Pondicherry University

Curriculum and Syllabus

BACHELOR OF TECHNOLOGY

B.Tech.

Artificial Intelligence and Data Science (AI & DS)

2023-24

[Affiliated College]

1. Conditions for Admission:

a) Candidates for admission to the first semester of the 8 semester B.Tech. degree programme should be required to have passed :

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the different State Boards/ Central Boards or any other examination equivalent there to with minimum of 45% marks (40% marks in case of candidates belonging to reserved category) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / IT and equivalent/ Electronics/ Biology (Botany & Zoology) or Passed D.Voc Streamin the same or allied sector or an Examination of any University or Authority recognizedby the Executive Council of the Pondicherry University as equivalent thereto.

b) Candidates for admission through Lateral entry into second year (third semester) of the 8 semester B.Tech. degree programme should be required to have passed :

Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology.

OR

Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.

OR

Passed D.Voc. Stream in the same or allied sector.

(The Universities/colleges will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

2. Age Limit :

As per applicable AICTE norms.

3. Duration of Programme:

The Bachelor of Technology degree programme shall extend over a period of 8 semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations.

4. Program Structure

The medium of instruction is English.

A student admitted to the B.Tech. programme in a particular branch of engineering will earn the degree in that branch by fulfilling all the requirements prescribed in the regulations during the course of study.

The student is also permitted to opt for earning an **Honors degree in the same discipline of Engineering or a Minor degree** in another discipline of engineering in addition to the degreein his own discipline of engineering. The student will be allowed to exercise this option at theend of first year based on his academic performance in the first year. The students admitted through lateral entry can exercise this option at the end of third semester, based on the GPA scored in the third semester examination.

The student opting for B.Tech. degree with **Honors or B.Tech. degree with Minor** is required to earn additional 20 credits starting from the third semester. The students admitted in the second year through lateral entry and opting for Honors / Minor degree will earn the additional 20 credits starting from the fourth semester.

5. Eligibility for the award of B.Tech. Degree:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the Faculty of Engineering and has passed the prescribed examinations in all the semesters. Details regarding the possible exit for a B.Tech. student – in line with one of the goals of the National Education Policy (NEP) 2020 are provided in section 13.

6. Branches of Study:

Branch I - Civil Engineering

Branch II – Mechanical Engineering

Branch III - Electronics & Communication Engineering

Branch IV - Computer Science & Engineering

Branch V – Electrical & Electronics Engineering

Branch VI – Chemical Engineering

Branch VII - Electronics & Instrumentation Engineering

Branch VIII – Information Technology

Branch IX - Instrumentation & Control Engineering

Branch X – Biomedical Engineering

Branch XI - Robotics and Automation

Branch XII – Food Technology

Branch XIII- CSE (Internet of Things & Cyber security including Block chain Technology)

Branch XIV – Artificial Intelligence and Machine Learning

Branch XV - Artificial Intelligence and Data Science

or any other branch of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

7. Course Structure and Subjects of Study:

Definition of Credit:

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

Range of Credits: The total credits of all the branches for the four-year B. Tech. degree Programme shall be in the range of 160 to 172 (Minor variation is allowed as per AICTE guidelines). "Minor Degree or Honors will cumulatively require additional 20 credits in the specified area in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline".

The subjects of study shall include theory, practical courses and project work/internships as given in the curriculum and shall be in accordance with the prescribed syllabus.

The curriculum of every programme will have courses that are categorized as follows:

(i) Humanities, Social Sciences and Management Courses (HSM)

(ii) Basic Science Courses (BSC)

(iii) Engineering Science Courses (ESC)

(iv) Professional Core Courses (PCC)

(v) Professional Elective Courses (PEC)

(vi) Open Elective Courses (OEC)

(vii) Professional Activity Courses (PAC)

(viii) Mandatory non-Credit Courses (MCC)

Each course will have either one or more of three components namely Lecture (L), Tutorial (T) and Practice (P). Each course is assigned credits as detailed below:

(i) Theory courses will carry either 3 or 4 credits - 3 credits for courses with 3 lecture periods per week and 4 credits for courses with 3 lecture periods and 1 tutorial period per week.

(ii) All Elective courses including online courses will carry maximum 3 credits. The student can earn the credits towards the Open Elective Courses (OEC) by completing the online courses offered in NPTEL anytime between third and seventh semester on prior approval of the courses by the Academic Courses Committee of the Institute. Credits earned through the NPTEL courses will be confined to 2 or 3 credits and subject to a maximum of 9 credits during the entire programme of study.

(iii) Practical courses will normally carry either 1 or 1.5 credits – 1.5 credits for courses with 3 practice periods per week and 1 credit for courses with 2 practice periods per week.

(iv) Out of total credits required for successful completion of the degree, 14 to 22 credits can be assigned for Project work and/or Internship.

(v) Mandatory non-credit courses carry zero credit.

8. Examinations:

The theory and practical examinations shall comprise continuous internal assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).

8.1. Evaluation Scheme

All Credit courses are evaluated for 100 marks comprising of Internal assessment and end-semester exam.

For Theory Course, the weightage of internal assessment is 40% and end semester examination is 60%

For Practical course, the weightage of internal assessment is 60% and end semester examination is 40%

For Project, the weightage of internal assessment is 60% and end semester examination is 40%

8.2. Internal Assessment (Theory)

Total Internal Assessment mark for a theory course is 40 marks. The breakup is as follows:

Criteria	Maximum Marks
a) Internal Assessment Tests	30
b) Percentage of Attendance	5
c) Assignment(s)	5
Total	**40**

Marks for Attendance is as follows:

Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

The Principal of the College/Institute schedules the Internal Assessment tests for all courses. All faculty members are expected to conduct this Internal Assessment tests for 1.30 hours duration and evaluate and required to upload the marks to the Controller of Examinations of University. Colleges are also requested to preserve the answer sheets of Internal Assessment tests until declaration of results by the University.

8.3. Internal Assessment (Practicals)

Faculty in-charge of Lab courses shall evaluate the practical course for 60 marks. The break up is as follows:

Criteria	Maximum Marks
a) Laboratory exercises and Record	30

c) Mid Semester exam (Average of 2 exams)	15
c) Internal Viva voce	5
d) Percentage of Attendance	10
Total	**60**

Marks for Attendance is as follows:

Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

8.4. Internal Assessment (Project)

The Project work carried out in the eighth semester shall be assessed as follows:

Criteria	**Marks**
a) Continuous assessment (Guide)	25
b) Project Evaluation Committee	35
Total	**60**

8.5 Requirement for appearing for University Examination

The Controller of Examinations (COE) of Pondicherry University schedules the End-Semester exams for all theory and practical courses based on the University academic calendar. A detailed Exam Time Table shall be circulated to all Colleges at least 15 days before the start of exams. Question Papers shall be set externally based on BOS approved syllabus.

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(*Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medicalofficer not below the rank of Assistant Director*)

ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester

iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

8.6 End Semester Exam Evaluation Pattern

Course	**Maximum marks**
a) Theory course (Sec A, Sec B and Sec C) Questions from all units of syllabus	60 marks
b) Practical course (Based on Lab exercises/Record/ Practicals /Viva)	40 marks
c) Internship /Project Work (Based on Seminar/Project Work/Project report/Presentation and viva voce)	40 marks

8.7 Consolidation of Marks and Passing Minimum

The Controller of Examinations of the University consolidates the Internal Assessment marks uploaded by the Colleges and marks secured by students in the end-semester examination.

A student shall be declared to have passed the examination in a subject of study only if he/she secures not less than **40% marks individually both in internal assessment and end-semester examination or an aggregate of 40%.**

A candidate who has been declared "Fail" in a particular subject may reappear for that subject during the subsequent semesters and secure pass marks. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

a) Applications for revaluation should be filed within 15 days from the date of declaration of results or 7 days from the date of receipt of grade sheet whichever is earlier.
b) The candidate should have attended all the internal assessments conducted by the college as well as all the end semester examinations conducted by the University.
c) If a candidate has failed in more than two papers in the end semester examinations, his/her representation for revaluation will not be considered.
d) The request for revaluation must be made in the prescribed format duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

A student shall be declared to have passed the examination in a subject of study only **if he/she secures not less than 40% marks in the end-semester examination and secures an overall aggregate of 40%.**

8.8. Arrear Exams

A student who failed to secure 40% marks in aggregate is declared as "Fail" and he is eligible to take up a supplementary examination by registering to the said course in the following semester. All other candidates who failed due to shortage of attendance and those seeking to improve the grade shall repeat the course.

8.9. Letter Grades and Calculation of CGPA

Total Marks Secured by a student in each course shall be converted into a letter grade. The following Table shows the seven letter grades and corresponding meaning and the grade points for the calculation of Cumulative Grade Point Average (CGPA).

Each course (Theory/Practical) is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of Marks	**Assigned Grade**	Grade Points
91-100	A^+	10
81-90	A	9
71-80	B^+	8

61-70	B	7
51-60	C^+	6
46-50	C	5
40-45	D	4
<40	F	0
Not Applicable	F^R (Fail due to shortage of attendance and therefore, to repeat the course)	0

Note: -F- denotes failure in the course; - F^R - denotes absent / detained as per AICTE norms. After the results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

a) The college in which the candidate has studied.
b) The list of courses enrolled during the semester and the grades scored.
c) The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.
d) GPA is the ratio of sum of the products of the number of credits (C) of courses registeredand the corresponding Grades Points (GP) scored in those courses, taken for all the courses andsum of the number of credits of all the courses.

$$\mathbf{GPA = \sum(C \times GP) / \sum C}$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. F^R grades are to be excluded for calculating GPA and CGPA.

e) The conversion of CGPA into percentage marks is as follows

$$\% \text{ Mark} = (\text{CGPA} - 0.5) \times 10$$

9. Procedure for completing the B.Tech. course:

A candidate can join/rejoin the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire B.Tech. course should be completed within 7 years (14 semesters) and six years (12 semesters) for students admitted under lateral entry.

10. Award of Class and Rank in B.Tech. degree:

i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of B.Tech. degree.

ii) A candidate who qualifies for the award of the B.Tech. degree passing in all subjects pertaining to the semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

iii) A candidate who qualifies for the award of the B.Tech. degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in **FIRST CLASS**.

iv) All other candidates who qualify for the award of B.Tech. degree shall be declared to have passed the examination in **SECOND CLASS**.

v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from the 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from the1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

11. Provisions for Honors/Minor degree along with B.Tech. degree:

1. <u>B.Tech. with Honors Degree in the same Engineering discipline</u>

a. The student shall be given an option to earn a Honors degree in the same discipline of engineering at the end of first year based on his academic performance in the first year.

b. A student is eligible to exercise this option if he has passed all the subjects offered in the first year in the first attempt itself and has earned a CGPA of not less than 7.5.

c. Honors degree in a particular discipline of engineering shall be offered for a batch of students if and only if a minimum of 5 eligible students opt for it.

d. The student is required to earn an additional 20 credits (over and above the prescribed maximum credits in the curriculum) starting from the third semester onwards to become

eligible for the award of Honors degree. 20 credits shall be earned by the student by completing 5 additional courses of 4 credits each, one in each of the 5 semesters starting from the third to seventh semester. The syllabus of these 5 courses are framed so as to cover advanced topics in that discipline of engineering.

e. The students admitted in the second year through Lateral Entry Scheme will also be given a chance to opt for Honors degree. Eligibility to avail this option is CGPA of 7.5 and above with no arrears in the third Semester. The student will join the existing batch of students in the fourth semester and earn 16 credits by registering the prescribed courses offered up to the seventh semester. The respective BoS will decide on a suitable course in lieu of the course offered in the third semester to facilitate the student to earn the remaining 4 credits.

f. A student is eligible to get the Honors degree only on completing the programme in 'First Class with Distinction' class.

g. A student can exercise the option to withdraw from the Honors degree at any time after entry.

h. Details about the courses completed and credits earned for Honors degree will appear only in the 'Eighth Semester Grade Sheet' and 'Consolidated Grade Sheet'. These details will be listed under the heading 'Credits Earned for Honors degree'. In the case of students who have either withdrawn from Honors degree or become ineligible for Honors degree by not securing 'First Class with Distinction', the credits earned for the courses registered and successfully completed for Honors degree will be listed under the heading 'Additional Credits Earned'.

i. The CGPA will be calculated for all the courses credited by the students inclusive of major and honors courses

j. Nomenclature of Honors Degree is 'B.Tech.(Honors) in XXX ', where XXX is Discipline in which the student has enrolled.

2. <u>B.Tech. with Minor degree in another Engineering discipline</u>

a) The student shall be given an option to earn a minor degree in another discipline of engineering of his choice at the end of first year based on his academic performance in the first year.

b) A student is eligible to exercise this option if he has passed all the subjects offered in the first year in the first attempt itself and has earned a CGPA of not less than 7.5.

c) Minor degree in a particular discipline of engineering shall be offered for a batch of

students if and only if a minimum of 5 eligible students opt for it.

d) The student is required to earn an additional 20 credits (over and above the prescribed maximum credits in the curriculum) starting from the third semester onwards to become eligible for the award of minor degree. 20 credits shall be earned by the student by completing 5 additional courses of 4 credits each, one in each of the 5 semesters starting from the third to seventh semester. The curricular content of these 5 courses are framed in such a way that that these courses will essentially cover the core minimum knowledge required to be fulfilled for award of degree in the discipline of engineering in which the student chooses to earn the minor degree.

e) The students admitted in the second year through Lateral Entry Scheme will also be given a chance to opt for Minor degree. Students with a CGPA of 7.5 and with no arrears in the third semester are eligible to avail this option. The student will join the existing batch of students in the fourth semester and earn 16 credits by registering for prescribed courses offered up to seventh semester. The respective BoS will decide on a suitable course in lieu of the course offered in the third semester to facilitate the student to earn the remaining 4 credits.

f) A student can exercise the option to withdraw from the Minor degree at any time after entry.

g) Details about the courses completed and credits earned for Minor degree will appear only in the 'Eighth Semester Grade Sheet' and 'Consolidated Grade Sheet'. These details will be listed under the heading 'Credits Earned for Minor degree'. In the case of students who have withdrawn from Minor degree, the credits earned for the courses registered and successfully completed for Minor degree will be listed under the heading 'Additional Credits Earned'.

h) Nomenclature of Minor Degree is 'B.Tech. in XXX with Minor in YYY', where XXX is Discipline in which the student is enrolled and YYY is Discipline which the student has opted as Minor.

i) The CGPA will be calculated for all the courses credited by the students inclusive of major and minor courses.

12. Provision for withdrawal:

Based on the recommendation of the Head of the Institution, a candidate with valid reasons may be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal

shall be permitted only once during the entire course. A candidate who has withdrawn is also eligible to be awarded DISTINCTION provided he/she satisfies the other necessary conditions. But, they are not eligible to be awarded a rank.

