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, AME Programmes and
M.Tech. – STRE, PE, AMS, SWE Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 2023: 101-150 Rank Band 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.
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ACADEMIC SECTION

VNR VJIET/ACADEMICS/2023-2024/**C053** Date: 22.12.2023

CIRCULAR

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

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

Activity	Date & Time
Selection of Open Elective – II and Professional Elective – II courses of **B.Tech. VI semester** by B.Tech. III year students	27.12.2023 (04.00 p.m.) to 28.12.2023 (06.00 p.m.)

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

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

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

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

22/12/23
Dr. Y. Shivraj Narayan
Co-ordinator, Academics

22/12/2023
Dr. K. Anuradha
Dean, Academics

Copy to:

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

VNRVJIET B.TECH. A19 ACADEMIC REGULATION :: OPEN ELECTIVE COURSES

:: PLEASE READ THE INSTRUCTIONS CAREFULLY ::

1. All the students of B.Tech. programmes under A19 academic regulation are informed that there are a total of **four Open-Elective (OE) courses to be studied** by them **one each in V, VI, VII and VIII semester**.
2. A student needs to select and pursue one open-elective course of his/her choice in each semester.
3. These courses are designed and grouped as **specialized tracks based on emerging technologies** called as "**Mezzanine Technologies**".
4. There are a total of **12 OE tracks based on Mezzanine Technologies** in the curriculum i.e.,
   i) Smart Cities
   ii) Waste Management
   iii) Green Energy
   iv) 3D Printing & Design
   v) Internet of Things
   vi) Augmented Reality (AR) / Virtual Reality (VR)
   vii) Artificial Intelligence
   viii) Blockchain Technologies
   ix) Robotics
   x) Cyber Security
   xi) Data Sciences / Big Data & Analytics
   xii) Autonomous Vehicles
5. Each **OE track based on a Mezzanine Technology** shall have **four courses**, one placed in each semester i.e., one each in V, VI, VII and VIII semester respectively as shown below.

	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 single Mezzanine Technology track successfully, as mentioned in the A19 Academic Regulation, shall be awarded a separate PROFICIENCY CERTIFICATE IN THAT SPECIALIZED TECHNOLOGY from the Institute.**

Ex. B.Tech. (Mechanical Engineering) with Proficiency in "Internet of Things"

10. By default, an open-elective course from a specialized OE track selected by the student in V semester shall be **his / her preferred OE track for the remaining 3 semesters.** It shall be deemed that the student is willing to continue to study the remaining 3 OE courses (level 2, 3 & 4) from the same track in the subsequent semesters unless the student wishes to exit from the track and opt for another OE track or course from General pool. Those students who would like to go for change of OE track need to submit a request in writing to Dean, Academic through HoD.
11. Students dropping out of the OE track may **opt to choose and pursue a course either from the General pool OR from any other OE track subjected to the offering and availability of seats of that OE track/course in semester.**
    a) In the event of student selecting a course from other OE track for studying in VI or VII semester, it shall be **the responsibility of the student to fulfill the eligibility conditions (pre-requisite courses) to pursue that course.**
    b) That is the student shall **complete all the pre-requisite courses on his/her own through MOOC offered by SWAYAM-NPTEL (courses that are atleast 80% equivalent – as decided by the respective Chairman, BoS and Dean, Academic)** prior to the start of semester in which the course is to be studied.
    c) Student shall **produce a documentary evidence** in support of this claim to the Dean, Academic to become eligible for taking the course**.** In case of the **pre-requisite course not on offer in the MOOC platforms, the fulfillment of pre-requisite courses shall be decided through a Diagnostic test** conducted by the parent department offering the course. A student completing the diagnostic test successfully shall be deemed to have met the pre-requisite courses criteria and shall be **allowed to change the OE track depending upon offering and availability of seats in that track.**
12. **Changing of an OE track by a student shall be allowed for pursuing OE courses of VI and VII semesters only i.e.,** a student shall be allowed to change the OE track only twice i.e., before the start of VI and VII semesters in the four semester span. However, **this condition shall not be applicable to the students opting for pursuing courses from General pool.**
13. **In the event of a STUDENT COMING OUT OF THE ALREADY CHOSEN OE track in any semester, due to any reason whatsoever, shall FORFEIT THE CLAIM ON THE PROFICIENCY CERTIFICATE.**
14. Open-elective courses offered in General pool may be appended with more number of courses as and when required at the discretion of the Institute and shall be informed well before the selection of electives by the students.
15. **It is informed that *only a limited number of elective courses shall be offered for selection* at the discretion of the offering department and Institute which shall be announced well before the start of the next semester.**
16. The list of OE courses under each of the specialized OE tracks is given in next section. For more details please refer to the Institute.

❖ OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

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	Fundamentals of Internet of Things	Wireless Sensor Networks
Augmented Reality (AR) / Virtual Reality (VR) [ECE]	Introduction to C Sharp	Introduction to Signal Processing	Introduction to Image & Video Processing	Fundamentals of Augmented Reality & Virtual Reality
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 / German / Spanish)
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 • Introduction to Application Development with C# • Introduction to Application Development with Java • Introduction to Application Development with Python

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

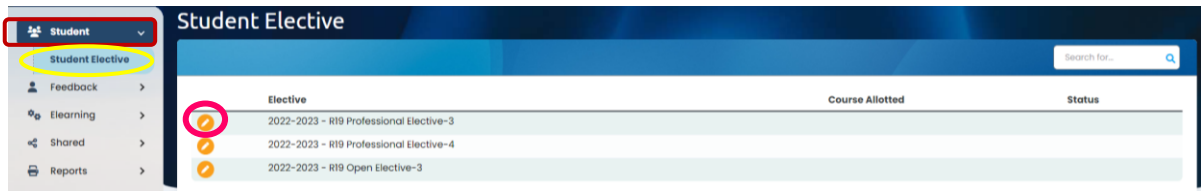
ACADEMIC SECTION

INSTRUCTIONS TO THE STUDENTS REGARDING SELECTION OF ELECTIVE COURSES IN EDUPRIME CAMS SOFTWARE

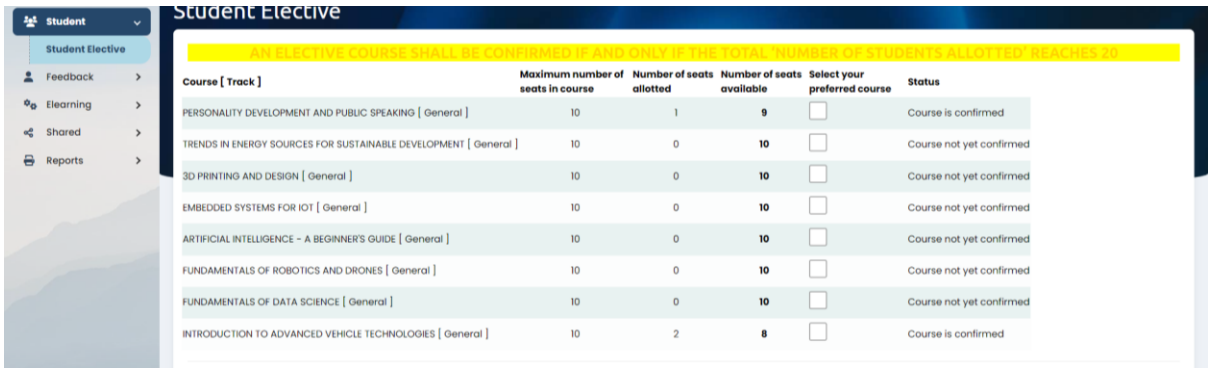
NOTE:
STUDENTS MUST PROTECT THEIR LOGIN ACCOUNTS BY CHANGING THE ACCOUNT PASSWORDS (UNIQUE) AND NOT TO DISCLOSE IT TO ANYONE.

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

1. **Students are advised to go through the syllabus of the open elective and professional elective courses available in the Institute website before selecting the elective course.**
2. Students must login to their account by entering **'Username'** and **'Password'** in Eduprime Software through the following link:
   https://automation.vnrvjiet.ac.in/EduPrime3
3. Click on '**Student'** in the left panel followed by '**Student Elective'**. Screen titled '**Elective Course Management**' containing Elective course groups would appear. Click on the **edit** button on the left of elective course group name.



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



- First column indicates the **names of courses on offer**.
- Second column indicates the **maximum number of seats in each course**.
- Third column indicates the **number of seats already allotted** to the students.
- Fourth column indicates the **number of seats now available**.
- Fifth column provides the option of **selecting your preferred course**. Students are advised that the elective course which they would like to study must be selected by selecting in this column.
- Sixth and last column indicates the **status of course** selected.

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

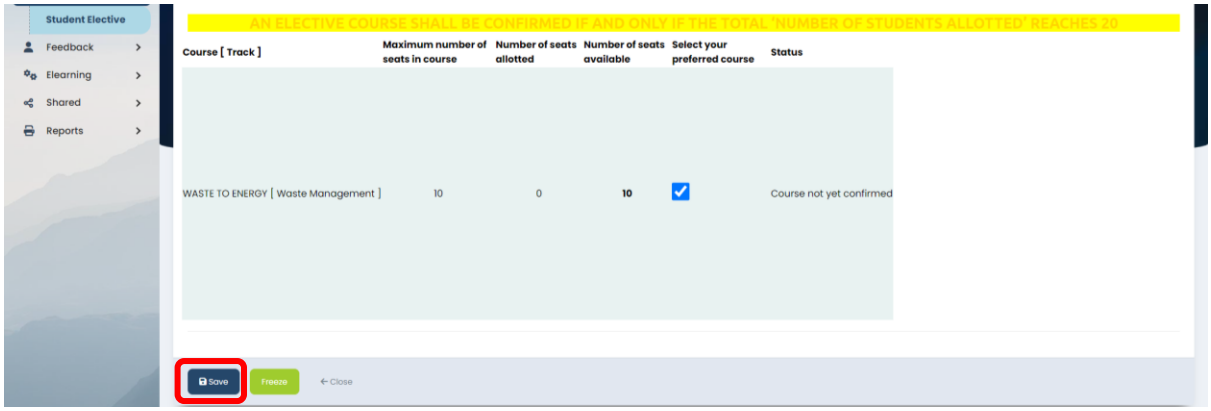
   i) **Course not yet confirmed**: It means the **number of students selecting an elective course is less than 20 hence the course will not be run during the semester**. Such students will have to choose another elective course.

