18PE1IT05	1	80
5		RF IC Design	18PE1EC15	1	80
1	Elective – VI	Radar Systems	18PE1EC16	2	80
2		Adaptive Signal Processing	18PE1EC17	1	80
3		Wireless Sensor Networks and Protocols	18PE1EC18	2	80
4		Distributed Trust and Blockchain Technologies	18PE1CS17	1	80
5		DSP Processors and Architectures	18PE1EC19	1	80

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 AND ENGINEERING

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1	Elective – V	Information Retrieval Systems	18PE1CS14	2	160
2		Cloud Computing	18PE1IT05	2	160
1	Elective – VI	Distributed Trust and Blockchain Technologies	18PE1CS17	1	80
2		Data Visualization	18PE1IT15	1	80
3		Cognitive Engineering	18PE1CS19	2	160

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

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

ELECTRONICS & INSTRUMENTATION ENGINEERING

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1	Elective – V	Digital Control Systems	18PE1EI10	1	80
2		Instrumentation for Pharmaceutical Industries	18PE1EI11	1	80
3		Principles and Applications of Nano Technology	18PE1EC23	2	160
4		CPLD and FPGA Architecture	18PE1EC05	1	80
5		Biomedical Nano Technology	18PE1EI12	1	80
1	Elective – VI	Automotive Instrumentation	18PE1EI13	1	80
2		Instrumentation and Control for Petrochemical Industries	18PE1EI14	2	160
3		Wireless Sensor Networks and Protocols	18PE1EC18	1	80
4		Digital Image Processing	18PE1EC04	1	80
5		Medical Imaging and Processing	18PE1EI15	1	80

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

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

INFORMATION TECHNOLOGY

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1		Neural Networks and Deep Learning	18PE1CS10	1	80
2	Elective – V	Network Security	18PE1IT13	1	80
3		Advanced Databases	18PE1IT14	1	80
1		Information Retrieval Systems	18PE1CS14	1	80
2	Elective – VI	Software Defined Networks	18PE1IT16	1	80
3		Distributed Trust and Blockchain Technologies	18PE1CS17	1	80

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

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

AUTOMOBILE ENGINEERING

R18 - B.TECH. VIII SEM - PROFESSIONAL ELECTIVE – V & VI COURSES AVAILABLE FOR SELECTION (A.Y. 2021 – 2022)

S. No.	Elective Group	Name of the Professional Elective	Course Code	Number of Sections to be offered in 2021-2022	Maximum Seats available for selection
1	Elective – V	Fuel Cell Technology	18PE1AE17	1	80
2		Automotive Materials	18PE1AE19	1	80
3		Flexible Manufacturing Systems	18PE1ME29	1	80
1	Elective – VI	Two and Three Wheeler Technology	18PE1AE20	1	80
2		Auto Air-conditioning	18PE1AE21	1	80
3		Special Purpose Vehicles	18PE1AE23	1	80

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

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