13. Provisions for exit in B.Tech. course:

(For courses where AICTE specifies exit in the model curriculum)

The curriculum and the syllabus for all B.Tech programmes have been planned in compliance with the NEP guidelines proposed by AICTE. Accordingly, students joining B.Tech programmes shall have all benefits NEP offers in terms of exercising exit option during the course of study. Every B.Tech programme governed under this school board shall adopt the NEP guidelines, as and when proposed/amended by AICTE, and the following scheme will be applied for all such B.Tech programmes specified by AICTE.

NEP 2020 suggests that a student can exercise exits at multiple stages of the course of study. As per AICTE norms, a student can have two possible exits before the completion of the Full Engineering degree and may get a UG Diploma /Certificate or B.Sc. degree in the relevant discipline if he/she fulfils the following conditions: (Subject to change as per AICTE guidelines)

1. **UG Diploma/Certificate in the relevant branch of study**

   A student should be able to get a UG Diploma if he/she completes:

   a. 50% of the credits for B.Tech. (80-85 credits)

   b. 50% of the program core courses

   c. Students exiting the program after earning 50% credit requirements will be awarded a UG Diploma provided they secure an additional 6 credits through summer internships/apprenticeship of 2 months duration.

   d. Students admitted through lateral entry cannot exercise the exit option as he will not be able to meet out the 50% Credits for B.Tech. degree.

2 B.Sc. in the relevant branch of study

A student should be able to get a B.Sc. degree if he/she completes:

(i) 75% of the credits for B.Tech. (minimum 120 credits) and at least 3 years in the program.

(ii) 100% of the core program courses.

(iii) Students exiting the program after earning 75% credit requirements will be awarded a B.Sc. provided they secure an additional 6 credits through 2 summer internships/apprenticeship for 2 months each.

(iv) With B.Sc. degree, the student is eligible for entry into programs which take B.Sc. degree as eligibility criteria.

2.1 Award of Class in B.Sc. degree

A candidate who satisfies the course requirements for all semesters and who passes all the examinations within a maximum period of 6 years (5 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of B.Sc. degree in the relevant discipline.

i) A candidate who qualifies for the award of the B.Sc. degree passing in all subjects pertaining to semesters the 3 to 6 in his/her first appearance within 4 consecutive semesters (2 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 6 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

ii) A candidate who qualifies for the award of the B.Sc. degree by passing in all subjects relating to semesters 3 to 6 within a maximum period of six semesters afterhis/her commencement of study in the third semester and in addition secures CGPAnot less than 6.5 shall declared to have passed the examination in **FIRST CLASS.**

iii) All other candidates who qualify for the award of B.Sc. degree shall be declared to have passed the examination in **SECOND CLASS**.

2. Re-entry to complete the program

A student exiting with B.Sc. should be entitled to re-enrol in the programme of the same Engineering discipline. Only students admitted to the B.Tech. programme and exercised an exit option are eligible for readmission to the B.Tech. programme under the same discipline. It is suggested that all credits will be transferred, if the student enrols back within a limited period (3 years) of exiting. In case a student enrols after that, then the decision on the transfer of credits should be based on the changes in the curriculum the student studied. A candidate after exit may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the B.Tech. course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

3. Completion Possibility in other Institutions

A student can earn B.Sc. in one institution (Engineering) and complete the degree program in another institution (same Engineering discipline only).

(Note: If these exit options are accepted for multiple B.Tech. programs, it is suggested that AICTE actively communicate these to the industry and other bodies, so they recognize these and accept them as bona-fide credentials for the purposes of recruitment and/or eligibility for admission to programs, appearing in competitive examinations, etc.)

14. Revision of Regulations and Curriculum:

The University may from time-to-time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

A. Range of Credits: In the light of the fact that a typical Model Four-year undergraduate degree program in Engineering has about 163 credits, the total number of credits proposed for the four-year B. Tech/B.E. in Computer Science and Engineering (Artificial Intelligence and Data Science (AIDS)) is kept as 174.

B. Structure of UG Program in Computer Science and Engineering (CSE): The structure of UG programming Computer Science and Engineering (Artificial Intelligence and Data Science (AIDS) shall have essentially the following categories of courses with the breakup of credits as given:

S.No.	Category	Credit Breakup for AIDS Students
1.	Humanities and Social Sciences including Management courses	16
2.	Basic Science courses	22
3.	Engineering Science courses including Workshop, Drawing, Basics of Electronics/Electrical/Mechanical/Computer etc.	26
4.	Professional Core courses	60
5.	Professional Elective courses relevant to chosen Specialization/ Branch	18
6.	Open Electives from other Technical and /or Emerging subjects	15
7.	Project work, Seminar and Internship in Industry or elsewhere	17
8.	Mandatory/Audit Courses [IDEA Workshop Lab, Sports and Yoga, Environmental Science, IndianConstitution]	(non-credit)
	Total	**174**

C. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credit
ADHS	Humanities & Social Science Courses
ADHL	Humanities & Social Science Lab Courses
ADBS	Basic Science Courses
ADBL	Basic Science Lab Courses
ADES	Engineering Science Courses
ADEL	Engineering Science Lab Courses
ADPC	Program Core Courses
ADPL	Program Core Lab Courses
ADAU	Audit Courses
ADMC	Mandatory Courses

ADPROJ	Employment Enhancement Courses (Project/Summer Internship/ Seminar)
ADM	Minor Courses
ADH	Honour Courses
ADPE	Program Elective Courses
ADOE	Open Elective Courses

- **Course level coding scheme:** Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the year in which course is offered. e.g.
  101, 102 … etc. for first year.
  201, 202 …. etc. for second year.
  301, 302 … etc. for third year.
- **Category-wise courses**

HUMANITIES & SOCIAL SCIENCES COURSES [ADHS]

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADHL104	Design Thinking	I	0	0	2	1
2.	ADHS201	English	II	2	0	1	3
3.	ADHS205	Universal Human Values-II: Understanding Harmony and Ethical Human Conduct	II	2	1	0	3
4.	ADHS301	Effective Technical Communication	III	3	0	0	3
5.	ADHS306	Engineering Economics	III	2	1	0	3
6.	ADHS504	Entrepreneurship and Start-ups	V	3	0	0	3
Total Credits							**16**

BASIC SCIENCE COURSES [ADBS]

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADBS102	Physics	I	3	0	0	3
2.	ADBL101	Physics Lab	I	0	0	4	2
3.	ADBS101	Mathematics-I	I	3	1	0	4
4.	ADBS203	Chemistry	II	3	0	0	3
5.	ADBL201	Chemistry Lab	II	0	0	4	2
6.	ADBS202	Mathematics-II	II	3	1	0	4
7.	ADBS302	Mathematics-III	III	3	1	0	4
Total Credits							**22**

ENGINEERING SCIENCE COURSES [ADES]

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADES103	Basic Electronics Engineering	I	3	0	0	3
2.	ADEL102	Basic Electronics Engineering Lab	I	0	0	4	2
3.	ADEL103	Engineering Graphics & Design Lab	I	1	0	4	3
4.	ADES204	Program for Problem Solving	II	3	0	0	3
5.	ADEL202	Program for Problem Solving Lab	II	0	0	4	2
6.	ADEL203	Workshop/Manufacturing Lab	II	1	0	4	3
7.	ADES303	Digital System Design	III	2	1	0	3
8.	ADEL301	Digital System Design Lab	III	0	0	4	2
9.	ADES304	Data Structures and Algorithms	III	2	1	0	3
10.	ADEL302	Data Structures and Algorithms Lab	III	0	0	4	2
Total Credits							**26**

PROFESSIONAL CORE COURSES [ADPC]

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADPC305	Database Management System	III	3	0	0	3
2.	ADPL303	Database Management System Lab	III	0	0	4	2
3.	ADPC402	Theory of Computation	IV	3	0	0	3
4.	ADPC403	Statistical Analysis and Computing	IV	3	0	0	3
5.	ADPL401	Statistical Lab (R and SPSS)	IV	0	0	4	2
6.	ADPC404	Introduction to Data Analytics and Visualization	IV	3	0	0	3
7.	ADPL402	Data Analytics and Visualization Lab	IV	0	0	4	2
8.	ADPC405	Discrete Mathematics	IV	3	0	0	3
9.	ADPC406	Operating Systems	IV	3	0	0	3
10.	ADPL403	Operating Systems Lab	IV	0	0	4	2
11.	ADPC407	Computer Organization and Design	IV	2	1	0	3
12.	ADPC501	Artificial Intelligence	V	3	0	0	3
13.	ADPL501	Artificial Intelligence Lab	V	0	0	4	2
14.	ADPC502	Computer Networks	V	3	0	0	3
15.	ADPL502	Computer Networks Lab	V	0	0	4	2
16.	ADPC503	Large Datasets Management	V	3	0	0	3
17.	ADPL503	Large Datasets Management Lab	V	0	0	4	2
18.	ADPC601	Introduction to IoT and Embedded Systems	VI	3	0	0	3
19.	ADPL601	IoT and Embedded Systems Lab	VI	0	0	4	2
20.	ADPC 602	Data and Internet Security	VI	3	0	0	3
21.	ADPC603	Cloud Computing	VI	3	0	0	3
22.	ADPC604	Machine Learning	VI	3	0	0	3
23.	ADPL602	Machine Learning Lab	VI	0	0	4	2
Total Credits							**60**

PROFESSIONAL ELECTIVE COURSES [ADPE]

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADPEXXX	Professional Elective – I	V	3	0	0	3
2.	ADPEXXX	Professional Elective - II	VI	3	0	0	3
3.	ADPEXXX	Professional Elective – III	VII	3	0	0	3
4.	ADPEXXX	Professional Elective - IV	VII	3	0	0	3
5.	ADPEXXX	Professional Elective - V	VIII	3	0	0	3
6.	ADPEXXX	Professional Elective - VI	VIII	3	0	0	3
Total Credits							**18**

OPEN ELECTIVE COURSES [ADOE]

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADOEXXX	Open Elective–I	V	3	0	0	3
2.	ADOEXXX	Open Elective-II	VI	3	0	0	3
3.	ADOEXXX	Open Elective-III	VII	3	0	0	3
4.	ADOEXXX	Open Elective – IV	VII	3	0	0	3
5.	ADOEXXX	Open Elective - V	VIII	3	0	0	3
Total Credits							**15**

PROJECT WORK, SEMINAR, AND INTERNSHIP IN INDUSTRY OR ELSEWHERE

S. No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADPROJ404	Minor Project	III	0	0	0	2
2.	ADPROJ603	Summer Internship - I	VI	0	0	0	2
3.	ADPROJ701	Project - I	VII	0	0	0	3
4.	ADPROJ702	Summer Internship - II	VII	0	0	0	3
5.	ADPROJ801	Project - II	VIII	0	0	0	7
Total Credits							**17**

MANDATORY COURSES [ADMC]

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	-	Induction Program (UHV)	I	3 Weeks			0
2.	ADMC401	Environmental Sciences	IV	3	-	-	0
3.	ADMC505	Indian Constitution	V	3	-	-	0
Total Credits							**0**

COMMUNITY ENGAGEMENT/ AUDIT COURSES[CSAU]

SI. No.	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	ADAU105	IDEA Workshop Lab	I	2	0	4	0
2.	ADAU204	Sports and Yoga	II	2	0	0	0
Total Credits							**0**

S.No	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences (HS)	**1**	6	6	-	3	-	-	-	**16**
2.	Basic Sciences (BS)	9	9	4	-	-	-	-	-	**22**
3.	Engineering Sciences (ES)	8	8	10	-	-	-	-	-	**26**
4.	Professional Core (PC)	-	-	5	24	15	16	-	-	**60**
5.	Professional Electives (PE)	-	-	-	-	3	3	6	6	**18**
6.	Open Electives (OE)	-	-	-	-	3	3	6	3	**15**
7.	Project Work/Seminar/ Internship (PROJ)	-	-	-	2	-	2	6	7	**17**
8.	Mandatory Courses (MC) /Audit Courses (AU)	0	-	-	0	0	-	-	-	**0**
Total Credits		**18**	**23**	**25**	**26**	**24**	**24**	**18**	**16**	**174**

INDUCTION PROGRAM

The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal,(Link:https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf).

Induction program(mandatory)	**Three-weekduration**
Induction program for studentsto be offered right at the start of the first year.	• Physical activity • CreativeArts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./ Branch & Innovations

MandatoryVisits /Workshop / ExpertLectures

a. It is mandatory to arrange one industrial visit every semester for the student of each branch

b. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on Professional/Industry/ Entrepreneurial Orientation.

c. It is mandatory to organize atleast one expert lecture per semester for each branch by inviting resource persons from domain specific industry.