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

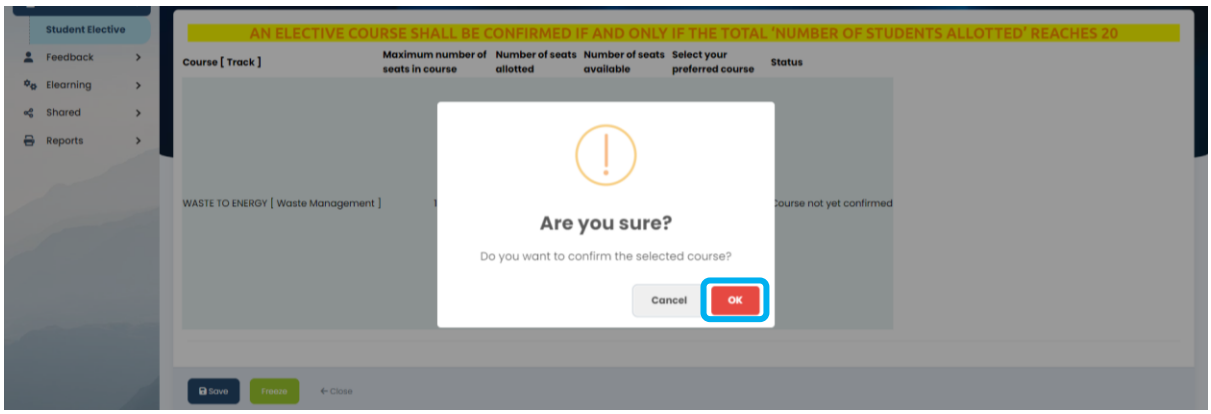
   iii) **Seats are not available**: It means the **maximum number of seats defined for an elective course are exhausted or over**. Students will not be able to choose such courses and shall select another course of their choice.

OPEN ELECTIVE TRACK BASED CATEGORY:

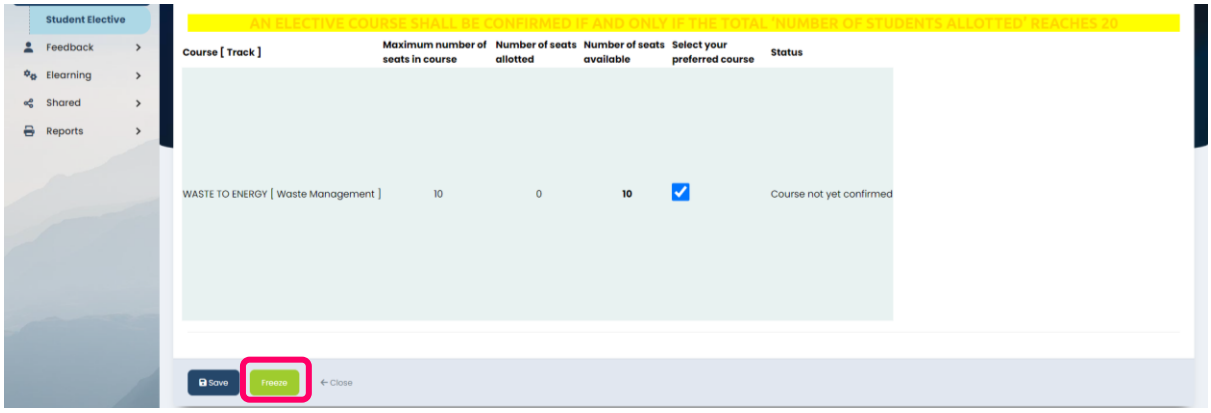
7. Students who **want to pursue an OE Course based on Open Elective Track** in **V semester** shall be able to see the following screen consisting of **Level-1 course defined in V semester**. After selection of the displayed open elective course, press **Save**.



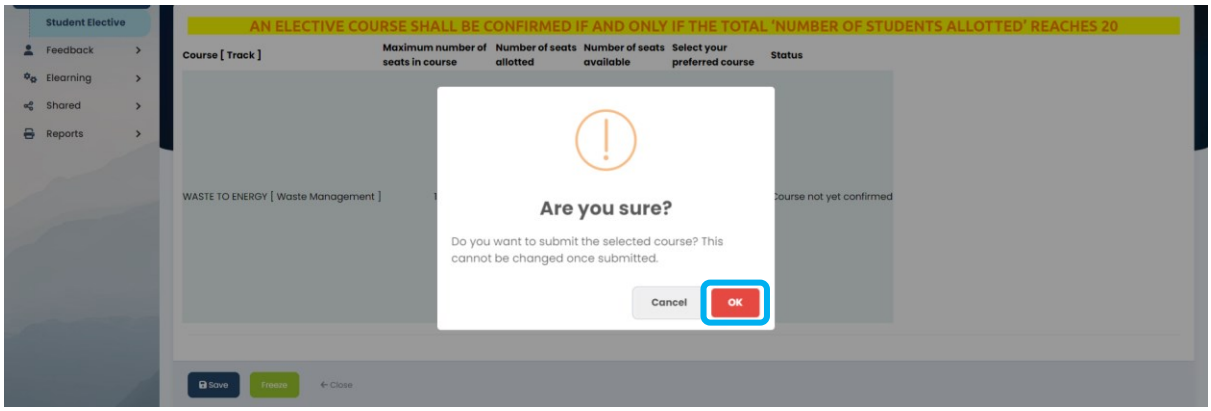
8. A message regarding confirmation of selection would appear on screen. Press **OK**.



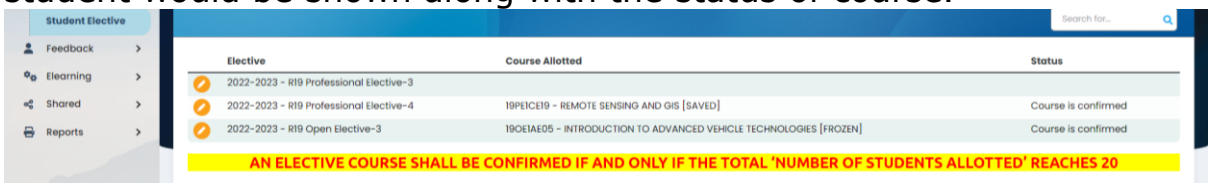
9. Click on **Freeze** button for course confirmation.



10. A message regarding confirmation of selection would appear on screen, then press **OK**.

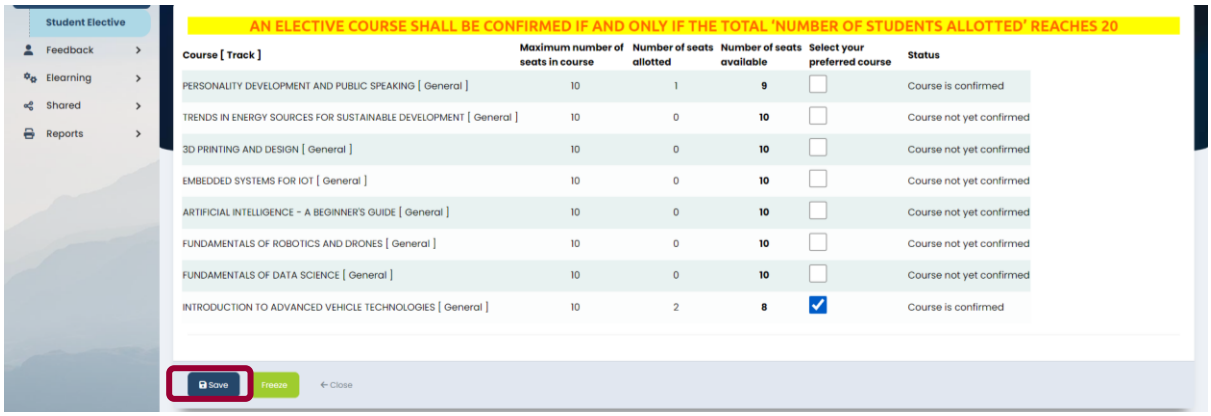


11. Upon pressing '**Close**' button displayed on the screen, student would be taken back to the first screen wherein against the open elective group name, title of the open elective course selected by the student would be shown along with the status of course.

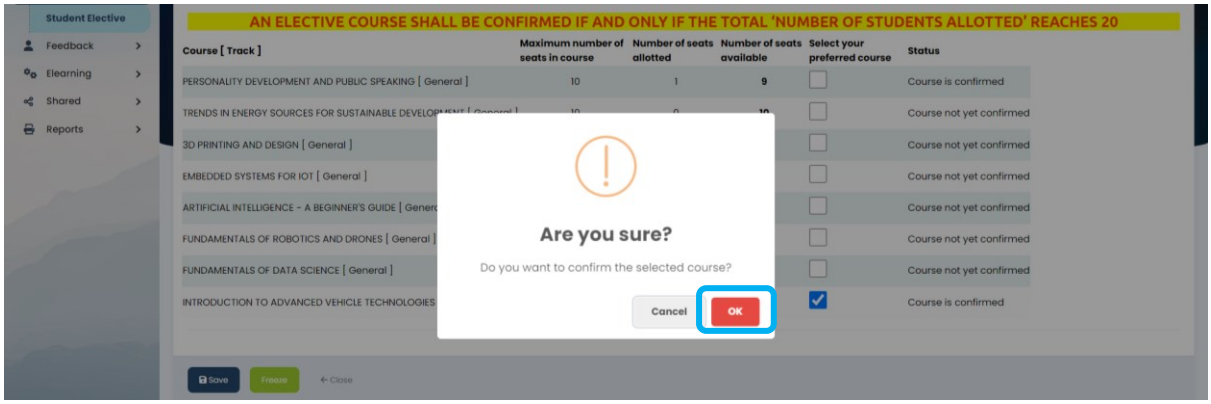


OPEN ELECTIVE GENERAL POOL BASED CATEGORY:

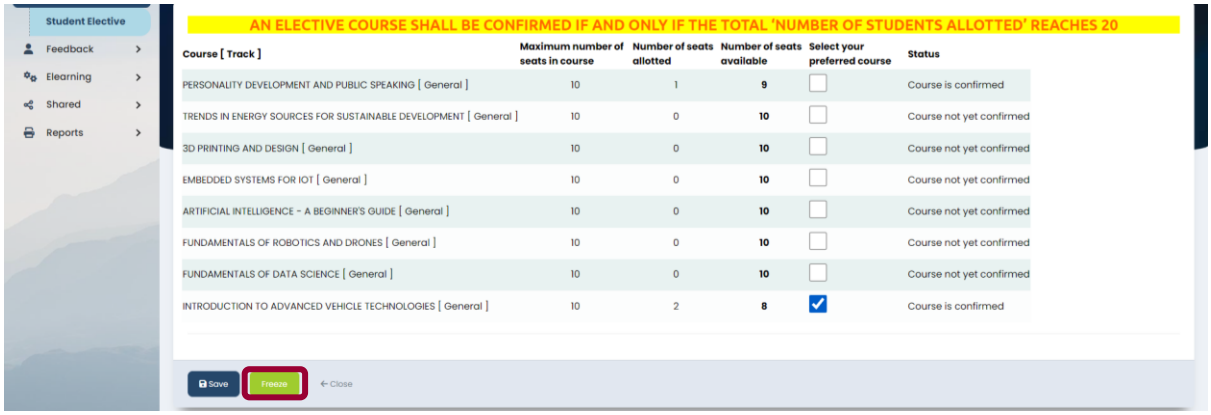
12. Students who **want to pursue an OE Course from General Pool in V semester** shall be able to see the screen consisting of **General Pool Courses offered in V semester** as shown below. After selection of an open elective course of your choice, press **Save**.