CURRICULUM

SEMESTER I						
3 WEEK ORIENTATION PROGRAMME						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory						
1.	ADBS101	Mathematics-I	3	1	0	4
2.	ADBS102	Physics	3	0	0	3
3.	ADES103	Basic Electronics Engineering	3	0	0	3
Practical						
4.	ADBL101	Physics Lab	0	0	4	2
5.	ADEL102	Basic Electronics Lab	0	0	4	2
6.	ADEL103	Engineering Graphics & Design Lab	1	0	4	3
7.	ADHL104	Design Thinking	0	0	2	1
8.	ADAU105	IDEA Lab Workshop	2	0	4	0
Total Credits						**18**

SEMESTER II						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory						
1.	ADHS201	English	2	0	2	3
2.	ADBS202	Mathematics-II	3	1	0	4
3.	ADBS203	Chemistry	3	0	0	3
4.	ADES204	Programming for Problem Solving	3	0	0	3
5.	ADHS205	Universal Human Values-II	2	1	0	3
Practical						
6.	ADBL201	Chemistry Lab	0	0	4	2
7.	ADEL202	Programming for Problem Solving Lab	0	0	4	2
8.	ADEL203	Workshop/Manufacturing Lab	1	0	4	3
9.	ADAU204	Sports and Yoga	2	0	0	0
Total Credits						**23**

SEMESTER III						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory						
1.	ADHS301	Effective Technical Communication	3	0	0	3
2.	ADBS302	Mathematics – III (Probability and Statistics)	3	1	0	4
3.	ADES303	Digital System Design	3	0	0	3
4.	ADES304	Data Structures and Algorithms	3	0	0	3
5.	ADPC305	Database Management System	3	0	0	3
6.	ADHS306	Engineering Economics	3	0	0	3
Practical						
7.	ADEL301	Digital System Design Lab	0	0	4	2
8.	ADEL302	Data Structure and Algorithms Lab	0	0	4	2
9.	ADPL303	Database Management System Lab	0	0	4	2
Total Credits						**25**

SEMESTER IV						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory,						
1.	ADMC401	Environmental Science	3	0	0	0
2.	ADPC402	Theory of Computation	3	0	0	3
3.	ADPC403	Statistical Analysis and Computing	3	0	0	3
4.	ADPC404	Introduction to Data Analytics and Visualization	3	0	0	3
5.	ADPC405	Discrete Mathematics	3	0	0	3
6.	ADPC406	Operating Systems	3	0	0	3
7.	ADPC407	Computer Organization and Architecture	3	0	0	3
Practical						
8.	ADPL401	Statistical Lab (R and SPSS)	0	0	4	2
9.	ADPL402	Data Analytics and Visualization Lab	0	0	4	2
10.	ADPL403	Operating Systems Lab	0	0	4	2
11.	ADPROJ404	Minor Project	0	0	0	2
Total Credits						**26**

SEMESTER V						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory						
1.	ADPC501	Artificial Intelligence	3	0	0	3
2.	ADPC502	Computer Networks	3	0	0	3
3.	ADPC503	Large Data Sets Management	3	0	0	3
4.	ADPEXXX	Professional Elective -I	2	1	0	3
5	ADOEXXX	Open Elective - I	3	0	0	3
6.	ADHS504	Entrepreneurship and Startups	3	0	0	3
7.	ADAU505	Indian Constitution	3	0	0	0
Practical						
8.	ADPL501	Artificial Intelligence Lab	0	0	4	2
9.	ADPL502	Computer Networks Lab	0	0	4	2
10.	ADPL503	Large Data Sets Management Lab	0	0	4	2
Total Credits						**24**

SEMESTER VI						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory						
1.	ADPC601	Introduction to IoT and Embedded Systems	3	0	0	3
2.	ADPC602	Data and Internet Security	3	0	0	3
3.	ADPC603	Cloud Computing	3	0	0	3
4.	ADPC604	Machine Learning	3	0	0	3
5.	ADPEXXX	Professional Elective-II	2	1	0	3
6	ADOEXXX	Open Elective-II	3	0	0	3
Practical						
7.	ADPL601	IoT and Embedded Systems Lab	0	0	4	2
8.	ADPL602	Machine Learning Lab	0	0	4	2
9.	ADPROJ603	Summer Internship - I	0	0	0	2
Total Credits						**24**

SEMESTER VII						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory						
1.	ADPEXXX	Professional Elective-III	2	1	0	3
2.	ADPEXXX	Professional Elective-IV	2	1	0	3
3.	ADOEXXX	Open Elective-III	3	0	0	3
4.	ADOEXXX	Open Elective-IV	3	0	0	3
Practical						
5.	ADPROJ701	Project -I	0	0	0	3
6.	ADPROJ702	Summer Internship - II	0	0	0	3
Total						**18**

SEMESTER VIII						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
Theory						
1.	ADPEXXX	Professional Elective-V	2	1	0	3
2.	ADPEXXX	Professional Elective-VI	2	1	0	3
3.	ADOEXXX	Open Elective-V	3	0	0	3
Practical						
4.	ADPROJ801	Project -II	0	0	0	7
Total						**16**

HONOR Courses							
S.No	**Semester**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
THEORY							
1.	III	ADH01	Data Wrangling	3	1	0	4
2.	IV	ADH02	Data Mining and Data Warehousing	3	1	0	4
3.	V	ADH03	Data Visualization Techniques	3	1	0	4
4.	VI	ADH04	Image Processing and Computer Vision	3	1	0	4
5.	VII	ADH05	Introduction to Robotics	3	1	0	4
Total Credits							**20**

MINOR Courses							
S.No	**Semester**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
THEORY							
1.	III	ADM01	Foundations of Data Science	3	1	0	4
2.	IV	ADM02	Data analytics with R	3	1	0	4
3.	V	ADM03	Programming in Python	3	1	0	4
4.	VI	ADM04	Foundations of AI	3	1	0	4
5.	VII	ADM05	Introduction to Big Data	3	1	0	4
Total Credits							**20**

LIST OF PROFESSIONAL ELECTIVE COURSES[ADPE]

S. No	Course Code	Course Title	Periods			Credits
			Lecture	Tutorial	Practical	
1.	ADPE001	Data Mining	2	1	0	3
2.	ADPE002	Interactive Data Visualization	2	1	0	3
3.	ADPE003	Robotic Process Automation	2	1	0	3
4.	ADPE004	Machine Learning Tools	2	1	0	3
5.	ADPE005	AI in Healthcare	2	1	0	3
6.	ADPE006	Computational Intelligence	2	1	0	3
7.	ADPE007	Speech Processing	2	1	0	3
8.	ADPE008	Natural Language Processing	2	1	0	3
9.	ADPE009	Business Intelligence	2	1	0	3
10.	ADPE010	Virtual Reality and Augmented Reality	2	1	0	3
11.	ADPE011	Optimization Techniques	2	1	0	3
12.	ADPE012	Deep Learning	2	1	0	3
13.	ADPE013	Big Data Analytics	2	1	0	3
14.	ADPE014	Soft Computing	2	1	0	3
15.	ADPE015	Knowledge Engineering	2	1	0	3

LIST OF OPEN ELECTIVE COURSES [ADOE]

S.No	Code No.	Course Title	Hours per week			Total Credits
			Lecture	Tutorial	Practical	
1.	ADOE001	Introduction to Data Science	3	0	0	3
2.	ADOE002	R Programming	3	0	0	3
3.	ADOE003	Python for Engineers	3	0	0	3
4.	ADOE004	Principles of Artificial Intelligence	3	0	0	3
5.	ADOE005	Social Media Analytics	3	0	0	3

ADBS101 MATHEMATICS - I

L	T	P	C
3	1	0	4

Course Objective:

- To comprehend the mathematical concepts of matrices, ordinary differential equations, multivariable calculus and problem-solving.

Course Outcomes:

- To solve practical problems using Matrix algebra.
- To solve various types of ordinary differential equations, including higher-order linear equation.
- To compute partial derivatives, determine total derivatives, Jacobians, employ Taylor series, and find extremes of functions of two variables.
- To demonstrate proficiency in evaluating double integration and triple integration and using them to compute area and volume.
- To apply Green's theorem, Stoke's theorem and Gauss divergence theorem.

UNIT I (12 Hrs)

LINEAR ALGEBRA(MATRICES): Rank of a matrix - Consistency of a system of linear equations - Characteristic equation of a matrix - Eigen values and Eigen vectors - Properties of Eigen values and Eigen vectors - Cayley-Hamilton theorem (excluding proof)- Verification- Application (Finding Inverse and Power of a matrix)- Diagonalization of a matrix by orthogonal and similarity transformation- Quadratic form – Nature of Quadratic Form- Orthogonal reduction of quadratic form to canonical form.

UNIT II (12 Hrs)

ORDINARY DIFFERENTIAL EQUATIONS: Differential Equations of First Order- Exact equations- Leibnitz's linear equations- Bernoulli's equation- Equations solvable for p- Clairaut's equation- Differential equations of Higher order- Linear differential equations of higher order with constant coefficients- Euler's linear equation of higher order with variable coefficients- Method of variation of parameters.

UNIT III (12 Hrs)

MULTIVARIABLE CALCULUS (DIFFERENTIATION): Partial differentiation- Partial derivatives of first order and higher order- Partial differentiation of implicit functions- Euler's theorem on homogeneous functions - Total derivative - Jacobian Properties - Taylor's series for functions of two variables- Maxima and minima of functions of two variables.

UNIT IV (12 Hrs)

MULTIVARIABLE CALCULUS (MULTIPLE INTEGRALS): Double integration (Cartesian form and Polar form)- constant limits- variable limits- over the region R- Change of variables in double integrals (Cartesian to polar)- Application of double integral- Area by double integration- Change of Order of Integration- Triple Integration (Cartesian- Spherical and Cylindrical)- constant limits- variable limits- over the region R- Application of triple integral- Volume by triple integration.

UNIT V (12 Hrs)

MULTIVARIABLE CALCULUS (VECTOR CALCULUS): Vector Differential Operator- Gradient - Properties - Directional derivative - Divergence and Curl Properties and relations- Solenoidal and Irrotational vector fields - Line integral and Surface integrals - Integral Theorems (excluding Proof) - Green's theorem - Stoke's theorem - Gauss divergence theorem.

Text Books:

1. Veerarajan T., "Engineering Mathematics - I & II ", Tata McGraw-Hill, New Delhi, 2014 & 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

References:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Differential equations for engineers: https://nptel.ac.in/courses/111106100
2. Calculus of Several Real Variables: https://nptel.ac.in/courses/111104125
3. Engineering Mathematics - I: https://nptel.ac.in/courses/111105121
4. Matrix Analysis with Applications: https://nptel.ac.in/courses/111107112

ADBS102 PHYSICS

L	T	P	C
3	0	0	3

Course Objective:

- To learn the fundamental concepts of oscillations, waves, optics, applications of real life optical systems, communication and other applications.

Course Outcomes:

- To understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations.
- To gain knowledge on transverse and longitudinal waves in one dimension.
- To acquire skills to identify and apply formulas of optics and wave physics.
- To apply principles of interference, diffraction and polarization gain knowledge on interferometers.
- To gain knowledge on lasers to engineering situations.

UNIT I (9 Hrs)

SIMPLE HARMONIC MOTION - DAMPED AND FORCED SIMPLE HARMONIC OSCILLATOR: Mechanical and electrical simple harmonic oscillators - complex number notation and phasor representation of simple harmonic motion - damped harmonic oscillator – heavy - critical and light damping - energy decay in a damped harmonic oscillator - quality factor - forced mechanical and electrical oscillators - electrical and mechanical impedance - steady state motion of forced damped harmonic oscillator - power absorbed by oscillator.

UNIT II (9 Hrs)

NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES IN ONE DIMENSION AND INTRODUCTION TO DISPERSION: Transverse wave on a string - the wave equation on a string - Harmonic waves - reflection and transmission of waves at a boundary - impedance matching - standing waves and their Eigen frequencies - longitudinal waves and the wave equation for them - acoustics waves and speed of sound - standing sound waves. Waves with dispersion - water waves - superposition of waves and Fourier method - wave groups and group velocity.

UNIT III (9 Hrs)

THE PROPAGATION OF LIGHT AND GEOMETRIC OPTICS: Fermat's principle of stationary time and its applications e.g. in explaining mirage effect -laws of reflection and refraction - Light as an electromagnetic wave and Fresnel equations - reflectance and transmittance - Brewster's angle - total internal reflection - evanescent wave. Mirrors and lenses and optical instruments based on them - transfer formula and the matrix method.

UNIT IV (9 Hrs)

WAVE OPTICS: Huygens' principle - superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment - Newton's rings - Michelson interferometer - Mach- Zehnder interferometer, Farunhofer diffraction from a single slit and a circular aperture - the Rayleigh criterion for limit of resolution and its application to vision, Diffraction gratings and their resolving power.

UNIT V (9 Hrs)

LASERS: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion - different types of lasers, gas lasers (He-Ne - CO_2) - solid-state lasers (ruby - Neodymium) - dye lasers,Properties of laser beams, mono-chromaticity - coherence - directionality and brightness - laser speckles - applications of lasers in science - engineering and medicine.

Text Books:

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", John Wiley & Sons Inc.USA 11th Edition, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", Mc-Graw Hill Publications Private Limited, 7th Edition, 2017.
3. N.Subramanyam, "Waves and oscillations", Vikas Publishing house,2nd Edition, 2009.

References:

1. Renk, Karl.F, "Basics of laser physics", Springer international publishing, 2nd Edition, 2017.
2. H. J. Pain, Patricia Rankin, "Introduction to vibration and waves", Wiley, 1st Edition, 2015.
3. David Halliday, Robert Resnick and Jearl Walker, "Fundamentals of Physics", Wiley publications, 2013.

ONLINE/NPTEL Courses:

1. Engineering Physics I (Theory): https://nptel.ac.in/courses/122103011
2. Waves and Oscillations: https://nptel.ac.in/courses/115106119
3. Modern Optics: https://nptel.ac.in/courses/115105104

ADES103 BASIC ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objective:

- To learn the fundamental skills in construction of electronics circuit design and develop various electronic systems.

Course Outcomes:

- To understand the semiconductor physics of the intrinsic, p and n materials.
- To understand the function and operation of diodes, transistors and amplifiers.
- To analyze the performances of BJT & FETs and its uses in amplifiers and oscillators.
- To analyze and design the operational amplifiers circuits.
- To understand the architecture, functions & their applications of IC 741 OP-Amp.

UNIT I (9 Hrs)

SEMI CONDUCTORS AND DIODES: Conductors - Semiconductors - Intrinsic Semiconductors - Extrinsic Semi Conductors. Diode Theory, Basic Ideas - ideal Diode - Forward and Reverse Bias - Diode Equation - Volt-Ampere Characteristic- Special diodes, symbol of zener diode - operation - V-I characteristics - symbol of photo diode - working principle - LED symbol and principle.

UNIT II (9 Hrs)

RECTIFIERS: Half-wave Rectifier - Full-wave and Bridge Rectifier - derivation of Ripple factor - efficiency of Half-wave -Full-wave and Bridge rectifiers, Merits and demerits of Half-wave - Full-wave and Bridge rectifiers - Comparisons of rectifiers.

UNIT III (9 Hrs)

BIPOLAR JUNCTION &, FIELD-EFFECT TRANSISTORS: Symbols of PNP and NPN transistors and their working principles -Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier -Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET & MOSFET.

UNIT IV (9 Hrs)

DIGITAL CIRCUITS: Boolean algebra – Reduction of Boolean expressions - De-Morgan's theorem – Logic gates -Implementation of Boolean expressions - Flip flops - RS - JK - T and D Combinational logic - Half adder - Full adder and Subtractors, Sequential logic - Ripple counters and shift registers.

UNIT V (9 Hrs)

OPERATIONAL AMPLIFIERS: Characteristics of Op-Amps, Introduction to Op-amp - Op-amp Block Diagram - ideal and practical Op-Amps specifications - 741 Op-Amps & its features - Op-amp parameters & Measurement - Applications of Op-Amps: Inverting and Non-inverting amplifier - Integrator and differentiator - Comparators.

Text Books:

1. Albert Malvino and David J Bates, "Electronic Principles", Tata McGraw–Hill, 9th Edition, 2021. (Unit 1 & 2)
2. Boyelstad, "Electronic Devices and Circuits Theory", Pearson Education, 11th Edition, 2013.(Unit 1, 2 & 3)
3. Morris Mano, "Digital design", PHI Learning, 4thEdition, 2016. (Unit 4)
4. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th Edition, 2015. (Unit 5)
5. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International Pvt.Ltd., 5th Edition, 2018.(Unit 5)

References:

1. Robert L.Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson/PHI, 10th Edition, 2010.
2. David A.Bell, "Electronic Devices and Circuits", Oxford, 5th Edition, 2009.
3. S.Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", TATA McGraw Hill, 2nd Edition, 2003.
4. David A, "Operational Amplifiers & Linear ICs", Oxford Uni. Press, 3rd Edition, 2005. (Unit 5)

ONLINE / NPTEL Courses:

1. Introduction to Basic Electronics: https://archive.nptel.ac.in/courses/122/106/122106025/
2. Basic Electronics: https://archive.nptel.ac.in/courses/108/101/108101091/

ADBL101 PHYSICS LAB

L	T	P	C
0	0	4	2

Course Objective:

- To understand the working principles of spectrometer, polarimeter, curvature of lens and determination of optical absorption.

Course Outcomes:

- To understand and experiment Newtons rings.
- To understand the principles, concepts abd comparison of results with theoretical calculations.
- To understand measurement technology, usage of new instruments and real time applications in engineering studies.
- To state various laws which they have studied through experiments.
- To describe principles of optical fibre communication.

LIST OF EXPERIMENTS

1. Radius of curvature of a Lens - Newton's rings.
2. Thickness of a thin object by air – wedge.
3. Spectrometer – resolving power of a prism.
4. Spectrometer - determination of wavelength using grating.
5. Spectrometer - ordinary and extraordinary rays by calcite prism.
6. Laurant's Half shade polarimeter – determination of specific rotatory power.
7. Determination of wavelength of a laser source using transmission grating, reflection grating vernier calipers and particle size determination.
8. Determination of numerical aperture and acceptance angle of an optical fiber.
9. Determination of optical absorption coefficient of materials using laser.
10. Compact disc - determination of width of the groove using laser.

(Total Periods:45)

ADEL102 BASIC ELECTRONICS LAB

L	T	P	C
0	0	4	2

Course Objective:

- To design and analyze electronic circuits such as diodes, rectifiers, Zener diode, BJT, FET. To verify the basic logic operations and simple arithmetic circuits using logic gates.

Course Outcomes:

- To understand the characteristics of basic electronic devices.
- To apply problem-solving skills, recognize and utilize the characteristics of diodes, rectifiers & transistors.
- To construct the adder, subtractor, multiplier circuits to verify their functionalities.
- To interpret the Op-Amp based inverting and non-inverting amplifier circuit.
- To integrate diverse applications of Op-Amp in differentiator, integrator, adder & subtractor circuits.

LIST OF EXPERIMENTS

1. Measurement of different signal parameters using oscilloscope.
2. V-I characteristics of ordinary p-n junction diode.
3. Full wave rectifier, with and without filter.
4. Zener diode as a voltage regulator.
5. Input and output characteristics of BJT.
6. Input and output characteristics of FET.
7. Realization of basic gates using Universal logic gates.
8. Construction of simple Decoder & Multiplexer circuits using logic gates.
9. Construction of simple arithmetic circuits-Adder, Subtractor.
10. Op-Amp based inverting and non-inverting amplifier.
11. Op-Amp based differentiator and integrator.
12. Op-Amp based adder and subtractor.

(Total Periods:45)

ADEL103 ENGINEERING GRAPHICS AND DESIGN LAB

L	T	P	C
1	0	4	3

Course Objective:

- To provide the basic knowledge about Engineering Drawing and learn the concepts of projections, technical drawing, dimensioning and specifications.

Course Outcomes:

- To understand the visual aspects of Engineering Design.
- To understand Engineering Graphics Standards.
- To illustrate Solid Modelling.
- To understand Computer-Aided geometric design
- To understand creation of design working drawings.
- To understand Engineering Communication inspect.

UNIT I

INTRODUCTION: Introduction, Conics and Special Curves.

UNIT II

PROJECTIONS: Projection of points, lines and planes.

UNIT III

SOLIDS: Projection of solids, section of solids, surface development in Engineering Design and Graphics Lab.

UNIT IV

ISOMETRIC: Isometric and Orthographic projections.

UNIT V

AUTOCAD: Introduction to computer aided drafting, hardware, overview of application software – 2D drafting commands (Auto CAD) for simple shapes – Dimensioning.

Text Books:

1. Bhatt N.D., Panchal V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House, 2014.
2. Lakhwinder Pal Singh and Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press Education, 2021.
3. Agrawal B. and Agrawal C. M., "Engineering Graphics", TMH Publication, 2012.
4. K. Venugopal, "Engineering Drawing and Graphics + Auto CAD", New Age International Publication Ltd., 4th Edition, 2004.

References:

1. Narayana, K.L. and P Kannaiah, “Engineering Drawing”, Scitech Publishers, 2008.
2. CAD Software Theory and User Manuals.

(Total Periods:45)

ADHL104 DESIGN THINKING

L	T	P	C
0	0	2	1

Course Objective:

- To understand the new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.

Course Outcomes:

- To compare and classify the various learning styles and memory techniques and apply them in their engineering education.
- To analyze emotional experience and inspect emotional expressions to better understand users while designing innovative products.
- To develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.
- To explore real-time innovative engineering product designs and choose appropriate frameworks, strategies,techniques during prototype development.
- To perceive individual differences, its impact on everyday decisions and create a better customer experience.

UNIT I (9 Hrs)

AN INSIGHT TO LEARNING: Understanding the Learning Process - Kolb's Learning Styles - Assessing and Interpreting - Remembering Memory:Understanding the Memory process, Problems in retention - Memory enhancement techniques - Emotions - Experience and Expression - Understanding Emotions - Experience and Expression -Assessing Empathy, Application with Peers.

UNIT II (9 Hrs)

BASICS OF DESIGN THINKING: Definition of Design Thinking - Need for Design Thinking - Objective of Design Thinking - Concepts and Brainstorming - Stages of Design Thinking Process (explain with examples) – Empathize - Define - Ideate - Prototype - Test. Being Ingenious and Fixing Problem - Understanding Creative thinking process - Understanding Problem Solving - Testing Creative Problem Solving.

UNIT III (9 Hrs)

PROCESS OF PRODUCT DESIGN: Process of Engineering Product Design - Design Thinking Approach - Stages of Product Design - Examples of best product designs and functions - Assignment – Engineering Product - Design Prototyping and Testing- Rapid Prototype Development process - Testing - Sample Example, Test Group Marketing.

UNIT IV (9 Hrs)

CELEBRATING THE DIFFERENCE: Understanding Individual differences and Uniqueness - Group Discus- sion and Activities to encourage the understanding - acceptance and appreciation of Individual differences. Design Thinking and Customer Centricity - Practical Examples of Customer Challenges - Use of Design Thinking to Enhance Customer Experience - Parameters of Product experience - Alignment of Customer Expectations with Product Design.

UNIT V (9 Hrs)

FEEDBACK, RE-DESIGN AND RE-CREATE: Feedback loop - Focus on User Experience - Address ergonomic challenges - user focused design - rapid prototyping and testing - final product - final Presentation - Solving Practical Engineering Problem through Innovative Product Design and Creative Solution.

Text Books:

1. Burgelman, Christensen, and Wheelwright, "Strategic Management of Technology and Innovation", 5th Edition, McGraw Hill Publications, 2017.
2. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons, 2013.

References:

1. E Balaguruswamy, "Developing Thinking Skills (The way to Success)", Khanna Book Publishing Company, 2022.
2. Hasso Plattner, Christoph Meinel and Larry Leifer , "Design Thinking: Understand –Improve– Apply", Springer, 2011.
3. Jeanne Liedtka, Andrew King and Kevin Bennett, "Book - Solving Problems with Design Thinking - Ten Stories of What Works", Columbia Business School Publishing, 2013.

(Total Periods:45)

ADAU105 IDEA WORKSHOP LAB

L	T	P	C
2	0	4	0

Course Objective:

- To learn skill tools and inventory associated with the IDEA Lab. To build useful standalone system/ project with Mechanical and Electronic fabrication process.

Course Outcomes:

- To understand the working of tools and inventory associated with the IDEA lab
- To understand the working of mechanical and electronic fabrication processes and designing the standalone project and report preparation.

UNIT I

DESIGNING AND INTRODUCTION TO HAND AND POWER TOOLS: Electronic component familiarization, Electronic system design flow.Schematic design and PCB layout and Gerber creation using Eagle CAD. Documentation: Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools: FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT. Introduction to basic hand tools: Tape measure, combination square, Vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits.

UNIT II

CIRCUIT PROTOTYPING AND MECHANICAL CUTTING AND JOINING PROCESS: Familiarization and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output) Circuit prototyping - breadboard, Zero PCB, Manhattan' style, custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines. Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboard a Box.

UNIT III

ELECTRONIC CIRCUIT BUILDING AND 3D PRINTING: Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input. Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging. 3D printing and prototyping technology –3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering. Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter andCNC routers. Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab.

UNIT IV

Discussion and implementation of a mini project.

UNIT V

Documentation of the mini project (Report and video).

Laboratory Activities:

List of Lab activities and experiments

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as soft wood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter and engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.

Text Books:

1. Chris Hackett, Weldon Owen, "The Big Book of Maker Skills: Tools and Techniques for Building Great Tech Projects", 2018.
2. Sean Michael Ragan, Weldon Owen "The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product", 2017.
3. Paul Horowitz and Winfield Hill, "The Art of Electronics", Cambridge University Press, 3rd Edition.

References:

1. Paul Sherz and Simon Monk. "Practical Electronics for Inventors" McGraw Hill, 4thEdition, 2016.
2. Charles Platt, "Encyclopedia of Electronic Components (Volume 1,2 and 3)", Shroff Publishers, 2012.
3. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer, "Building Scientific Apparatus",Cambridge University Press, 4th Edition, 2009.
4. Simon Monk "Programming Arduino: Getting Started with Sketches", McGraw Hill, 2ndEdition, 2016.
5. Simon Monk and Duncan Amos, "Make Your Own PCBs with EAGLE: From Schematic Designs to Finished-Boards", McGraw Hill Education, 2017.

ADHS201 ENGLISH

L	T	P	C
2	0	2	3

Course Objective:

- Build the competence in English grammar and vocabulary for effective communication by developing Reading, Writing, Listening and Speaking skills of students.

Course Outcomes:

- To enhance communication skills through formal and informal mode.
- To apply the technical writing and communication skills in their academic and professional life.
- To gain self-confidence with improved command over English.
- To understand the technical aspects of communication for better performance in extra curricular activities, recruitment process and prospective jobs.
- To develop and deliver professional presentations.

UNIT I (9 Hrs)

FUNDAMENTALS OF COMMUNICATION SKILLS: Importance of communication through English - Process of communication and factors that influence speaking - Importance of audience and purpose - Principles of communication - comparing general communication and business communication - Professional communication - barriers to communication - strategies to overcome communication barriers - formal and informal communication.

UNIT II (9 Hrs)

WRITING SKILLS: Basics of Grammar - Placing of Subject and Verb - Sentence Structures - Use of Phrases and Clauses in sentences - Importance of proper punctuation - Creating coherence - Techniques for writing precisely - Parts of Speech - Uses of Tenses - Active and Passive - Modes of Writing.

UNIT III (9 Hrs)

VOCABULARY BUILDING AND WRITING: The Concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes - Synonyms & Antonyms -Words often confused - One-word substitutes - Idioms and Phrasal Verbs - Abbreviations of Scientific and Technical Words.

UNIT IV (9 Hrs)

SPEAKING SKILLS: Introduction to Phonetic Sounds & Articulation - Word Accent - Rhythm and Intonation - Interpersonal Communication - Oral Presentation - Body Language and Voice Modulation (Para linguistics and Non-Verbal) - Negotiation and Persuasion - Group Discussion - Interview Techniques (Telephonic and Video Conferencing).

UNIT V (9 Hrs)

TECHNICAL WRITING: Job Application - CV Writing - Business Letters - Memos - Minutes - Notices - Report Writing Structures - E-mail Etiquette - Blog Writing.

Text Books:

1. Ludlow R. and Panton F., "The Essence of Effective Communication", Prentice Hall, 2020.
2. Kul Bhushan Kumar & R. S. Salaria, "Effective Communication Skills", Khanna Publishing House, 2018.
3. Dr. Bikram K. Das et al., "An Introduction to Profession English and Soft Skills", Cambridge University Press, 2009.

References:

1. Michael Mccarthy and Felicity O Dell, "English Vocabulary in Use", McCarthy M, Cambridge University Press, 3rd Edition, 2017.
2. Raman M. Sharma S, "Technical Communication: Principles and Practice", Raman, Oxford University Press, 2nd Edition, 2012.

ONLINE/ NPTEL Courses:

1. English Language and Literature: https://nptel.ac.in/courses/109103020
2. Business English Communication: https://nptel.ac.in/courses/109106129
3. Technical English: https://nptel.ac.in/courses/109106066

ADBS202 MATHEMATICS-II

L	T	P	C
3	1	0	4

Course Objective:

- To formulate and solve partial differential equations, Laplace, Fourier transforms within the Engineering domain.

Course Outcomes:

- To formulate and solve various types of partial differential equations.
- To understand the Laplace transform and its properties.
- To apply Laplace transforms to solve ordinary differential equations with constant coefficients and simultaneous ordinary differential equations.
- To understand and apply Fourier transform techniques, including Fourier integral theorem, properties of Fourier transforms, convolution, and Parseval's identity.
- To apply Fourier series and harmonic analysis, enabling them to analyze and synthesize periodic signals and functions in various engineering and mathematical applications.

UNIT I (12 Hrs)

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations, Solutions of standard types of first order partial differential equations, Lagrange s linear equation, Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II (12 Hrs)

LAPLACE TRANSFORM: Existence conditions, Transforms of elementary functions , Properties, Transform of unit step function and unit impulse function , Transforms of derivatives and integrals , Transforms of Periodic Functions ,Initial and final value theorems.

UNIT III (12 Hrs)

INVERSE LAPLACE TRANSFORM: Inverse Laplace Transforms Properties, Convolution theorem, Application - Solution of ordinary differential equations with constant coefficients - Solution of simultaneous ordinary differential equations.

UNIT IV (12 Hrs)

FOURIER TRANSFORM: Fourier Integral theorem (statement only) , Fourier transform and its inverse, Properties: Fourier sine and cosine transforms, Properties, Convolution and Parseval's identity.

UNIT V (12 Hrs)

FOURIER SERIES: Dirichlet s conditions , Expansion of periodic functions into Fourier series- Change of interval, Half-range Fourier series, Root mean square value - Parseval's theorem on Fourier coefficients, Harmonic analysis.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2. Veerarajan T, "Transforms and Partial Differential Equations", Tata McGraw-Hill, New Delhi, 2012.

References:

1. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Laplace Transform: https://nptel.ac.in/courses/111106139
2. Partial Differential Equations: https://nptel.ac.in/courses/111101153
3. Advanced Engineering Mathematics: https://nptel.ac.in/courses/111107119

ADBS203 CHEMISTRY

L	T	P	C
3	0	0	3

Course Objective:

- To understand the concepts of atomic structures, spectroscopic techniques, chemical equilibrium, periodic properties and stereo chemistry.