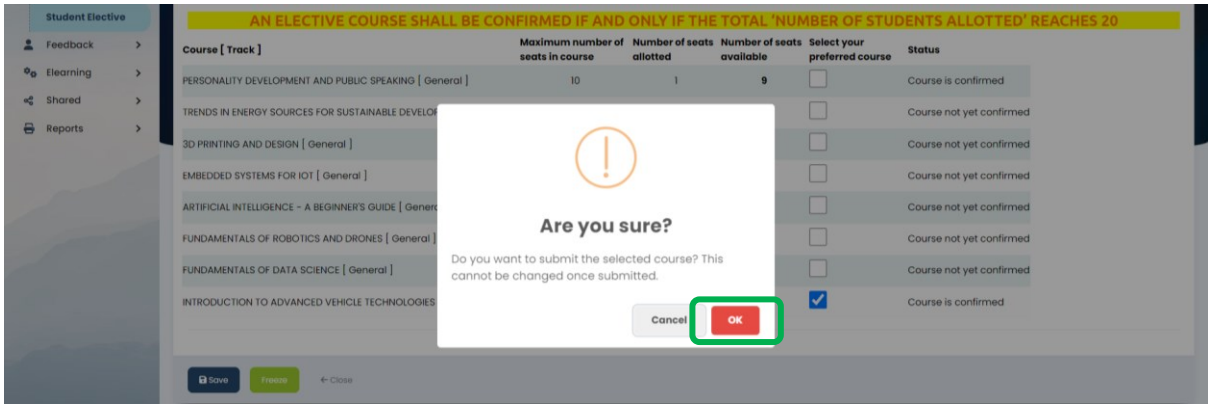
13. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press **OK**, otherwise press **Cancel** and make selection of another open elective course.



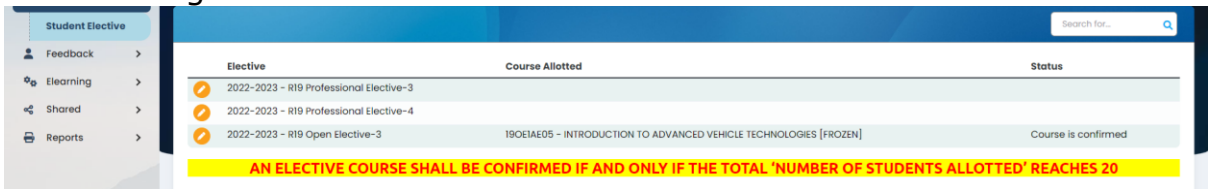
14. If the student is satisfied with the selected open elective course then click on **Freeze** button for course confirmation.



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

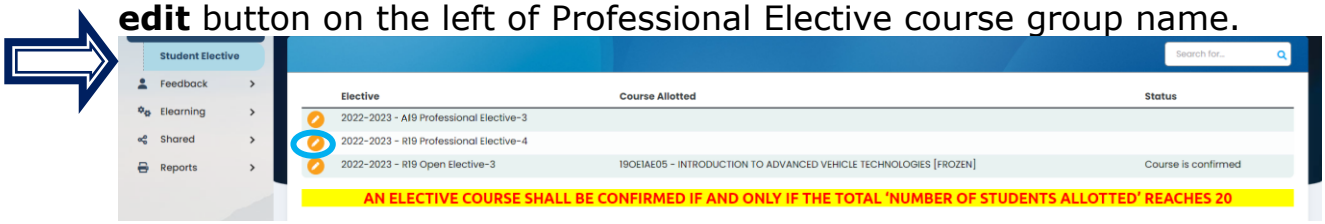


16. Upon pressing **'Close'** button displayed on the screen, student would be taken back to the first screen wherein against the open elective group name, title of the elective course selected by the student would be shown along with the status of course.



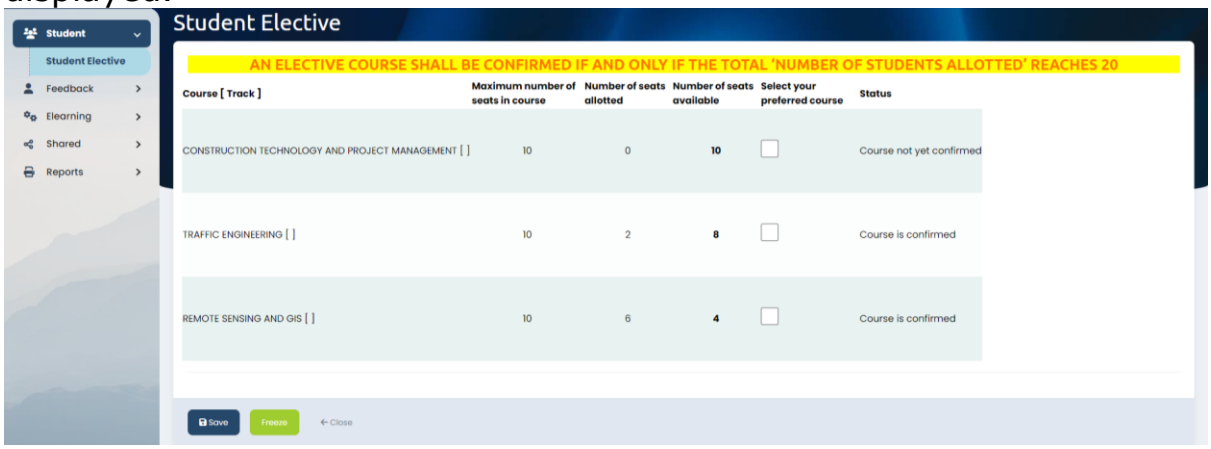
PROFESSIONAL ELECTIVE GROUP:

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

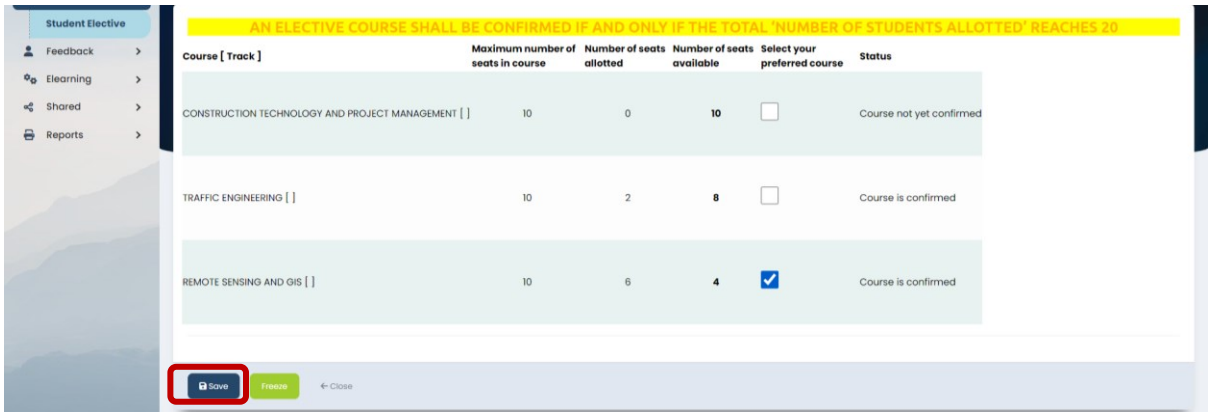


18. Pop-up containing **detailed instructions** would appear. Read the instructions carefully and then click on **'Proceed'.**

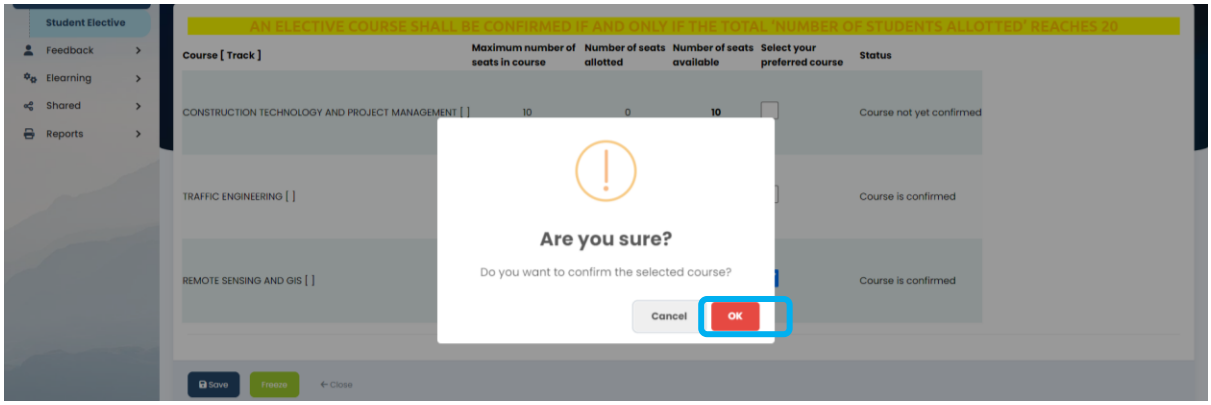
19. A screen containing the list of Professional Elective courses will be displayed.



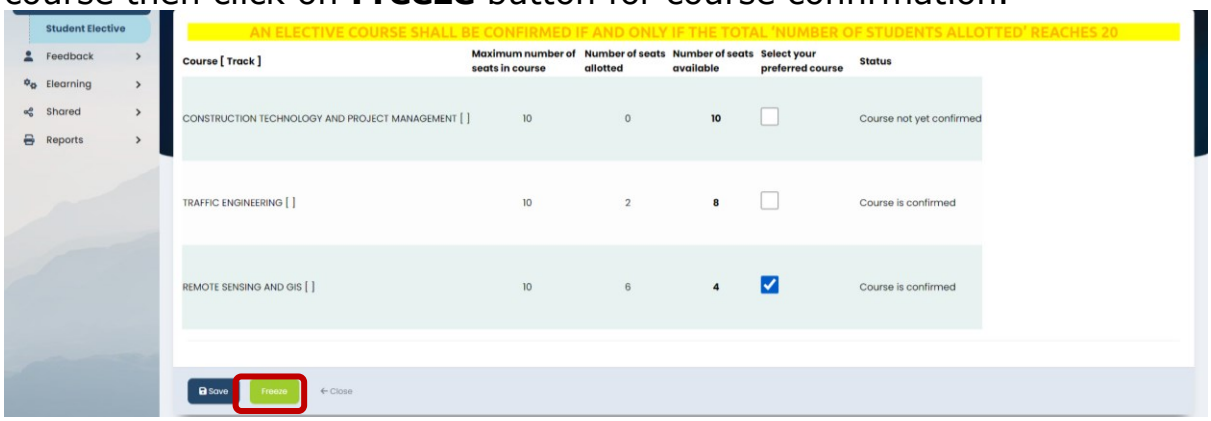
20. After selection of professional elective course of your choice, press **Save**.



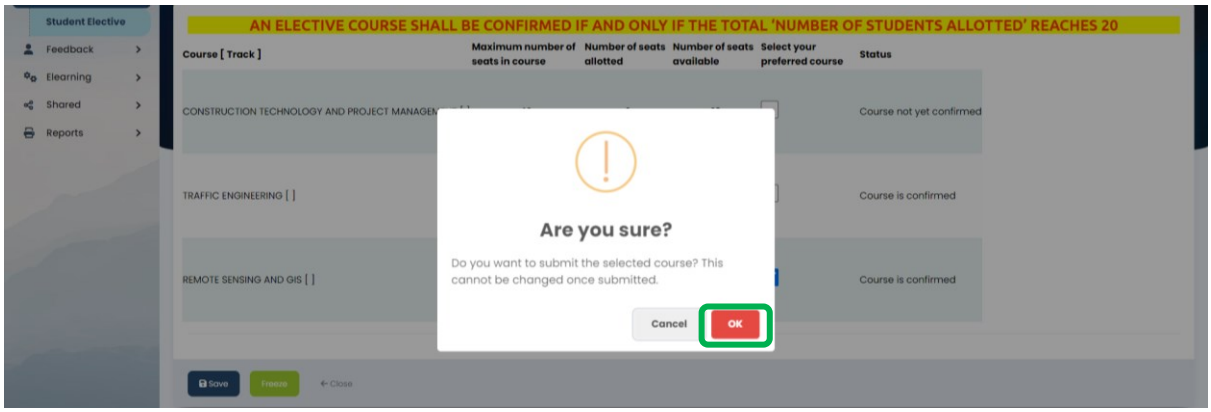
21. A message regarding confirmation of selection would appear on screen. If the student is satisfied with his / her choice, press **OK**, otherwise press **Cancel** and make selection of another professional elective course.



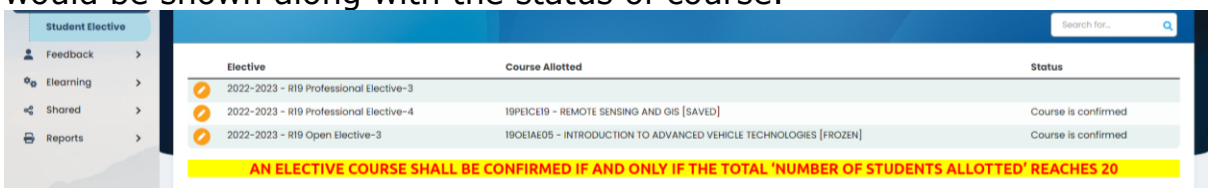
22. If the student is satisfied with the selected professional elective course then click on **Freeze** button for course confirmation.



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



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



NOTE:

(i) FOR AN ELECTIVE COURSE TO BE ALLOTTED, IT IS COMPULSORY TO SAVE THE SELECTED COURSE BY PRESSING 'SAVE' AND FOLLOWED BY FREEZING THE CHOICE BY PRESSING 'FREEZE'.

(ii) STUDENT WILL NOT BE ABLE TO CHANGE HIS / HER SELECTION OF COURSE(S) UPON PRESSING 'FREEZE' BUTTON.

IF THE COURSE IS NOT FREEZED, THEN THAT COURSE SHALL NOT BE ALLOTTED.

25. A student can change his/her selection of **Professional Elective course / Open Elective General Pool** course any number of times during the time the elective selection window is open***, provided the student has not freezed his course***. Note that **if the preferred elective course is already FREEZED through 'FREEZE' button, then student will not be able to change his/her selection of course.**
26. As the elective course selection is dynamic in nature, **status of course may change at any point of time** depending upon selection of elective courses by the students. Hence, **STUDENTS ARE ADVISED TO CHECK THE STATUS OF THE ELECTIVE COURSE SELECTED BY THEM ON THE CLOSING DATE OF ELECTIVE SELECTION WINDOW**.
27. **If the status changes from 'confirmed' to 'not confirmed', student may opt for another elective course of his/her choice on the last date**.
28. **If a student does not perform this activity during the elective selection window, then the student shall be allotted an elective course by the concerned HoD**. For such students, a message regarding non-selection of elective course shall be displayed in the student login dashboard.
29. A student may select / change his / her Professional Elective course / Open Elective General Pool course **(only if not freezed)** upto the closing date of the window.
30. **ONLINE SELECTION OF PROFESSIONAL ELECTIVE COURSE IN EDUPRIME SOFTWARE BY A STUDENT WHO HAS OPTED FOR PURSUING PROFESSIONAL ELECTIVE COURSE THROUGH NPTEL-SWAYAM PLATFORM SHALL NOT BE CONSIDERED.**

DO NOT FORGET TO PRESS 'SAVE' &'FREEZE' BUTTONS UPON FINALIZED SELECTION OF ELECTIVE COURSES

OPEN ELECTIVE – II COURSES AVAILABLE FOR SELECTION (A.Y. 2023 – 2024)

OE Track	Name of the Open Elective – II Course & Offering Department	Course code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection	Courses available to B.Tech.
Smart Cities	GREEN BUILDING TECHNOLOGY **(CE)**	A19OE1CE02	1	80	**EEE, ME, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
Waste Management	HAZARDOUS WASTE MANAGEMENT **(CE)**	A19OE1CE06	2	160	**EEE, ME, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
Green Energy	RENEWABLE ENERGY TECHNOLOGIES **(EEE)**	A19OE1EE02	2	160	**CE, ME, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
3D Printing & Design	INTRODUCTION TO 3D PRINTING **(ME)**	A19OE1ME02	2	158	**CE, EEE, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
Internet of Things	INTRODUCTION TO MICROCONTROLLERS AND INTERFACING / ARTIFICIAL INTELLIGENCE - A BEGINNER'S GUIDE **(ECE)**	A19OE1EC02 / A19OE1CS09	1	67	**CE, EEE, ME, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), AI&DS**
Augmented Reality (AR) / Virtual Reality (VR)	INTRODUCTION TO SIGNAL PROCESSING **(ECE)**	A19OE1EC05	1	77	**CE, EEE, ME, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
Artificial Intelligence	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE **(CSE)**	A19OE1CS01	1	60	**CE, EEE, ME, ECE, EIE, AE**
Robotics	KINEMATICS AND DYNAMICS OF ROBOTS **(EIE)**	A19OE1EI02	1	31	**CE, EEE, ME, ECE, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
Cyber Security	CRYPTOGRAPHY AND NETWORK SECURITY **(IT)**	A19OE1CS06	1	25	**CE, EEE, ME, ECE, EIE, AE**
Data Sciences/ Big Data Analytics	COMPUTATIONAL THINKING USING PYTHON **(IT)**	A19OE1IT03	1	80	**CE, EEE, ME, ECE, EIE, AE**
Autonomous Vehicles	MODERN AUTOMOTIVE TECHNOLOGIES **(AE)**	A19OE1AE02	1	65	**CE, EEE, ME, ECE, CSE, EIE, IT, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**

OE Track	Name of the Open Elective – II Course & Offering Department	Course code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection	Courses available to B.Tech.
General-Computing	RELATIONAL DATA BASE MANAGEMENT SYSTEMS **(CSE/IT)**	A19OE1CS08	1	21	**CE, EEE, ME, ECE, EIE, AE**
General	ENTREPRENEURSHIP **(H&S)**	A19OE1HS02	3	240	**CE, EEE, ME, ECE, CSE, IT, EIE, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
	SMART CITIES **(CE)**	A19OE1CE09	1	80	**EEE, ME, ECE, CSE, IT, EIE, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
	TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVELOPMENT **(EEE)**	A19OE1EE05	1	80	**CE, ME, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
	3D PRINTING AND DESIGN **(ME)**	A19OE1ME05	2	160	**CE, EEE, ECE, CSE, EIE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
	EMBEDDED SYSTEMS FOR IOT **(ECE)**	A19OE1EC09	1	80	**CE, EEE, ME, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), AI&DS**
	ARTIFICIAL INTELLIGENCE - A BEGINNER'S GUIDE (CSE)	A19OE1CS09	1	80	**CE, EEE, ME, ECE, EIE, AE**
	FUNDAMENTALS OF ROBOTICS AND DRONES **(EIE)**	A19OE1EI05	1	80	**CE, EEE, ME, ECE, CSE, IT, AE, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**
	FUNDAMENTALS OF CYBER SECURITY **(IT)**	A19OE1IT08	1	80	**CE, EEE, ME, ECE, EIE, AE**
	FUNDAMENTALS OF DATA SCIENCE **(IT)**	A19OE1IT09	1	80	**CE, EEE, ME, ECE, EIE, AE**
	INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES **(AE)**	A19OE1AE05	2	160	**CE, EEE, ME, ECE, CSE, EIE, IT, CSE(AIML), CSE(CYS), CSE(DS), CSE(IOT), AI&DS**

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

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

CIVIL ENGINEERING

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

S. No.	Elective Group	Name of the Professional Elective - II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	WATER SUPPLY ENGINEERING	A19PE1CE10	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

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	POWER SYSTEM OPERATION AND CONTROL	A19PE1EE04	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

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	UNCONVENTIONAL MACHINING PROCESSES	A19PE1ME08	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 AND COMMUNICATION ENGINEERING