Course Outcomes:

- To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- To rationalise bulk properties and processes using thermodynamic considerations.
- To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- To understand the major chemical reactions those are used in the synthesis of molecules.

UNIT I (9 Hrs)

ATOMIC AND MOLECULAR STRUCTURE: Schrodinger equation - Particle in a box solutions and their applications for conjugated molecules and nano particles - Forms of the hydrogen atom wave functions and the plots to explore their spatial variations - Molecular orbitals of diatomic molecules and plots of the multicentre orbitals - Pi-molecular orbitals of butadiene and aromaticity - Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties - Band structure and role of doping of solids.

UNIT II (9 Hrs)

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS: Principles of spectroscopy and selection rules - Electronic spectroscopy of Fluorescence and its applications in medicine - Applications of Vibrational and rotational spectroscopy of diatomic molecules - Nuclear magnetic resonance imaging and surface characterization techniques.

UNIT III (9 Hrs)

USE OF FREE ENERGY IN CHEMICAL EQUILIBRIUM: Thermodynamic functions-energy, entropy and free energy- Applications of Cell potentials - Nernst equation, acid-base, oxidation-reduction and solubility equilibrium - Use of free energy considerations in metallurgy through Ellingham diagrams. Inter molecular forces and poten- tial energy: surfaces- Ionic, dipolar and Van Der Waals interactions - Equations on state of real gases and critical phenomena.

UNIT IV (9 Hrs)

PERIODIC PROPERTIES: Effective nuclear charge - variations of s, p, d and f orbital and energies of atoms in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability and molecular geometries.

UNIT V (9 Hrs)

STEREO CHEMISTRY: Representations of 3 dimensional structures - structural isomers and stereoisomers, symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis - Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation and reduction - Synthesis of a commonly used drug molecule.

Text Books:

1. Manisha Agrawal, "Chemistry-I", Khanna Book Publishing Co., 1st Edition, 2021.
2. P.W.Atkins, Julio de Paula and James Keeler, "Physical Chemistry", Oxford University, 11th Edition, 2018.
3. B. H. Mahan, "University chemistry", Pearson Education, 4th Edition, 2013.
4. C.N.Banwell, "Fundamentals of Molecular Spectroscopy", 3rd Edition, 2008.

References:

1. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry: Structure and Function", 5th Edition, 2022.

ONLINE/ NPTEL Courses:

1. Spectroscopic Techniques for Pharmaceutical and Biopharmaceutical Industries: https://nptel.ac.in/courses/104102113
2. Engineering Chemistry I: https://archive.nptel.ac.in/courses/122/106/122106028
3. Quantum Chemistry of Atoms and Molecules: https://nptel.ac.in/courses/104101124

ADES204 PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
3	0	0	3

Course Objective:

- To acquire the knowledge of programming in Python. To learn the concepts, principles, functions and develop an application.

Course Outcomes:

- To understand the basic concepts and working principles of Python Programming.
- To develop algorithmic solutions to simple computational problems.
- To understand the structure of solving problems using programming.
- To explore the concepts of compound data using Python lists, tuples, dictionaries.
- To explore the various multimedia features using python.

UNIT I (9 Hrs)

INTRODUCTION: History - Features - Working with Python - Installing Python - basic syntax - Data types - variables - Manipulating Numbers - Text Manipulations - Python Build in Functions.

UNIT II (9 Hrs)

COMPONENTS OF PYTHON PROGRAMMING: Python objects and other languages - operator Basics - Numbers - String - List - Tuples - Dictionaries - Files - Object Storage - Type Conversion - Type Comparison - Statements - Assignments - Control Statements.

UNIT III (9 Hrs)

FUNCTIONS AND MODULES: Functions Definition and Execution - Arguments - Return Values - Advanced Function Calling - Modules - Importing modules - Packages - Creating a module.

UNIT IV (9 Hrs)

OBJECT ORIENTED AND EXCEPTION HANDLING: Classes and Objects - creating a class - class methods - class inheritance. Exceptions Handling-Build in Exceptions- Files, File operations, reading a file content, writing a file, change position, controlling file I/O, Manipulating file paths.

UNIT V (9 Hrs)

APPLICATIONS: Working with PDF and Word Documents - Working with CSV Files and JSON Data - Sending Email and Text Messages - Manipulating Images - Using Python for Multimedia.

Text Books:

1. Allen B.Downey, "Think Python: How to Think Like a Computer Scientist", Shroff O Reilly Publishers, 2nd Edition, 2016.
2. Guido Van Rossum and Fred L. Drake Jr, "An Introduction to Python", Network Theory Ltd., 2011.
3. Martin C.Brown, "The Complete reference - Python", Tata McGraw Hill Indian Edition, 2010.

References:

1. Eric Matthes, "A Hands-On, Project-Based Introduction To Programming", 2nd Edition, 2019.
2. Budd T A, "Exploring Python", Tata McGraw Hill Education, 2011.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.

ONLINE/ NPTEL Courses:

1. Programming, Data Structures and Algorithms using Python: https://nptel.ac.in/courses/106106145
2. The Joy of Computing using Python: https://nptel.ac.in/courses/106106182
3. Python for Data Science: https://nptel.ac.in/courses/106106212

ADHS205 UNIVERSAL HUMAN VALUES II

L	T	P	C
2	1	0	3

Course Objective:

- To highlight the plausible implications of such a holistic understanding in terms of ethical human conduct, trustful, mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- To have a holistic vision of life.
- To enhance a socially responsible behavior.
- To understand the responsibility of an environmental work.
- To understand the Competence and Capabilities for Maintaining Health and Hygiene.
- To appreciate the aspiration for excellence (merit) and gratitude for all.

UNIT I (9 Hrs)

INTRODUCTION TO VALUE EDUCATION: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity the Basic Human Aspirations, Happiness and Prosperity Current Scenario, Method to Fulfil the Basic Human Aspirations.

UNIT II (9 Hrs)

HARMONY IN THE HUMAN BEING: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

UNIT III (9 Hrs)

HARMONY IN THE FAMILY AND SOCIETY: Harmony in the Family, the Basic Unit of Human Interaction, Trust, Foundational Value in Relationship, Respect, Right Evaluation, Other Feelings, Justice in Human to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

UNIT IV (9 Hrs)

HARMONY IN THE NATURE/EXISTENCE: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

UNIT V (9 Hrs)

IMPLICATIONS OF THE HOLISTIC UNDERSTANDING: Natural Acceptance of Human Values, Definitive-ness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Hu- man Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text Books:

1. Premvir Kapoor, "Professional Ethics and Human Values", Khanna Book Publishing Company, New Delhi, 2022.
2. R R Gaur,R Asthana, G P Bagaria, "The Textbook - A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
3. RR Gaur, R Asthana, G P Bagaria, "The Teacher's Manual- Teachers Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, 2019.

References:

1. Annie Leonard, "The Story of Stuff", 2011.
2. A.N. Tripathi,"Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth", FP classic, 2009.
4. A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, "VanVidya: EkParichaya", 1999.

ADBL201 CHEMISTRY LAB

L	T	P	C
0	0	4	2

Course Objective:

- To experiment various methods of volumetric analysis - Redox, Iodometric, complexometric, Neutralization etc. and use of conductivity meter for measurement of conductance of water sample..

Course Outcomes:

- To illustrate the principles of physical chemistry relevant to the study of rate of reactions.
- To estimate rate constants of reactions from concentration of reactants/products as a function of time.
- To measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
- To understand the changes in matter and acquire scientific skills in the laboratory.
- To synthesize a small drug molecule and analyze a salt sample.

LIST OF EXPERIMENTS

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Determination of cell constant and conductance of solutions.
6. Potentiometry - determination of redox potentials and emfs.
7. Synthesis of a polymer/drug.
8. Determination of the partition coefficient of a substance between two immiscible liquids.
9. Saponification/acid value of an oil.
10. Chemical analysis of a salt.
11. Lattice structures and packing of spheres.
12. Determination of the rate constant of a reaction.
13. Colligative properties using freezing point depression.
14. Models of potential energy surfaces.
15. Chemical oscillations- Iodine clock reaction.
16. Adsorption of acetic acid by charcoal.
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

(Total Periods : 45)

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Determination of surface tension and viscosity.	http://pcv-au.vlabs.ac.in/ physical- which has to be broken of_Organic_Solvents/
2	Ion exchange column for removal of hardness of water.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water Analysis Determination _of_Chemical_Parameters/
3	Determination of chloride content of water.	http://vlabs.iitb.ac.in/vlabs dev/labs/nitk_labs/Environmental Engineering_1/ experiments/determination-of-chloride-nitk/simulation.html
4	Colligative properties using freezing point depression.	http://pcv-au.vlabs.ac.in/ physical- chemistry/Cryoscopy/
5	Determination of the rate constant of a reaction.n.	http://pcv-au.vlabs.ac.in/ physical- chemistry/EMF Measurement/
6	Determination of cell constant and conductance of solutions.	http://icv-au.vlabs.ac.in/ inorganic- chemistry/ Water_Analysis_Determinatio n_of_Physical_Parameters/
7	Potentiometry - determination of redox potentials and emfs.	http://pcv-au.vlabs.ac.in/ physical- chemistry/EMF_Measurement/
8	Saponification/acid value of an oil	http://biotech01.vlabs.ac.in/bio chemistry/ Estimation of _Saponificatio n_Value_of_Fats_or_Oils/
9	Lattice structures and packing of spheres.	https://vlab.amrita.edu/ ?sub=1&brch=2 82&sim=370&cnt=1

ADEL202 PROGRAMMING FOR PROBLEM SOLVING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Programming language

Course Objective:

- To develop a application using python libraries and packages.

Course Outcomes:

- To develop a application for simple real life problems.
- To write programs using python statements and expressions.
- To write programs by implementing functions and strings in python.
- To demonstrate a application by dealing with an exceptions
- To explore Pygame tool by developing a gaming application.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems. (Electricity Billing, Retail shop billing, Sin series etc).
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, Scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter s age validity, student mark range validation)
11. Exploring Pygame tool.Developing a game activity using Pygame like bouncing ball, car race etc.

(Total Periods:45)

ADEL203 WORKSHOP/MANUFACTURING LAB

L	T	P	C
1	0	4	3

Course Objective:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

Course Outcomes:

- To fabricate components with their own hands.
- To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- To design small devices of their interest by assembling different components.
- To practice Arc Welding and Gas Welding.
- To develop a casted products.

Course Content:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Electrical & Electronics.
5. Carpentry.
6. Plastic moulding, glass cutting.
7. Metal casting.
8. Welding (arc welding & gas welding), brazing.

Practicals:

1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical & Electronics
5. Welding shop (Arc welding + Gas welding)
6. Casting
7. Smithy
8. Plastic moulding & Glass Cutting

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Welding shop (Arc welding + Gas welding).	http://mm- coep.vlabs.ac.in/ LaserSpotWelding/Theory.html? domain=Mechanical%20Engineering &lab=Welcome %20to %20Micromachining %20laboratory
2	Casting	http://fab- coep.vlabs.ac.in/exp7/Theory.html? domain=Mechanical %20Engineering&lab=Welcome%20tO %20FAB%20laboratory

(Total Periods:45)

ADAU204 SPORTS AND YOGA

L	T	P	C
2	0	0	0

Course Objective:

- To expose the students in variety of physical, yogic activities and stimulating their continued inquiry about Yoga, physical education, health and fitness.

Course Outcomes:

- To practice physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
- To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- To learn breathing exercises and healthy fitness activities.
- To understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- To perform yoga movements in various combination and forms.

UNIT I

Introduction to Physical Education - Olympic Movement - Physical Fitness - Wellness and Lifestyle.

UNIT II

Fundamentals of Anatomy & Physiology in Physical Education - Sports and Yoga - Kinesiology - Biomechanics & Sports

UNIT III

Postures - Yoga - Yoga & Lifestyle

UNIT IV

Training and Planning in Sports - Psychology & Sports - Doping

UNIT V

Sports Medicine - Sports/Games

References:

1. Dr. Sudhakara.G, “Modern Trends in Physical Education, Sports and Yogic Science”, 2020.
2. Swami Vivekananda, “PatanjaliÆs Yoga Sutras”, paperback, 2019.
3. B.K.S. Iyengar, “Light On Yoga”, 2006.
4. Health and Physical Education NCERT (11^{th} and 12^{th}Classes)

ADHS301 EFFECTIVE TECHNICAL COMMUNICATION

L	T	P	C
3	0	0	3

Course Pre-Requisite:

- Knowledge in Subject Competence, Linguistic Competence, and Organizational Competence.

Course Objectives:

- To Convey Complex Information Clearly and Precisely, To the Intended Audience, Using Appropriate Language, Visuals, and Formatting.

Course Outcomes:

- To Define and Discuss the Dynamics of Verbal and Nonverbal Aspects of Communication.
- To Write Various Formal Documents for Technical and Professional Communication.
- To Communicate in Diverse Formal Situations Taking Place in Organizations.
- To Illustrate and Examine the Knowledge of Ethical Aspects of Engineering.
- To Demonstrate and Explain Social and Professional Etiquette.

UNIT I (9 Hrs)

INFORMATION DESIGN AND DEVELOPMENT: Different Kinds of Technical Documents - Information Development Life Cycle - Organization Structures - Factors Affecting Information and Document Design - Strategies for Organization - Information Design and Writing for Print and Online Media.

UNIT II (9 Hrs)

TECHNICAL WRITING: Grammar and Editing - Technical Writing Process - Forms of Discourse - Writing Drafts and Revising - Collaborative Writing - Creating Indexes - Technical Writing Style and Language - Basics of Grammar - Study of Advanced Grammar - Editing Strategies to achieve Appropriate Technical Style - Introduction to Advanced Technical Communication: Usability - Human Factors - Managing Technical Communication Projects - Time Estimation - Single Sourcing - Localization.

UNIT III (9 Hrs)

SELF DEVELOPMENT AND ASSESSMENT: Self-Assessment: Awareness - Perception and Attitudes - Values and Belief - Personal Goal Setting - Career Planning - Self-Esteem. Managing Time: Personal Memory - Rapid Reading - Taking Notes - Complex Problem Solving - Creativity.

UNIT IV (9 Hrs)

COMMUNICATION AND TECHNICAL WRITING: Public Speaking - Group Discussion - Oral: Presentation - Interviews - Graphic Presentation - Presentation Aids - Personality Development - Writing Reports - Project Proposals - Brochures - Newsletters - Technical Articles - Manuals - Official Notes - Business Letters - Memos - Progress Reports - Minutes of Meetings - Event Reports.

UNIT V (9 Hrs)

ETHICS: Business Ethics - Etiquettes in Social and Office Settings - Email Etiquettes - Telephone Etiquettes - Engineering Ethics - Managing Time - Role and Responsibility of Engineer - Work Culture in Jobs - Personal Memory - Rapid Reading - Taking Notes - Complex Problem Solving - Creativity.