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	MOBILE COMMUNICATION AND PROTOCOLS	A19PE1EC03	1	80
2		DIGITAL IMAGE PROCESSING	A19PE1EC04	1	80
3		INTERNET OF THINGS	A19PE1EC05	1	80
4		NEURAL NETWORKS AND DEEP LEARNING	A19PE1CS10	1	80
5		CPLD AND FPGA ARCHITECTURE	A19PE1EC06	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

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	SOFT COMPUTING	A19PE1CS03	1	80
2		SOFTWARE PROJECT MANAGEMENT	A19PE1CS04	2	160
3		DISTRIBUTED SYSTEMS	A19PE1IT12	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 & INSTRUMENTATION ENGINEERING

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	ROBOTICS AND APPLICATIONS	A19PE1EI04	1	80
2		POWER PLANT INSTRUMENTATION	A19PE1EI05	1	80
3		COMPUTER NETWORKS AND SYSTEM APPROACH	A19PC1EC12	1	80
4		PRINCIPLES OF COMMUNICATIONS	A19PE1EC22	1	80
5		BIO MEDICAL EQUIPMENT	A19PE1EI06	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

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	SOFTWARE TESTING METHODOLOGIES	A19PE1IT04	1	80
2		SOFT COMPUTING	A19PE1CS03	1	80
3		CLOUD COMPUTING	A19PE1IT05	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

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	AUTOMOTIVE POLLUTION AND CONTROL	A19PE1AE04	1	80
2		MECHANICS OF MACHINERY	A19PE1AE05	1	80
3		AUTOMOTIVE EMBEDDED SYSTEMS	A19PE1AE06	1	80
4		AERODYNAMICS OF ROAD VEHICLES	A19PE1AE07	1	80
5		FINITE ELEMENT METHODS	A19PE1ME06	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 ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	WEB PROGRAMMING	A19PE1CS16	3	240

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

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

COMPUTER SCIENCE ENGINEERING (IOT)

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	ARTIFICIAL INTELLIGENCE	A19PE1CS09	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 ENGINEERING (DATA SCIENCE)

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	DATA SCIENCE FOR ENGINEERS	A19PE1CS48	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.

COMPUTER SCIENCE ENGINEERING (CYBER SECURITY)

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	Elective – II	INFORMATION SECURITY MANAGEMENT	A19PE1CS08	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.

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

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

S. No.	Elective Group	Name of the Professional Elective – II	Course Code	Number of Sections to be offered in 2023-2024	Maximum Seats available for selection
1	**Elective – II**	DATA SCIENCE FOR ENGINEERS	**A19PE1CS48**	**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.

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:

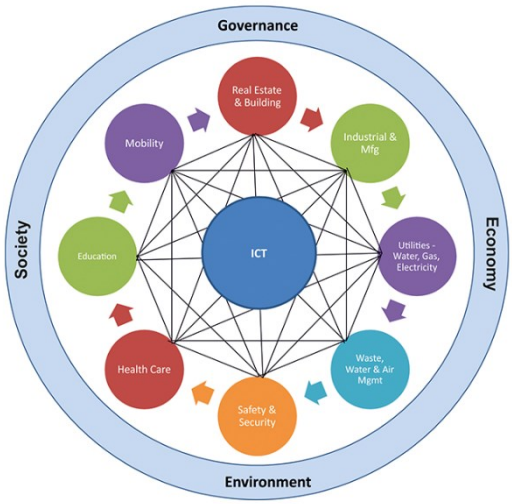
- Public information systems
- Redressal of grievances
- Electronic service delivery
- Maximum engagement of citizens
- Reduced energy and fuel usage
- Reduces the development of wastes
- Smart water monitoring
- Treatment of wastewater
- Sustainable monitoring water quality
- Maximum utilization of 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. VI SEMESTER	**L**	**T/P/D**	**C**
	3	**0**	**3**

(A19OE1CE02) GREEN BUILDING TECHNOLOGY
(Open Elective-II)

COURSE PRE-REQUISITES: Smart Cities Planning and Development

COURSE OBJECTIVES:

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

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

CO-1: Explain the importance, features and requisites of a green building

CO-2: Identify suitable sustainable building materials for construction of green building

CO-3: Plan and design various systems for green buildings

CO-4: Explain various codal provisions of green buildings and accordingly rate a building

UNIT – I:

Introduction: Definition of Green Buildings - Typical features of green buildings - Benefits of Green Buildings - Green Building Materials and Equipment in India - Key Requisites for Constructing a Green Building - Important Sustainable features for Green Building - Climate responsive buildings - Carbon footprint and eco footprints of buildings.

UNIT – II:

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

UNIT – III:

Design of Green Buildings: Indoor environmental quality requirement and management: Thermal comfort - HVAC - Visual perception - Illumination requirement - Auditory requirement – Energy Efficiency - Lighting and day lighting - Steady and non-steady heat transfer through the glazed window and the wall – Indoor air quality - Local climatic conditions – temperature, humidity, wind speed and direction.

UNIT – IV:

Construction of Green Buildings: IoT Integrated Automated Building Systems - Synthetic Roof Underlayment - Green Roofs - Grid Hybrid System - Passive Solar - Greywater Plumbing Systems - Electrochromic Glass - Solar Thermal Cladding - Structural 3D Printing - Self-healing Concrete - Bird Friendly Design - Landscaping for Parking Lot Runoff - Composting Toilets - Proactive Maintenance - Green Cleaning.

UNIT – V:

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

UNIT – VI:

Green Building Rating Systems and Codes: Green building rating systems: BREAM, LEED and GRIHA, ISO 14020 – Green building codes: ECBC and NBC 2016 - Green materials: Standard specifications – Case Studies: Dockland Building in Hamburg, SOKA Building in Wiesbaden, KSK Tuebingen, Nycomed, Constance, DR Byen, Copenhagen.

TEXT BOOKS:

1. Green Building Handbook, Tomwoolley and Samkimings, 2009
2. Sustainable Construction: Green Building Design and Delivery, Charles J. Kibert, 2012

REFERENCES:

1. Green Building Fundamentals-II, Mike Montoya, Pearson, USA, 2010
2. Sustainable Construction - Green Building Design and Delivery, Charles J. Kibert, John Wiley & Sons, New York, 2008
3. Sustainable Construction and Design-II, Regina Leffers, Pearson / Prentice Hall, USA, 2009
4. Introduction to Environmental Economics, Nick Hanley, Jason, F. Shogren and Ben White, Oxford University Press, 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. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(A19OE1CE06) HAZARDOUS WASTE MANAGEMENT
(Open Elective-II)

COURSE PRE-REQUISITES: Solid Waste Management

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

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

UNIT – I:
Introduction: Need for hazardous waste management – Sources of hazardous wastes – Effects on community – terminology and classification – Storage and collection of hazardous wastes – Problems in developing countries – Protection of public health and the environment.

UNIT – II:
Waste Characterization, Storage, Transport and Processing: Hazardous Waste Characterization and Definable Properties - Analytical– Analytical methods – Hazardous waste inventory- Source reduction of hazardous wastes - Handling and storage of Hazardous wastes –Waste Compatibility Chart – Hazardous Waste Transport- Manifest system – Transboundary movement of wastes – Basal Convention – Hazardous waste treatment technologies – Physical, chemical and thermal treatment of hazardous waste – Solidification – Chemical fixation – Encapsulation – Incineration.

UNIT – III:
Nuclear Waste: Characteristics – Types – Nuclear waste – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – spent fuel –

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

UNIT – IV:

Management of Hazardous Wastes: Identifying a hazardous waste – methods – Quantities of hazardous waste generated – Components of a hazardous waste management plan – Hazardous waste minimization – Disposal practices in Indian Industries – Future challenges - Emergency Response - National Response Team and Regional Response Teams; National Contingency Plan and Regional Contingency Plans; National Response Center; State, Local and Industry Response Systems.

UNIT – V:

Secure Landfills: Hazardous waste landfills – Site selections – landfill design and operation – Regulatory aspects – Liner System- Liners: clay, geomembrane, HDPE, geonet, geotextile – Cover system- Leachate Collection and Management – Environmental Monitoring System- Landfill Closure and post closure care - Underground Injection Wells.

UNIT – VI:

Natural Resource Damage Assessment and Restoration: Natural Resource Damage Assessment Laws and Regulations - Central and State government agencies - Damage Assessment and Restoration Procedures - Groundwater Hydrology and Contamination Processes - Groundwater Contamination Detection, Analysis and Monitoring - Overview of CERCLA - Remedial Action Process and RCRA Correction Action Program - Preliminary Assessments and Site Inspections - Hazard Ranking System - National Priorities List - State Priorities List - Remedial Investigations and Feasibility Studies - Records of Decision and the Administrative Process - Remedial Design - Remedial Action - NPL Deletion Process.

TEXT BOOKS:

1. Hazardous Waste Management, Charles A. Wentz., 2nd Edition, McGraw Hill International, 1995
2. Standard Handbook of Hazardous Waste Treatment and Disposal, Harry M. Freeman, McGraw Hill, 1997

REFERENCES:

1. Hazardous Waste (Management and Transboundary Movement) Rules, Ministry of Environment and Forests, Government of India, New Delhi
2. Guidelines and Criteria for Hazardous Waste Landfills and Hazardous Waste Treatment Disposal Facilities, Central Pollution Control Board, New Delhi, 2010
3. Hazardous Waste Management, Prof. Anjaneyulu
4. Hazardous Waste Management, M. LaGrega and others, McGraw-Hill Publication

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 Bill Gates lobbied for the Energy sector as one of the top three career choices for making an impactful career.

RENEWABLE ENERGY TECHNOLOGIES:

Within crisis there are seeds of opportunity..! We are at the wedge of fossil fuel end. After few years you can witness fuel crisis all over the world, as an engineer one must aware of the solution. To design sustainable systems those last for decades, one must use renewable energy as main or auxiliary source of energy. The application may be electrical or mechanical or chemical, one must convert energy from renewable source into electricity for ease of use.

Renewable Energy Technologies course will introduce you to Different types of Solar PV systems and their characteristics. Students will know the functionality of Power Converters such as Inverters etc., through block diagram approach. Fuel cell technology, which is one of the solutions for energy crisis will be discussed in detail. Course will conclude by discussing impact of PV panel production on environment and disposal of it.

Job Opportunities:

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

ENERGY STORAGE TECHNOLOGIES

Battery technology is an essential skill for every engineer in present scenario. Course on energy storage technologies will enable student to, Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles. It will make student to understand various electrochemical storages such as Lead

acid, Li Ion cell etc. and their characteristics. The course enables student to compare non electric, electric storage systems and analyze application of them to various domains.

Job opportunities:

Upon successful completion of course student will enhance the chances of getting into EV industry , which almost open fact. Job Profiles include

i. Battery algorithms engineer
ii. Battery management engineer
iii. Battery modeling expert
iv. Design engineer – EV

ENERGY MANAGEMENT AND CONSERVATION

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(A19OE1EE02) RENEWABLE ENERGY TECHNOLOGIES
(Open Elective-II)

COURSE PRE-REQUISITES: Renewable Energy Sources

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

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

UNIT – I:
Behavior of Solar Cells-Basic Structure and Characteristics: Types - equivalent circuit-modeling of solar cells including the effects of temperature, irradiation and series/shunt resistances on the open-circuit voltage and short-circuit current-Solar cell arrays- PV modules-PV generators- shadow effects and bypass diodes- hot spot problem in a PV module and safe operating area.

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

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

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

UNIT – V:
Fuel Cell Technology: History of Fuel cells, Fuel Cell Vehicle Emissions, Hydrogen safety factors, Principle of Operation- Fuel cell Model- cell voltage, Power and efficiency of fuel cell, Various types of fuel cells, Various storage systems for Hydrogen, Applications

UNIT – VI:

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

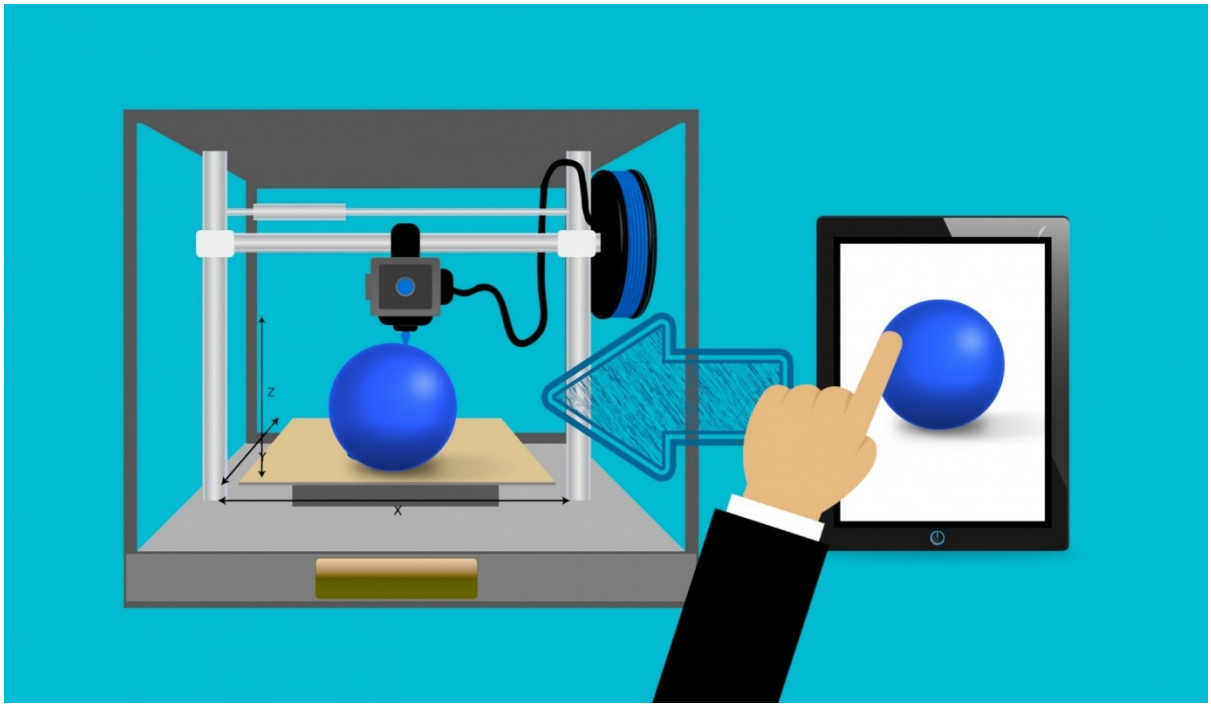
Solar PV System Environment Impact: Potential Hazards in production of PV cell, Energy payback and CO2 emission of PV systems, Procedure for decommissioning of PV plant, Future Trends of Wind Energy system

TEXT BOOKS:

1. Handbook of Renewable Energy Technology, Ahmed F. Zobaa, World Scientific Publishing Company, 2011
2. Wind and Solar Power Systems Design, Analysis, and Operation, Patel M. R., 2nd Edition, CRC Press, New York, 2005
3. Practical Handbook of Photovoltaics - Fundamentals and Applications, Augustin McEvoy, Tom Markvart, T. Markvart, L. Castaner, Elsevier Science, 2003

REFERENCE:

1. Electric Powertrain - Energy Systems, Power Electronics & Drives for Hybrid, Electric & Fuel Cell Vehicles, Goodarzi, Gordon A., Hayes, John G, John Wiley & Sons, 2018



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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(A19OE1ME02) INTRODUCTION TO 3D PRINTING
(Open Elective-II)

COURSE PRE-REQUISITES: Elements of CAD

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

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

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

UNIT – II:
Generalized 3D Printing Process Chain: Process chain, Materials for 3D Printing, Design for 3D Printing and Overview of Medical Modeling & Reverse Engineering.

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

UNIT – IV:
Solid Based Systems: Introduction, basic principles, Fused Deposition Modeling, Multi-Jet Modeling, Laminated Object Manufacturing (LOM), Advantages and Applications.

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

UNIT – VI:
Post-Processing: Introduction, Support Material Removal, Surface Texture Improvements, Accuracy Improvements, Aesthetic Improvements.

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 & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, Emand Abouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

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…

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

(A19OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING
(Open Elective-II)

COURSE PRE-REQUISITES: Sensors Transducers and Actuators

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

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

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

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

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

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

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

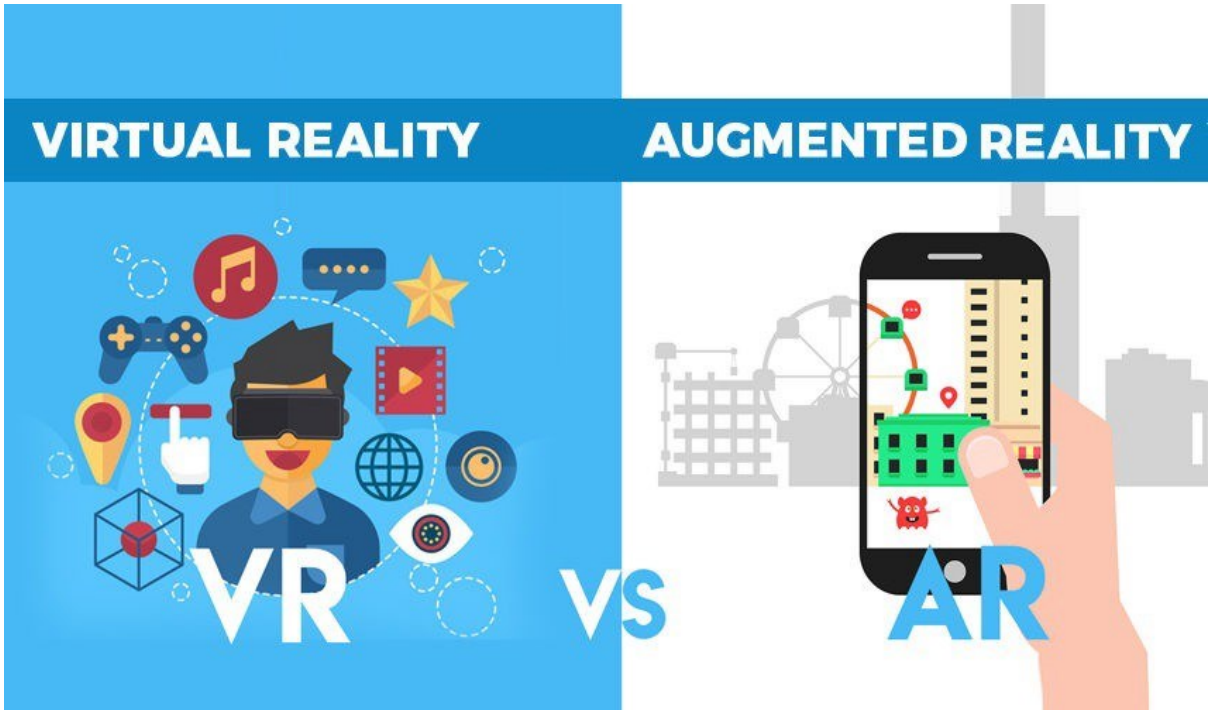
UNIT – VI:
Introduction to Arduino: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, Cengage Publications 3rd Edition, 2008
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005

REFERENCES:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH



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…

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

(A19OE1EC05) INTRODUCTION TO SIGNAL PROCESSING
(Open Elective-II)

COURSE PRE-REQUISITES: Introduction to C Sharp

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

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

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

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

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

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

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

UNIT – VI:

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

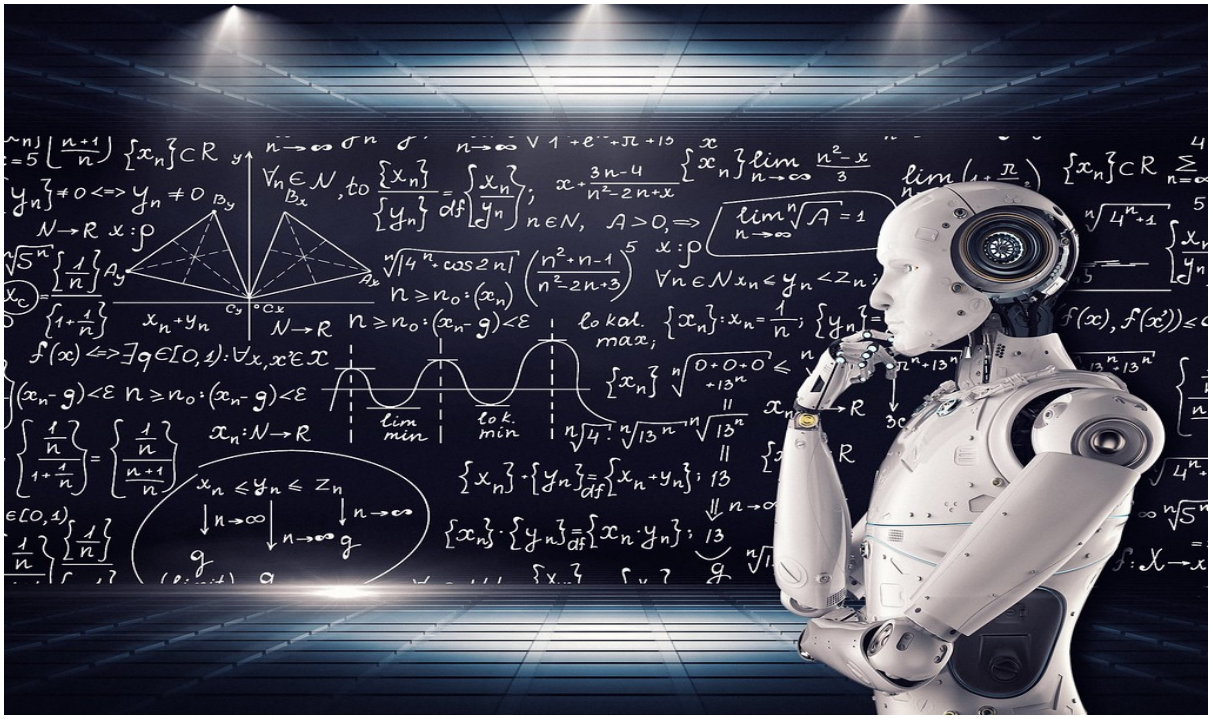
Realization of IIR and FIR Filters: Direct and Cascade forms.