TEXT BOOKS:

1. Shiv Khera, "You Can Win, Macmillan Books", 1 th Edition, Bloomsbury Publishing, 2020.
2. Diane Hacker," Pocket Style Manual", 6th Edition, Bedford Publication,2020.
3. Kulbhushan Kumar," Effective Communication Skills", 1st Edition, Khanna Publishing House, 2019.
4. David F. Beer and David Mc Murrey," Guide to writing as an Engineer", 5th Edition, John Willey, 2019.

REFERENCES:

1. M. Ashraf Rizvi, "Effective Technical Communication ", 2nd Edition, McGraw Hill, 2017.
2. Raman Sharma, "Technical Communications",1st Edition, Oxford Publication,2015.

Online /NPTEL COURSES:

1. Ethics: https://nptel.ac.in/courses/109104032
2. Communication Skills: https://nptel.ac.in/courses/109104030
3. Understanding Creativity and Creative Writing: https://nptel.ac.in/courses/109101017

ADBS302 MATHEMATICS - III

L	T	P	C
4	0	0	4

Pre-requisite:

- Basic Knowledge in Maths & Statistics

Course Objective:

- To learn the foundations of probabilistic and statistical methods in engineering field.

Course Outcomes:

- To understand the fundamental concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- To understand and apply measures of central tendency, dispersion, moments, skewness, kurtosis, correlation, regression, and rank correlation for effective data analysis and interpretation.
- To attain proficiency in curve fitting techniques and conduct significance tests for large samples.
- To perform t-tests for means, correlation tests, F - test, and Chi-square tests for goodness of fit and independence of attributes.
- To apply the fundamental principles of experimental design classifications in the field of engineering.

UNIT I (12 Hrs)

BASIC PROBABILITY: Sample Space and Events, Axioms of Probability, Conditional Probability, Bayes' Theorem, Independent Events, Random Variables, Discrete and Continuous Random Variables – Probability Mass Function - Probability Density Function – Cumulative Distribution Function - Expectation and Variance, Standard Probabil- ity Distributions (Problems only): Bernoulli, Binomial, Poisson, Geometric, Multinomial, Uniform , Exponential, Gamma, Erlang and Normal Distribution.

UNIT II (12 Hrs)

BASIC STATISTICS: Measures of Central tendency – Mean – Median – Mode; Measure of Dispersion – Range – Variance – Standard Deviation; Moments, Skewness and Kurtosis, Correlation and regression, Rank Correlation.

UNIT III (12 Hrs)

APPLIED STATISTICS (LARGE SAMPLES): Curve Fitting by the Method of Least Squares- Fitting of straight lines, second degree parabolas and more general curves. **Test of Significance:** Large Sample Test for Single Propor- tion, Difference of Proportions, Single Mean, Difference of Means and Difference of Standard Deviations.

UNIT IV (12 Hrs)

APPLIED STATISTICS (SMALL SAMPLES): Student's' t-Tests - Test for Single Mean, Difference of Means and Correlation Coefficients, Test for ratio of variances (F - Test), Chi-square Test for goodness of fit and Independence of Attributes.

UNIT V (12 Hrs)

DESIGN OF EXPERIMENTS: One-Way and Two-way Classifications- Completely randomized design- Randomized block design- Latin square design -2 factorial designs.

Text Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
2. S. Ross, "A First Course in Probability", Pearson Education India,9th Edition, 2013.

References:

1. Bali N.P and Manish Goyal, "A Textbook Of Engineering Mathematics", Laxmi Publications(P) Ltd, 10th Edition, 2019.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2018.
3. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2017.
4. William Feller, "An Introduction to Probability Theory and its Applications", (WSE) Vol. 1, 3rd Edition, 2013.

ONLINE/ NPTEL Courses:

1. Probability and Statistics: https://nptel.ac.in/courses/111105090
2. Advanced Engineering Mathematics: https://nptel.ac.in/courses/111107119
3. Introduction to Probability Theory and Statistics: https://nptel.ac.in/courses/111102160

ADES303 DIGITAL SYSTEM DESIGN

L	T	P	C
2	0	0	3

Course Objectives:

- To introduce the fundamentals of digital system design, and to lay a strong foundation.
- To the combinational and sequential logic also to educate from basic concepts to advanced system design.
- To impart an understanding of the hardware fundamentals of computer design.

Course Outcomes:

- To Understand the binary number systems and Boolean algebra.
- To Design combinational logic using only of universal gates, MSI gates, and PLDs
- To Design and implement sequential logic circuits of any complexity.
- To Simulate and validate the correctness of the digital circuits using VHDL packages.
- To Develop any prototypes using state-of-the-art reconfigurable devices.

UNIT I (9 Hrs)

REVIEW OF BINARY NUMBER SYSTEMS: Binary, Decimal, Octal, Hexadecimal number systems, Number base conversions, Signed binary numbers, Arithmetic operations, Binary codes, weighted BCD codes, Excess-3 codes, Gray Codes, Alphanumeric Codes, Error detecting and Correction codes, Boolean Algebra & Theorems: Fundamental postulates, DeMorgan's theorems, Sum of Products and Product of Sums functions, Canonical form, Minimization of expressions using Karnaugh Maps and Quine-McCluskey method, and Implementation of Boolean functions using universal gates and multilevel gates.

UNIT II (9 Hrs)

COMBINATIONAL LOGIC: Half & full adders/subtractors, Parallel Adders, Look-ahead carry adders, BCD adders /subtractors, Binary Multiplier, Code convertors, Decoders, Encoders, Parity encoders, Multiplexers, Implementation of combinational logic using Multiplexers, Demultiplexers, Magnitude comparators, Parity generator/checker.

UNIT III (9 Hrs)

SEQUENTIAL LOGIC: Latches versus Flip Flops, SR, D, JK, Master-Slave Flip Flops, Excitation table, Conversion of Flip flops, Counters: Asynchronous, synchronous, decade, presettable, Shift Registers: types, applications, Ring counter, Analysis and design of clocked sequential circuits, Mealy and Moore models, State machine notations, state reduction techniques.

UNIT IV (9 Hrs)

RECONFIGURABLE DIGITAL CIRCUITS: Types of Memories, Organization of ROM and RAM, Address Decoding, Programmable Logic Devices (PLDs), Programmable Logic Arrays (PLAs), Programmable Array Logic(PAL) devices, Field Programmable Gate Arrays (FPGAs), Combinational Logic implementation using PROMs, PLAs, PALs.

UNIT V (9 Hrs)

DIGITAL DESIGN WITH VERILOG HDL: Hierarchical Modeling concepts, 4-bit ripple carry counter, modules, instances, Data types, Arrays, System tasks, directives, Modules and Ports, Gate-Level Modeling, Dataflow Modeling, Design of Multiplexers, counters and full adders, Introduction to Behavioral Modeling.

TEXT BOOKS:

1. M. Morris R. Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Prentice Hall,2018.
2. Joseph Cavanagh, "Verilog HDL Design Examples", 1st Edition, CRC Press, 2021.

REFERENCES:

1. A. P. Godse and D. A. Godse, "Digital Systems Design", Technical Publications, Pune, 2008.
2. Leach Malvino, "Digital Principles and Applications", Tata McGraw Hill, 5th Edition, 2005.
3. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall, 2009.

Online /NPTEL COURSES:

1. Introduction to Digital System Design: https://nptel.ac.in '/courses/117105080.
2. Digital System design with PLDs and FPGAs: https://nptel.ac.in/courses/117108040

ADES304 DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

Course Objective:

- To impart knowledge about the importance of data structures in programming and to familiarise basic searching and sorting algorithms.

Course Outcomes:

- To comprehend the basics of algorithms and understand the operations performed using arrays.
- To understand the linear data structures and its applications.
- To realize the properties of tree data structure and its importance in searching large database.
- To understand graph data structure and its applications.
- To know the need for hash tables.

UNIT I (9 Hrs)

INTRODUCTION: Data structures: Definition, Types - Algorithm: Definition, Properties, Analyzing algorithms: Space and Time Complexity-Arrays: One dimensional array, multidimensional array, Applications. Searching Algorithms: Linear search, Binary Search, Fibonacci search. Sorting Algorithms: Selection Sort, Bubble Sort, Quick Sort, Insertion sort, Heap Sort and Merge Sort.

UNIT II (9 Hrs)

STACK,QUEUE AND LINKED LISTS: Stacks: Definition – Operations - Applications of stack. Queues: Definition - Operations - Priority queues – De-queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, Linked stacks, Linked queues, Applications of Linked List – Dynamic storage management.

UNIT III (9 Hrs)

TREE: Definition - Binary tree – Terminology – Representation – Operations - Applications – Binary search tree – AVL tree. B Trees: B Tree indexing - Operations on a B Tree - B + Tree Indexing. Trie - Trie operations.

UNIT IV (9 Hrs)

GRAPH: Definition – Terminology – Representation - Traversals – Applications - Spanning tree, Shortest path and Transitive closure, Topological sort. Set: Definition - Representation - Operations on sets – Applications

UNIT V (9 Hrs)

HASH TABLE: Tables: Rectangular tables - Jagged tables – Inverted tables - Symbol tables – Static tree tables - Dynamic tree tables - Hash tables-Overflow handling- Files: Sequential organization – Indexed organization.

Text Books:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Pvt. Ltd., 2004.
2. D. Samanta, Classic Data Structures, 2nd, Prentice-Hall of India, Pvt. Ltd., India, 2012.

References:

1. Thomas Cormen, Charles Lieserson, Ronald L Rive stand Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2022.
2. John Canning, Alan Broder, Robert Lafore, "Data Structures & Algorithms in Python", Addison-Wesley Professional,1st Edition, 2022.

ONLINE/ NPTEL Courses:

1. Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac. in/noc23 cs95
2. Introduction to Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac.in/noc23_cs15
3. Programming, Data Structures and Algorithms using Python for beginners: https: //nptel.ac.in /courses/106106145

ADPC305 DATABASE MANAGEMENT SYSTEM

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Data Structures and Algorithms, Programming skills

Course Objectives:

- To understand the concepts of Database Management System(DBMS), relational model, SQL quries, database storage structure, transaction processing and concurrency control.

Course Outcomes:

- To explain the basics of DBMS and design of database using ER model.
- To understand the relational model and SQL queries.
- To understand the authorization, security in database and normalization concepts.
- To understand the various storage components of a database and file organization techniques.
- To understand the concepts of ACID, concurrent transaction processing and recovery systems.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Database Systems: Overview – Data Models – Database System Architecture – History of Database Systems. Entity-Relationship Model: Basic Concepts – Constraints – Keys – Design Issues – Entity Relationship Diagram – Weak Entity Sets – Extended E-R Features – Design of an E-R Database Schema.

UNIT II (9 Hrs)

Relational Model: Structure of Relational Databases – Relational Algebra – Extended - Relational Algebra Operations – Modification of Database – Views – Tuple Relational - Calculus – Domain Relational Calculus. SQL: Background – Basic Structure – Set - Operations – Aggregate Functions – Null Values – Nested Sub-queries – Views – Complex Queries – Modification of the database –Joined Relations – Data-Definition Language.

UNIT III (9 Hrs)

Integrity and Security: Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization,Authorization in SQL. Relational-Database Design: Normalization, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form.

UNIT IV (9 Hrs)

Storage and File Structures: Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary Storage – Storage Access – File Organization. Indexing and Hashing: Basic Concepts –Static Hashing – Dynamic Hashing.

UNIT V (9 Hrs)

Transactions: Transaction concept – Transaction State – Implementation of Atomicity and Durability – Concurrent Executions – Serializability – Testing for Serializability. Concurrency Control: Lock-Based Protocols – Timestamp-Based Protocols. Recovery System: Failure Classification – Storage Structure – Recovery and Atomicity – Log-Based Recovery – Shadow Paging.

Text Books:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", McGraw-Hill Higher Education, 7th Edition, 2021.

References:

1. Fred R McFadden, Jeffery A Hoffer and Mary B. Prescott, "Modern Database Management", Addison Wesley, 7th Edition, 2004.
2. Elmasri and Navathe, "Fundamentals of database Systems", Addison Wesley, 6th Edition, 2010.
3. Jefrey D.Ulman and Jenifer Widom, "A First Course in Database Systems", Pearson Education Asia, 2001.
4. Bipin C Desai, "An Introduction to Database Systems", Galgotia Publications Pvt Limited, 2003.

ONLINE/NPTEL Courses:

Database Management System: https://nptel.ac.in/courses/106105175

ADHS306 ENGINEERING ECONOMICS

L	T	P	C
2	1	0	3

Course Objectives:

- To provide the student with advanced concepts of engineering economic analysis and its role in engineering decision-making.
- To provide knowledge on topics such as depreciation, after-tax analysis, replacement analysis, uncertainty, inflation, deflation, and estimation of future events.

Course Outcomes:

- To Describe the role of economics in the decision-making process and perform calculations regarding interest formulas.
- To Estimate the Present, annual, and future worth comparisons for cash flows.
- To Calculate the rate of return, depreciation charges, and income taxes.
- To Enumerate different cost entities in estimation and costing.
- To Explain the elements of budgeting and benchmarking.

UNIT I (9 Hrs)

INTRODUCTION: Definition – Nature – Scope and Significance of Economics for Engineers. **DEMAND AND SUPPLY:** Demand – Types – Determinants – Law of Demand – Elasticity of Demand – Types – Significance – Supply – Market price determination - Case Study in Demand Forecasting – Meaning – Methods – Consumer Survey – Trend Projections – Moving average.

UNIT II (9 Hrs)

COST AND REVENUE: Concepts – Classifications – Short-run and long-run cost curves – Revenue – Concepts – Measurement of Profit (Case Study).

UNIT III (9 Hrs)

MARKET STRUCTURE: Perfect Competition – Characteristics – Price and output determination in the short run and long run – Monopoly – Price Discrimination – Monopolistic Competition – Product Differentiation – Oligopoly and Duopoly. **Market Failure:** Causes – Type of Goods – Rivalrous and Non-rivalrous goods – Excludable and Non-excludable goods – Solutions – Government Intervention.

UNIT IV (9 Hrs)

MONEY AND BANKING: Money – Functions – Quantity theory of money – Banking – Commercial Banks – Functions – Central Bank (RBI) – Functions – Role of Banks in Economic Development. **FOREIGN EXCHANGE:** Balance of Payments – Exchange rate determination – Methods of foreign payments – International Institutions – IMF, IBRD.

UNIT V (9 Hrs)

BUSINESS CYCLE AND NATIONAL INCOME: Meaning –Phases of business cycle - Inflation – Causes – Control measures - Deflation - National Income – Concepts – Methods of calculating national income – Problems in calculating national income.