TEXT BOOKS:

1. Signals, Systems and Communications, B.P. Lathi, BS Publications, 2009
2. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2nd Edition, PHI
3. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D.G. Manolakis, 4th Edition, Perason/PHI, 2009

REFERENCES:

1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition, John Wiley
2. Signals, Systems and Transforms, C.L. Philips, J. M Parr and Eve A. Riskin, 3rd Edition, Pearson, 2004
3. Signals and Systems, Schaum's Outlines, Hwei P. Hsu, Tata Mc Graw Hill, 2004
4. Digital Signal Processing – A Practical Approach, Emmanuel C. Ifeacher, Barrie W. Jervis, 2nd Edition, Pearson Education



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. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(A19OE1CS01) FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (Open Elective-II)

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence

COURSE OBJECTIVES:

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

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

CO-1: Apply the basic concepts of artificial intelligence and the use of agents into the real-world scenario

CO-2: Design and formulate complex problem solutions with the use of various searching techniques

CO-3: Correlate the algorithmic approach of machine learning algorithms for a given case study

CO-4: Analyse the phenomenon of neural networks and apply basic learning laws

UNIT – I:

Introduction to AI: Foundations of AI – History of AI - Applications of AI, Intelligent Agents – Agents and Environments – Nature of Environments – Structure of Agents – Problem solving Agents – Problem formulation – Example Problems.

UNIT – II:

Searching Techniques: Uninformed Search Strategies – Breadth first search – Depth first search – Depth limited search - Bidirectional search – comparison – Search with partial information - Heuristic search – Greedy best first search – A* search – Memory bounded heuristic search - Heuristic functions - Local search- Hill climbing – Simulated annealing search - Local beam search, Genetic algorithms.

UNIT – III:

Constraint Satisfaction Problems: Backtracking search for CSP's - local search for constraint satisfaction problem. *Adversarial search* – Games - Minimax algorithm, Alpha beta pruning, cutting-off search.

UNIT – IV:

Knowledge Representation and Reasoning: Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment.

UNIT – V:

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT – VI:

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

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw Hill Publications
3. Neural Networks A Comprehensive Foundation, Simon Haykin, Pearson Education, 2nd Edition, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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.

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

(A19OE1CS05) DISTRIBUTED DATA BASES
(Open Elective-II)

COURSE PRE-REQUISITES: Fundamentals of Computer Networks

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

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

UNIT – I:
Introduction: Features of Distributed versus Centralized Databases,
Levels of Distribution Transparency: Reference Architecture for Distributed Databases, Types of Data Fragmentation, Distribution transparency for Read – only Applications, Distribution transparency for update Applications, Distributed database Access primitives, Integrity Constraints in Distributed Databases.

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

UNIT – III:
Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

UNIT – IV:
The Management of Distributed Transactions: A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural aspects of Distributed Transactions.

UNIT – V:
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – VI:

Reliability: Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

TEXT BOOKS:

1. Principles of Distributed Database Systems, M. Tamer OZSU and Patuck Valduriez, Pearson Education Asia, 2001
2. Distributed Databases, Stefano Ceri and Willipse Pelagatti, McGraw Hill

REFERENCES:

1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and Johhanes Gehrke, MGH

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 Robots**	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. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

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

COURSE PRE-REQUISITES: Fundamentals of Robotics

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

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

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

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

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

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

UNIT – V:
Manipulator Dynamics: Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

UNIT – VI:

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

TEXT BOOKS:

1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

REFERENCES:

1. Robotic Engineering–An Integrated Approach, Klafter. R.D, Chimielewski. T.A, Negin M, Prentice Hall of India, New Delhi, 2009
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
3. Robotics-Control, Sensing, Vision and Intelligence, K.S. Fu, R.C. Gonzalez, C.S.G Lee, McGraw-Hill International Edition

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.

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

(A19OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY
(Open Elective-II)

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

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

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

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

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication

Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

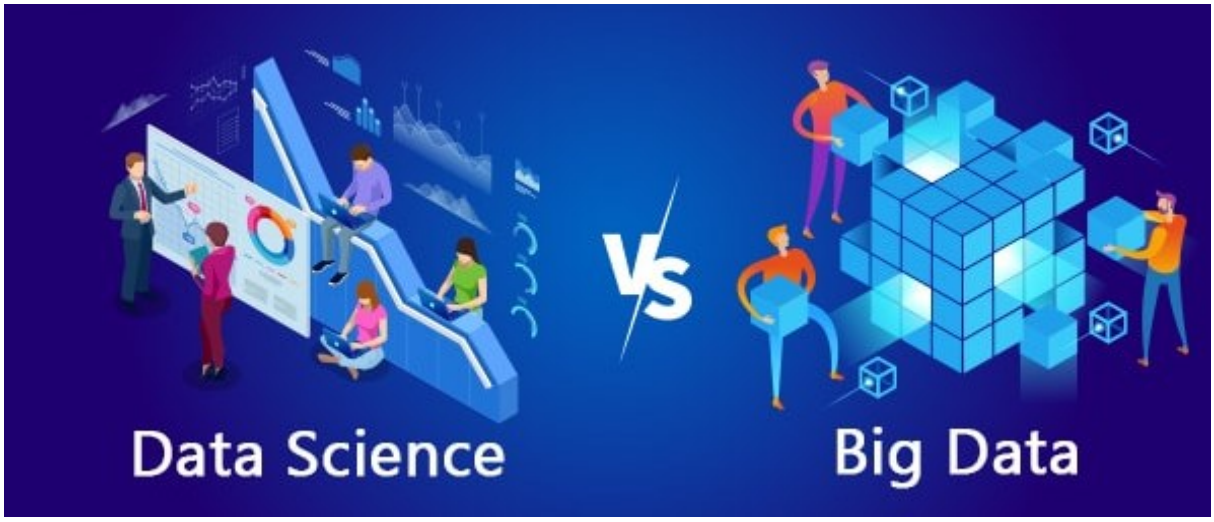
System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003



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.

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

(A19OE1IT03) COMPUTATIONAL THINKING USING PYTHON
(Open Elective-II)

COURSE PRE-REQUISITES: Statistical Methods for Data Science

COURSE OBJECTIVES:

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

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

CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)

CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)

CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program

CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)

CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:

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

UNIT – II:

Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:

Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

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

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

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

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

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.

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

(A19OE1AE02) MODERN AUTOMOTIVE TECHNOLOGIES
(Open Elective-II)

COURSE PRE-REQUISITES: Principles of Automobile Engineering

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

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

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

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

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

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

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

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

TEXT BOOKS:

1. Understanding Automotive Electronics, William B. Ribbens, 5th Edition, Butterworth Heinemann Woburn,1998
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001

REFERENCES:

1. Automotive Handbook, Robert Bosch, SAE, 5th Edition, 2000
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Understanding Automotive Electronics, Bechhold, SAE, 1998

GENERAL-COMPUTING

Offered by: COMPUTER SCIENCE AND ENGINEERING / INFORMATION TECHNOLOGY

Courses in the Pool:

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

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

(A19OE1IT06) PROGRAMMING THROUGH JAVA

COURSE PRE-REQUISITES: None

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop applications for range of problems using object-oriented programming techniques
CO-2: Design simple graphical user interface applications
CO-3: Explore the design of graphical user interface using applets and swings

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

UNIT – II:
Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

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

Threads, Interthread Communication, Thread Groups, Daemon Threads. Enumerations, Autoboxing, Annotations, Generics.

UNIT – IV:

Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.

The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT – V:

Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

UNIT – VI:

Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:

1. Java The Complete Reference, Herbert Schildt, 7th Edition, TMH
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education
3. An Introduction to Programming and OO Design using Java, J. Nino and F.A. Hosch, John Wiley & Sons

REFERENCES:

1. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
2. An Introduction to Java Programming and Object-Oriented Application Development, R.A. Johnson, Thomson
3. Core Java 2, Vol. 1 - Fundamentals, Cay. S. Horstmann and Gary Cornell, Eighth Edition, Pearson Education
4. Core Java 2, Vol. 2 - Advanced Features, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(A19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

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

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

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Data base design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

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

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(A19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)

CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)

CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program

CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)

CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:

Introduction, History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If

If- else Nested if-else Looping for While Nested loops Control Statements Break Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:

Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and

Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods

Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:

Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

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

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

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

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, 2nd Edition, O'Relly, 2003

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

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

(A19OE1IT07) 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

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

(A19OE1CS11) FUNDAMENTALS OF COMPUTER ALGORITHMS

COURSE PRE-REQUISITES: None

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

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

UNIT – I:
Introduction: Characteristics of algorithm. Analysis of algorithms: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs.

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

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

UNIT – IV:
Dynamic Programming-I: General method, Principle of optimality, applications-Multistage graphs, Matrix chain multiplication, Optimal binary search trees.