TEXT BOOKS:

1. Premvir Kapoor, "Sociology and Economics for Engineers",1st Edition, Khanna Book Publishing Company Private Limited, 2018.
2. Bhatia H, L, "Economics for Engineers",3rd Edition, Vikas Publishing, 2017.
3. Dewett. K.K., Navalur M. H., "Modern Economic Theory",1st Edition, S Chand and Company, 2016.

REFERENCES:

1. Frank Musgrave Ph.D., "AP Microeconomics/Macroeconomics",6th Edition, Barrons Educational, 2018.
2. Paul Krugman, Maurice Obstfeld, "International Economics", 10th Edition, Pearson Education, 2017.

Online /NPTEL COURSES:

1. Engineering Economic Analysis: https://nptel.ac.in/courses/112107209

ADEL301 DIGITAL SYSTEM DESIGN LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Digital Logic Design.

Course Objectives:

- To Illustrate simplification of Algebraic equations and Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators
- To describe Latches and Flip-flops, Registers, and Counters, and to analyze Mealy and Moore Models.
- To develop state diagrams of Synchronous Sequential Circuits again to appreciate the applications of digital circuits.

Course Outcomes:

- To Explain the concept of combinational and sequential logic circuits.
- To Analyze and Design the combinational logic circuits.
- To Describe and characterize flip-flops and their applications.
- To Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines.
- To Design applications of Combinational & Sequential Circuits

List of Exercises:

1. Verification of DeMorgan's theorems using basic logic gates.
2. Design and implementation of adders and subtractors.
3. Design and implementation of Carry Look-Ahead Adders.
4. Design and implementation of Parity Generator/Checkers.
5. Design and implementation of Priority encoders using logic gates.
6. Design and implementation of simplified Boolean expressions using Multiplexers.
7. Design and implementation of simplified Boolean expressions using Decoders.
8. Design and implementation of Magnitude Comparators.
9. Study of clocked RS, D, and JK Flip-Flops.
10. Design and implementation of Serial Input Parallel Output (SIPO) and Parallel Input Serial Output (PISO) Shift Registers.
11. Design and implementation of ripple and synchronous counters.
12. Simulation of a combinational logic using HDL.
13. Simulation of a sequential logic using HDL.
14. Implementation of given Boolean expressions using multioutput PAL/PLA realization.
15. Implementation of a sequential circuit using PAL/PLA realization.

(Total Periods:45)

ADEL302 DATA STRUCTURES AND ALGORITHMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic knowledge in programming

Course Objective:

- To enable students write programs using various data structures, analyse and understand the benefits of choosing the right data structure.

Course Outcomes:

- To write programs for search and sorting algorithms.
- To write programs for implementing stacks, queues and linked list.
- To write programs for searching using tree data structure.
- To write programs for identifying shortest path in a network.
- To write programs that implements hash tables.

LIST OF EXPERIMENTS

1. Searching Algorithms (With the Number of Key Comparisons) - Sequential, Binary and Fibonacci Search Algorithms on an Ordered List
2. Sorting Algorithms: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Heap Sort and Merge Sort.
3. Implementation of Stack and Its Operations.
4. Application of Stack for Converting an Arithmetic Expression into Postfix Form and Evaluation of Postfix Expression.
5. Implementation of Queue, Circular Queue, Priority Queue, Dequeue and Their Operations.
6. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List.
7. Implementation of Binary Tree and Binary Traversal Techniques.
8. Implementation of Graph Traversal Techniques.
9. Implement Dijkstra's Algorithm to Obtain the Shortest Paths.
10. Implementation of Hash Tables and its Operations.

(Total Periods:45)

ADPL303 DATABASE MANAGEMENT SYSTEM LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Data Structures and Algorithms, Programming Skills

Course Objectives:

- To understand SQL,JDBC and ODBC connectivity. To design and develop databases for real-time applications.

Course Outcomes:

- To analyze database needs, functions and to create data models.
- To create Entity-Relationship (E-R)diagrams.
- To design and implement databases using database technology.
- To use normalization rules and principles to create normalized databases.
- To develop real-time database applications.

LIST OF EXPERIMENTS

1. Study of Database Concepts
2. Implementation of BASIC commands
3. Implementation of DDL commands
4. Implementation of DML commands
5. Implementation of DQL commands
6. Implementation of DCL commands
7. Implementation of TCL commands
8. Implementation of Built in functions
9. Implementation of Aggricate functions
10. Implementation of set operations, joins, nested sub quries
11. Create a set of tables, add foreign key constraints and incorporate referential integrity.
12. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
13. Write user defined functions and stored procedures in SQL.
14. Write SQL Triggers for insert, delete, and update operations in a database table.
15. Create View and index for database tables with a large number of records.
16. Design and develop any three real life database applications from the following list
    (a) Library Information System
    (b) Logistics Management System
    (c) Students' Information System

(d) Ticket Reservation System

(e) Hospital Management System

(f) Inventory Management for a Grocery Shop

(g) Employee Information System

(h) Property Management system

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
- Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate settings.

(Total Periods: 45)

ADMC401 ENVIRONMENTAL SCIENCE

L	T	P	C
3	0	0	0

Course Pre-requisite:

- Basic Science Courses

Course Objective:

- To work and produce most efficient, economical, eco-friendly finished products, to solve various engineering problems applying ecosystem to produce eco–friendly products.

Course Outcomes:

- To understand the basic concepts of industrial management.
- To understand the importance of air and noise pollution.
- To analyze the importance of solid and water pollution.
- To understand the importance of renewable sources of solar energy.
- To understand the environmental management in fabrication industry and solid waste management.

UNIT I (9 Hrs)

ECOSYSTEM: Structure of ecosystem-Biotic & Abiotic components- Food chain and food web- Aquatic (Lentic and Lotic) and terrestrial ecosystem- Carbon, Nitrogen, Sulphur, Phosphorus cycle- Global warming, Causes, effects, process, Green House Effect, Ozone depletion.

UNIT II (9 Hrs)

AIR AND, NOISE POLLUTION: Definition of pollution and pollutant-Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler)- Air Pollutants: Types, Particulate Pollutants- Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)- Gaseous Pollution Control, Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler- Noise pollution, sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.

UNIT III (9 Hrs)

WATER AND SOIL POLLUTION : Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD- Definition, calculation- Waste Water Treatment, Primary methods, sedimentation, froth flotation, Secondary methods- Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method- Membrane separation technology, RO (reverse osmosis).

UNIT IV (9 Hrs)

RENEWABLE SOURCES OF ENERGY SOLAR ENERGY: Basics of Solar energy- Flat plate collector (Liquid & Air). Theory of flat plate collector- Importance of coating- Advanced collector- Solar pond- Solar water heater, solar dryer- Solar stills- Biomass: Overview of biomass as energy source- Thermal characteristics of biomass as fuel- Anaerobic digestion- Biogas production mechanism- Utilization and storage of biogas- New Energy Sources, Need of new sources- Different types new energy sources- Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy.

UNIT V (9 Hrs)

SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT: Solid waste generation- Sources and characteristics of Municipal solid waste, E- waste, Biomedical waste- Air quality act 2004, air pollution control act 1981 and Water Pollution and Control Act 1996- Structure and role of Central and state pollution Control Board- Concept of Carbon Credit, Carbon Footprint- Environmental management in fabrication industry- ISO14000: Implementation in industries, Benefits.

Text Books:

1. S.C. Sharma & M.P. Poonia, "Environmental Studies", Khanna Publishing House, New Delhi, 2021.
2. Arceivala, Soli Asolekar, Shyam, "Waste Water Treatment for Pollution Control and Reuse", Mc-Graw Hill Education India Pvt. Ltd., New York, 2007.
3. Nazaroff, William, Cohen, Lisa, "Environmental Engineering Science", Willy, New York, 2000.
4. O.P. Gupta, "Elements of Environmental Pollution Control", Khanna Publishing House, New Delhi.

References:

1. Aldo Vieira, Da Rosa, "Fundamentals of renewable energy processes", Academic Press Oxford, 2013.
2. Patvardhan, A.D, "Industrial Solid Waste", Teri Press, 2013.
3. Metcalf and Eddy, "Waste Water Engineering", Mc-Graw Hill, 2013.
4. Keshav Kant, "Air Pollution & Control", Khanna Publishing House, 2018.

ONLINE/NPTEL Courses:

1. Introduction to Environmental Engineering: https://nptel.ac.in/courses/103107084
2. Environmental Quality Monitoring & Analysis: https://nptel.ac.in/courses/103106162
3. Basic Environmental Engineering and Pollution Abatement: https://nptel.ac.in/courses/103107215
4. Environmental Air Pollution: https://nptel.ac.in/courses/105104099

ADPC402 THEORY OF COMPUTATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Discrete Mathematics, Digital Electronics and System, Design and Analysis of Algorithms

Course Objective:

- To learn the concepts of automata computation, decision problems with limitations of computational models, algebraic formalisms of languages.

Course Outcomes:

- To understand models and abstractions: automata as a basic model of computation
- To understand Link between languages, automata, and decision problems.
- To understand layering as a means of tackling complexity, layering applied to the Internet.
- To understand algebraic formalisms of languages such as regular expressions, context-free grammar.
- To understand algorithms and computability through the lens of Turing machines.

UNIT I (12 Hrs)

FINITE AUTOMATON: Alphabets, formal languages and problems. Regular languages and automata models- Deterministic Finite automaton, Formal argument of correctness, Regular languages -Properties of regular languages, Closure, properties, product construction, Limitations of Automata Nonregularity, Pumping Lemma, Non-Deterministic Finite Automaton, Subset construction, Equivalence with DFAs.

UNIT II (12 Hrs)

REGULAR EXPRESSIONS: Equivalence with regular languages- Algorithms for regular languages, Minimization and its algorithm. Myhill- Nerode relations, Characterization of regular languages.

UNIT III (12 Hrs)

GRAMMARS, CONTEXT-FREE LANGUAGES AND MACHINE MODELS: Grammars and the motivation from language theory- Context-free grammars, closure properties- Chomsky Normal Form for CFGs. PDAs - Empty-stack vs Final state acceptance conditions - Equivalence of PDAs and CFGs. Limitations of PDA computation, non-context-free language - Pumping Lemma for CFLs, Deterministic CFLs and PDAs, CYK Algorithm for parsing of CFLs.

UNIT IV (12 Hrs)

TURING MACHINES AND COMPUTABILITY: Modeling computation using Turing Machines - Equivalent models - Church Turing Hypothesis - Decidability and Turing recognizability (i.e., recursive and recursively enumerable)- Closure properties - Undecidability by diagonalization, Reductions to show undecidability.

UNIT V (12 Hrs)

RESOURCE BOUNDED TURING MACHINES & INTRO TO COMPLEXITY: Basic complexity classes- Time bounded classes Post's correspondence problem, undecidable problems, Polytime reductions, NP-completeness, Cook-Levin Theorem without proof.

Text Books:

1. Michael Sipser, "Introduction to the Theory of Computation", Cengage Publications, 3rd Edition 2012.
2. John Hopcroft, Rajeev Motwani, Jeffrey D. Ullmann, "Introduction to Automata, Theory, Languages and Computation".Pearson Publications, 3rd Edition, 2008.

References:

1. R.B. Patel, "Theory of Computation", Khanna Book Publishing, 2020.
2. Harry Lewis, Christos Papadimitriou, "Elements of the Theory of Computation", Prentice Hall, Pearson Publisher, 2nd Edition, 1997.

ONLINE/NPTEL Courses:

1. What is theory of computation? Set membership problem, basic notions like alphabet, strings, formal languages: https://nptel.ac.in/courses/106104028
2. Introduction- Theory of Computation: https://nptel.ac.in/courses/106104148
3. Grammers and Natural Language Processing: https://nptel.ac.in/courses/106106049

ADPC403 STATISTICAL ANALYSIS AND COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Probability and Statistics.

Course Objectives:

- To get introduced to methods and tools for statistical computing. This course aims at contemporary tools and languages such as R.
- To be accompanied by the computational lab for statistical packages.

Course Outcomes:

- To Identify the distribution of the datasets and perform statistical measurements.
- To Determine the important predictor variables in a regression analysis of the datasets.
- To Formulate a hypothesis and perform a suitable hypothesis test.
- To Apply resampling to address mixed data distributions, and identify and remove biases from the datasets.
- To Learn Bootstraping Process datasets via statistical packages.

UNIT I (9 Hrs)

PROBABILITY AND STATISTICS: An Introduction to Probability and Statistics - Representation of Data - An Introduction to R - Data Description - Qualitative Data - Categorical Data - and Factors - Probability on Discrete Sample Spaces - Discrete Probability Distributions - Continuous Probability Distributions.

UNIT II (9 Hrs)

LINEAR AND POLYNOMIAL REGRESSION: Simple Linear Regression: Estimating the coefficients - Assessing the Accuracy of the coefficient Estimates - Assessing the accuracy of the model. Multiple Linear Regression: Estimating the regression coefficients - Other considerations in the Regression Model - The Marketing Plan - Comparison of Linear Regression with K-Nearest Neighbors.

UNIT III (9 Hrs)

HYPOTHESIS TESTING: Introduction - Hypothesis and Hypothesis test - Null Hypothesis and Alternative Hypothesis - Null Hypothesis and Alternative Hypothesis - Critical and rejection region - Types of Test-One and Two-Tailed Test - Errors in Hypothesis Testing - Power of a Test and the Size Effect - Power of a Test and the Size Effect - Test of Significance - Hypothesis Testing for Large and small Samples - Student's t-Distribution.

UNIT IV (9 Hrs)

RESAMPLING TECHNIQUES: Cross-Validation - The Validation Set Approach - Leave-One-Out Cross-Validation - K-Fold Cross-Validation - Bias-Variance Trade-off for K-Fold Cross-Validation - Cross-Validation on Classification Problems.

UNIT V (9 Hrs)

BOOTSTRAPPING: Introduction - Bootstrap Standard Errors - Bootstrap Confidence Intervals. Introduction to contemporary statistical packages - Case Study.

TEXT BOOKS:

1. B. L. S. Prakasa Rao, "A First Course in Probability and Statistics",1st Edition, World Scientific, 2020.
2. Gareth M. James," Introduction to statistical learning: With applications to R",7th Edition, Springer,2017.

References :

1. Allen Craig Robert V Hogg, Joseph W Mckean, "Introduction to Mathematical Statistics", 8th Edition, Pearson Education India, 2021.
2. Jay Kerns. G "Introduction to Probability and Statistics Using R" 2nd Edition, Chapman and Hall/CRC, 2015.

Online /NPTEL COURSES:

1. Essentials of Data Science With R Software: Probability and Statistical Inference: https://nptel.ac.in/courses/111104146

ADPC404 INTRODUCTION TO DATA ANALYTICS AND VISUALIZATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in mathematics, statistics, linear algebra, calculus, and statistical analysis is essential.