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

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

TEXT BOOKS:
1. Fundamentals of Computer Algorithms, E. Horowitz et al, Galgotia Publications

2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Lieserson, Ronald L. Rivest and Clifford Stein, 4th Edition, MIT Press/McGraw-Hill

REFERENCES:

1. Algorithm Design, Jon Kleinberg and EvaTardos, 1st Edition, Pearson
2. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich and Roberto Tamassia, Second Edition, Wiley
3. Algorithms – A Creative Approach, Udi Manber, 3rd Edition, Addison-Wesley, Reading, MA
4. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd Edition, Pearson Publications

GENERAL POOL

Offered by: HUMANITIES AND SCIENCES

Courses in the OE Pool:

- Professional Ethics and Human Values
- **Entrepreneurship**
- Personality Development & Public Speaking
- Foreign Language – French

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(A19OE1HS02) ENTREPRENEURSHIP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

CO-1: Discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Apply lean methodology to startup ideas using Business Model Canvas and Lean Canvas and be able to create Business Plan

CO-3: Validate ideas, design, production, and marketing systematically using techniques such as 5 Whys, Innovation Accounting, Value and Growth Propositions

CO-4: To strategize during ideation, production, market research, marketing and facing competition

UNIT – I:

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

UNIT – II:

Introduction to Lean Startup Methodology: Overview, Principles of Lean Startup, Lean vs. Traditional Startup; Vision-to-Steering, Start-Define-Learn-Experiment, Leap-Test-Measure-Pivot, Build-Measure-Learn

UNIT – III:

Business Model Concepts: Components of Business Plan; Business Model Canvas (BMC); Lean Canvas (LC); Pitch Deck; Elevator Pitch; Financial Aspects – Financing, Funding Stages, Inflows, Outflows; Market Research and Marketing

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

Strengthen Your Business Model: Why startups fail? Value and Waste; Design Thinking for Business; Analogs and Antilogs; Paralysis by Analysis and Extinct by Instinct; The three A's: Actionable, Accessible, and Auditable Metrics and Vanity Metrics

TEXT BOOKS:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin Portfolio, 2015 (ISBN: 978-0670921607)
2. Entrepreneurship, Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, Tata McGraw Hill, 11th Ed., 2020 (ISBN: 978-9390113316)
3. Entrepreneurship Simplified: From Idea to IPO, Ashok Soota, S R Gopalan, Penguin Random House India, 2016 (ISBN: 978-0670088959)

REFERENCES:

1. Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth, John Doerr, Penguin Portfolio, 2018 (ISBN: 978-0241348482)
2. Entrepreneurship Development and Business Ethics, Abhik Kumar Mukherjee, Shaunae Roy, Oxford University Press, 2019 (ISBN: 978-0199494460)
3. The Manual for Indian Start-Ups, Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism, Madhukar Shukla, SAGE Publications India Pvt Ltd, 2020 (ISBN: 978-9353882372)
5. Entrepreneurship: A South Asian perspective. Donald F Kuratko, T.V Rao. Cengage Learning, 2012

GENERAL POOL

Offered by: DEPARTMENTS

Courses in the OE Pool:

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

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

(A19OE1CE09) SMART CITIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain and elaborate smart city concepts and their international and national standards
CO-2: Conceptualize smart community, transportation and building concepts
CO-3: Develop and calibrate energy demand and their capacity limits
CO-4: Predict the various smart urban transportation systems and the transition from existing city towards a smart city

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

UNIT – II:
City as a System of Systems: Systems thinking – Developing a smart city approach – Core elements of a smart city – Relevant open data for a smart city – Sustainability – Privacy and Ethics – Energy systems for smarter cities.

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

UNIT – IV:
Smart Urban Energy Systems: Conventional vs. Smart, City components, Energy demand, Green approach to meet Energy demand, Index of Indian cities towards smartness – a statistical analysis -Meeting energy demand through direct and indirect solar resources- Efficiency of indirect solar resources and its utility, Capacity limit for

the indirect solar resources- Effectiveness in responsive environment in smart city; Smart communication using green resources- **Relevant case studies**

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

1. Internet of Things in Smart Technologies for Sustainable Urban Development, G. R. Kanagachidambaresan, R. Maheswar, V. Manikandan, K. Ramakrishnan., Springer, 2020
2. Society 5.0: A People-Centric Super-Smart Society, Hitachi-UTokyo Laboratory (H-UTokyo Lab), Springer, 2020
3. The Routledge Companion to Smart Cities, Katharine S. Willis, Alessandro Aurigi, Routledge International Handbooks, 2020

REFERENCES:

1. Smart Cities in Asia: Governing Development in the Era of Hyper-Connectivity Yu-min Joo, Yu-Min Joo, Teck-Boon Tan, Edward Elgar Pub, 2020
2. Urban Systems Design: Creating Sustainable Smart Cities in the Internet of Things Era, Yoshiki Yamagata, Perry P. J. Yang, Elsevier, 2020
3. Smart Cities and Artificial Intelligence: Convergent Systems for Planning, Design, and Operations, Christopher Grant Kirwan, Zhiyong Fu, Elsevier, 2020

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

(A19OE1EE05) TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVLOPMENT

COURSE PRE-REQUISITES: None

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

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

UNIT – I:
Introduction: Trends in energy consumption - Conventional and renewable sources, Energy sources and their availability, Energy Conservation status in India -need of new energies for sustainable development.

UNIT – II:
Fundamentals of Solar Radiation: Introduction-The Sun as Source of Energy, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, instruments for measuring solar radiation and sunshine recorder.
Solar PV Conversion: The PV Cell-Crystalline Solar cells -Thin film and amorphous solar cells, Module, Array, Equivalent Electrical circuit- Open circuit voltage and Short circuit current, I-V, P-V Curves. Developments in efficient non silicon solar cells

UNIT – III:
Wind Energy: origin of winds-Global (or Planetary) Winds- Local Winds-Factors Affecting the Distribution of Wind Energy on the Surface of Earth, Wind Turbine – Types, construction of HAWT, VAWT, performance characteristics, Betz criteria.

UNIT – IV:
Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Biogas digesters, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – V:
Geothermal Energy: Resources, types of wells, methods of harnessing the energy
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – VI:

Energy Storage:

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

Non-Electric Storage: Methods of Energy storage –Pumped Energy Storage – Compressed air Energy Storage, Superconducting Magnet Energy Storage.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G.D. Rai, 6th Edition, Khanna Publishers, 2004
2. Non-Convention Energy Resources, B.H. Khan, 3rd Edition, McGraw Hill, 2017

REFERENCES:

1. Renewable Energy Sources, Twidell & Weir, 3rd Edition, CRC Press, 2015
2. Solar Energy, Sukhatme, 3rd Edition, McGraw Hill, 2008
3. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern, 1990

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

(A19OE1ME05) 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

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

(A19OE1EC09) 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

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	3	**0**	**3**

(A19OE1CS09) ARTIFICIAL INTELLIGENCE – A BEGINNER'S GUIDE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

UNIT – II:
AI as Search Process: On overview of Search Strategy. Types of Searches- Uninformed, Informed, Bidirectional search, Heuristic search. Local search, Local beam search, Adversarial Search.

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

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

UNIT – V:
AI as Neural Networks: Introduction to biological neural networks. Link between biological neuron and artificial neuron. Architecture of artificial neural network, Types of Neural networks-single layer, multilayer, Back propagation networks.

UNIT – VI:

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

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, M. C. Graw Hill Publications
3. Neural Networks-A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence, A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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

(A19OE1CS10) BLOCKCHAIN TECHNOLOGY ESSENTIALS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

UNIT – I:

Fundamental of Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, computer network peer to peer connection

Fundamental of Blockchain Part II: History of Blockchain, Various technical definitions of Blockchain. Generic elements of a blockchain: Block, Transaction, Node, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology, Limitations of blockchain as a technology

UNIT – II:

Concept of Blockchain Technology Part I: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X, smart contract

Concept of Blockchain Technology Part II: Types of blockchain: Public blockchain, private blockchain, hybrid blockchain, examples of Public, private, hybrid blockchain and it merit and demerit.

UNIT – III:

Technical Foundations Part I: Component of block, Structure of Block chain, Technical Characteristics of the Blockchain, genesis block, Nonce

Technical Foundations Part II: Cryptography, Hashing, Distributed database, Consensus mechanisms, and basic of Cryptographic primitives, Technical Characteristics of Secure Hash Algorithms (SHA), Digital signature.

UNIT – IV:

Consensus Algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of authority (PoA), Confidentiality, Integrity, Authentication,

Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

E-Governance and other contract enforcement mechanisms, Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation. **Crypto Currency:** Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

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

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(A19OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

COURSE PRE-REQUISITES: None

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

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

UNIT – I:
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

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(A19OE1IT08) FUNDAMENTALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

COURSE OBJECTIVES:

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

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

UNIT – I:
Introduction to Cybersecurity, Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cybersecurity, Cybersecurity Principles - Confidentiality, integrity, & availability, Authentication & nonrepudiation, The Trinity of IT Security (CIA), Computer Protocols, Cookies, The TCP/IP

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

UNIT – III:
Cyber Offenses: How Criminals Plan Them: Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes,

UNIT – IV:
Security Threats: Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of

attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

UNIT – V:

Introduction to Computer Forensics: computer crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata. Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files, Computer Forensic tools, Network Forensic. Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.

UNIT – VI:

Fundamentals of Cyber law: Evolution of the IT Act, Genesis and Necessity , Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences, amendments, Impact on other related Acts Cyber Space Jurisdiction - Jurisdiction issues under IT Act, 2000- Traditional principals of Jurisdiction - Extra-terrestrial Jurisdiction- Case Laws on Cyber Space Jurisdiction Sensitive Personal Data or Information (SPDI) in Cyber Law (a) SPDI Definition and Reasonable Security Practices in India (b) Reasonable Security Practices – International perspective

TEXT BOOKS:

1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunit Belpure, Wiley
2. Fundamentals of Cyber Security, Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, BPB Publications
3. Cyber Law & Cyber Crimes, Advocat Prashant Mali, Snow White Publications, Mumbai

REFERENCES:

1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, 3rd Edition, 2013
2. Digital Forensics with Open-Source Tools. Cory Altheide and Harlan Carvey, Elsevier, 2011(ISBN: 978-1-59749- 586-8)
3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
5. Information Technology Law and Practice, Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd

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(A19OE1IT09) FUNDAMENTALS OF DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

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

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

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

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user

(customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT – V:

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT – VI:

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

TEXT BOOKS:

1. Doing Data Science, Straight Talk From The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Mining of Massive Datasets v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2014
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2013 (ISBN 0262018020)

REFERENCES:

1. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, 2nd Edition, 2009 (ISBN 0387952845)
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
3. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr. Cambridge University Press, 2014
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790)

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(A19OE1AE05) 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