Course Objectives:

- To provide a broad overview of data analysis and visualization techniques.
- To give hands-on training in data analytics.
- To build descriptive and predictive models, and validate their models.
- To perform data wrangling, cleaning, and sampling to get a suitable data set.

Course Outcomes:

- To get familiar with the concepts of Data Science and Data Visualization.
- To explain and demonstrate various techniques for automatic data Wrangling and data cleaning.
- To understand and apply modeling and analysis techniques for various types of datasets including e-commerce transactions, review datasets, time series datasets, text documents, etc.
- To get familiar with the Spatial and Geospatial data.
- To select methods and create effective visualizations to explain the artifacts in the data, distributions of attributes, relationships between the attributes, efficacy of the models, and predictions generated by them.

UNIT I (9 Hrs)

INTRODUCTION DATA SCIENCE AND DATA VISUALIZATION : Basics of Data Science - Exploratory Data Analysis and Data Science Process. Motivation for using Python for Data Analysis - Introduction to Data Visualization - History of Visualization - Need for Visualization - Interactive Visualization - Common Types of Data Visualization - Data Visualization and Info-graphics.

UNIT II (9 Hrs)

DATA WRANGLING AND DATA CLEANING: Combining and Merging Data Sets - Reshaping and Pivoting - Data Transformation - String Manipulation - Regular Expressions. Data Cleaning and Preparation: Handling Missing Data - Data Transformation - String Manipulation.

UNIT III (9 Hrs)

DATA AGGREGATION, GROUP OPERATIONS, TIME SERIES: GroupBy Mechanics -Data Aggregation - GroupWise Operations and Transformations - Pivot Tables and Cross Tabulations - Date and Time Date Type tools - Time Series Basics - Data Ranges - Frequencies and Shifting.

UNIT IV (9 Hrs)

SPATIAL AND GEOSPATIAL DATA: Spatial Data: One-dimensional - Two-dimensional - Three-dimensional data - Dynamic data. Geospatial data: visualizing spatial data - Point data - Line data - Area data. Multivariate data: Point-based, Line-based, Region-based, Hybrid Techniques.

UNIT V (9 Hrs)

DATA VISUALIZATION TECHNIQUES: Visualization techniques for trees - graphs - networks - Text and Document Visualization. Matplotlib package - Plotting Graphs - Controlling Graphs - Adding Text - More Graph Types - Getting and setting values - Patches.

TEXT BOOKS:

1. McKinney, W., "Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython",2nd Edition, O'Reilly Media, 2017.
2. Matthew O. Ward," Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, A K Peters/CRC, 2015.

REFERENCES:

1. Oliver Theobald, "Analytics for Absolute Beginners: Make Decisions Using Every Variable: (Introduction to Data, Data Visualization, Business Intelligence & Machine ... Science, Python & Statistics for Beginners)",1st Edition, Scatterplot, 2019.

Online /NPTEL COURSES:

1. Data Analytics with Python: https://nptel.ac.in/courses/106107220

ADPC405 DISCRETE MATHEMATICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Mathematics I, II

Course Objectives:

- To learn the fundamentals of set operations, Cartesian products, binary equivalence relations, functions, and their properties.
- To learn the fundamental concepts of Combinatorics and Graph theory.

Course Outcomes:

- To analyse and comprehend Cantor's diagonal argument and understand the Power Set theorem.
- To apply the Chinese Remainder Theorem to solve systems of congruences and real-world problems.
- To solve the problems on combinatorial concepts such as permutations, combinations and matching algorithms to graph theory problems.
- To interpret and evaluate formulas using interpretations in first-order logic.
- To analyse the homomorphism and isomorphism between algebraic structures and Calculate expectations, variances, probabilities in Bernoulli trials and conditional probability scenarios using Bayes' Theorem.

UNIT I (9 Hrs)

SET, RELATIONS, FUNCTIONS: Operations and Laws of Sets, Cartesian Products,Binary Relation and functions, Partial Ordering Relation - Equivalence Relation - Image and Size of a Set - Sum and Product of Functions - Bijective functions - Inverse and Composite Function - Finite and infinite Sets - Countable and uncountable Sets-Cantor's diagonal argument and The Power Set theorem.

UNIT II (9 Hrs)

PROOF STRATEGIES AND MODULAR ARITHMETIC: Proof Methods and Strategies- Forward Proof - Proof by Contradiction - Proof by Contraposition - Proof of Necessity and Sufficiency - Case analysis - Induction -Extended Euclid's Greatest Common Divisor algorithm - The Fundamental Theorem of Arithmetic - Modular arithmetic - Co-primality (or Euler's totient function)- Chinese Remainder Theorem.

UNIT III (9 Hrs)

COMBINATORICS AND GRAPHS: Permutation and Combination - Inclusion-Exclusion - pigeon-hole principle -generating functions - Recurrence - Connected components - Paths - Cycles - Trees - Hamiltonian/Eulerian Walks - Coloring - Planarity - Matching.

UNIT IV (9 Hrs)

LOGIC: Languages of Propositional logic and First-order logic - expressing natural language sentences in languages of propositional and first-order logic - expressing natural language predicates in the language of first-order logic. Semantics of First-order logic- interpretation and its use in evaluating a formula.

UNIT V (9 Hrs)

ALGEBRA: Group, Permutation Groups, Cosets, Normal Subgroups, Ring, Field, Finite fields, Fermat's little theorem, Homomorphisms, Isomorphisms.

Text Books:

1. Rosen, K. H, "Discrete Mathematics and Its Applications", 8th Edition, 2019.
2. Liu, C.L. and Mohapatra, D.P., "Elements of Discrete Mathematics", Tata McGraw-Hill, 2008.
3. Huth, M.and Ryan M., "Logic in Computer Science: Modelling and Reasoning about Systems", Cambridge University Press, 2nd Edition, 2004.

References:

1. Mitzenmacher.M, and Upfal.E, "Probability and computing: Randomization and probabilistic techniques in algorithms and data analysis", Cambridge University Press, 2017.
2. Shoup.V, "A computational introduction to number theory and algebra", Cambridge University Press, 2009.
3. Bóna.M, "A Walk Through Combinatorics: An Introduction to Enumeration and Graph Theory", 2006.
4. Herstein.I.N, "Topics in algebra", John Wiley and Sons, 2006.

ONLINE/NPTEL Courses:

1. Discrete Mathematics: https://nptel.ac.in/courses/106103205
2. Introduction-Discrete Mathematics: https://nptel.ac.in/courses/106108227
3. Discrete Mathematics: https://nptel.ac.in/courses/111106086

ADPC406 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Programming Languages, Data Structures and Algorithms, Computer Organization and Architecture.

Course Objective:

- To learn the details of the abstractions, interfaces provided by the OS for program execution and execution requirements, processes, threads, memory management, files. To analyse concurrency and related synchronization based solutions.

Course Outcomes:

- To understand the role, functionality of the layering systems software components
- To understand the design and usage of the OS API and OS services.
- To understand process management, concurrency and thread introduction.
- To understand problems arising due to concurrency and related synchronization based solutions.
- To have Hands-on practical experience with usage of the OS API and basics of OS mechanisms.

UNIT I (9 Hrs)

INTRODUCTION TO OPERATING SYSTEMS: Application requirements, The systems stack and role of OS, resources, abstractions and interfaces, Components overview of an OS, Examples of different types of OS - Basic organization of hardware components, Von Neumann architecture -Processes: Process abstraction, Process Control Block (PCB),Design of system calls - Invocation and basic OS handling, Process control system calls, fork, wait, getpid, getppid and variants, The limited direct execution model.

UNIT II (9 Hrs)

MEMORY MANAGEMENT: Address bus and memory access, Memory view of a process, heap, stack, code, data - Process memory usage requirements, virtual memory and related system calls (mmap, munmap, sbrk, mprotect) -Address translation mechanisms: static mapping, segmentation, paging Page faults, page sharing, read/write permissions, swapping, process vs OS memory - Memory bookkeeping and management - motivation and mechanisms (process and OS) - Case studies: malloc and role of OS for program to process.

UNIT III (9 Hrs)

PROCESS MANAGEMENT AND CONCURRENCY: The process lifecycle, source code to execution, The OS mode of execution, limited direct execution recap, interrupts, system calls, switch mechanism and PCB state- Schedul- ing policies, scheduling metrics, goals and examples (interactive vs. real-time, priority)- Motivation, application, process and OS use cases- Introduction to threads and the pthread API.

UNIT IV (9 Hrs)

SYNCHRONIZATION: Synchronization primitives, limitations of software solutions, atomic Instructions, test-and-set, spinlocks, mutexes, condition variables, semaphores- Introduction to the pthread synchronization API- Case studies, producer-consumer, reader, writers, barriers- Discussion on issues with concurrency: race conditions, deadlocks, order violation.

UNIT V (9 Hrs)

FILE SYSTEMS: Persistence and the File abstraction, Hardware view- Hard disk architecture and its interfacing, Process view - System calls for file handling, Roles and responsibilities of file system, File system design details- file and file system metadata, directory structure, caching optimizations, File System case study (the Unix file system etc.).

Text Books:

1. Andrew S. Tannenbaum and Herbert Bos, "Modern Operating Systems", Pearson Education India, 4th Edition 2014.
2. Avi Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", Wiley India; John Wiley & Sons, 9th Edition, 2013.

References:

1. William Staling, "Operating Systems: Internals and Design Principles", Prentice Hall, 7th Edition, 2012.
2. D M Dhamdhere, "Operating Systems:A Concepts Based Approach", McGraw-Hill Education, 3rd Edition, 2017.

ONLINE/NPTEL Courses:

1. Introduction to Operating Systems: https://nptel.ac.in/courses/106106144
2. Operating System Fundamentals: https://nptel.ac.in/courses/106105214
3. Operating Systems: https://nptel.ac.in/courses/106108101

ADPC407 COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Problem solving and programming

Course Objective:

- To learn the basic components of computer, instruction set architecture, memory hierarchy, super scalar processor and multicore systems.

Course Outcomes:

- To understand the components of a basic computer.
- To understand the key components of a CPU and how the instructions are executed.
- To analyze the execution time taken in a pipelined processor.
- To understand the need of memory hierarchy and efficiency achieved due to the use of cache.
- To interpret how the data is stored and input-output is performed in computers.

UNIT I (9 Hrs)

INTRODUCTION: Role of abstraction, Basic functional units of a computer, Von-Neumann model of computation, Moore's law, form Notion and perance- Data representation and basic operations.

UNIT II (9 Hrs)

INSTRUCTION SET ARCHITECTURE (RISC-V): CPU registers, Instruction format and Encoding, addressing modes, Instruction set, Instruction types, Instruction Decoding and Execution, Basic Instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC), RISC-V instructions - X86 Instruction set.

UNIT III (9 Hrs)

PROCESSOR: Revisiting clocking methodology, Amdahl's law, Building a data path and control, single cycle processor, multi-cycle processor, instruction pipelining, Notion of ILP, data and control hazards and mitigations - Limits of ILP.

UNIT IV (9 Hrs)

MEMORY HIERARCHY: SRAM/DRAM, Locality of reference, Caching - different indexing mechanisms, trade- offs related to block size, associativity, cache size, processor, cache interactions for a read/write request, basic optimizations - write through/writeback caches, average memory access time, cache replacement policies, memory interleaving.

UNIT V (9 Hrs)

STORAGE AND I/O: Introduction to magnetic disks, flash memory- I/O mapped I/O and memory mapped I/O - I/O data transfer techniques - programmed I/O, Interrupt-driven I/O and DMA.

Text Books:

1. Carl Hamacher, "Computer Organization and Embedded Systems", McGrawHill Higher Education, 6th Edition, 2022.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier, 5th Edition, 2014.

References:

1. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Pearson Education, 2nd Edition, 2016.
2. Smruti Ranjan Sarangi, "Computer Organisation & Architecture", McGraw Hill, 2014.
3. Mano M. Morris, "Computer System Architecture", Pearson, 2007.

Online Simulators and Tools:

1. RIPES: https://freesoft.dev/program/108505982
2. GEM5:https://www.gem5.org/documentation/learning gem5/introduction

ONLINE/NPTEL Courses:

1. Introduction to computer System and its submodules: https://nptel.ac.in/courses/106103068
2. Computer Organization and Architecture: https://nptel.ac.in/courses/106106166
3. Computer Organization and Architecture A Pedagogical Aspect:https://nptel.ac.in/courses/106103180

ADPL401 STATISTICAL LAB (R AND SPSS)

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Knowledge in Probability and Statistics.

Course Objectives:

- To get introduced to methods and tools for statistical computing. This course aims at contemporary tools and languages such as R. The course shall be accompanied by the computational lab for statistical packages.

Course Outcomes:

At the end of this course, a student should be able to:

- Process datasets via statistical packages.
- Apply various statistical tests to determine the measures of central tendency.
- Identify the distribution of the datasets and perform statistical measurements.
- Understand multivariate analysis and perform the same.
- Determine the important predictor variables in a regression analysis of the dataset.
- Formulate a hypothesis and perform a suitable hypothesis test.
- Apply resampling to address mixed data distributions and identify and remove biases from the datasets.

List of Exercises:

1. Implement a program in random number generation using R/Python or MATLAB drawn from various distribu- tions such as Uniform, Normal, Exponential, etc. Plot the histograms of the generated numbers and compute the mean and standard deviations.
2. Implement a program in sampling and verify the central limit theorem.
3. Implement a program to generate certain distributions and compute the various moments and measures of the central tendency and statistical tests of significance.
4. Implement a program using census data from the Govt. of India and perform statistical analysis as defined by the instructor (for example multivariate analysis to find correlation between various attributes of data).
5. Implement a program to perform linear regression to study the dependency of a dependent variable on various input/predictor variables.
6. Study various types of regularizations and determine which predictor variables are significant.
7. Demonstrate a program to form a hypothesis and using the given dataset perform hypothesis testing (as defined by the instructor).
8. Implement a program to perform various types of resampling to address mixed distributions, removing bias.

(Total Periods:45)

ADPL402 DATA ANALYTICS AND VISUALISATION LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- A foundation in mathematics, statistics, linear algebra, calculus, and statistical analysis is essential.

Course Objectives:

- To acquire knowledge on techniques and algorithms for creating effective visualizations based on principles from graphic design.
- To introduce several industry-standard software tools to create a compelling and interactive visualization of various types of data.

Course Outcomes:

At the end of this course, a student should be able to:

- Explain and demonstrate various techniques for automatic data collection, data cleaning, and exploration using visualizations.
- Implement data collection, data cleaning, and exploration techniques in a programming language.
- To Understand and apply modeling and analysis techniques for various types of datasets.
- To Select methods and create effective visualizations.
- To become proficient in data analysis tasks involving real-life datasets with noise.

List of Exercises:

1. To understand the meaning of big data and its application.
2. To understand the meaning of big data and its application.
3. Explore different open-source technologies available for big data.
4. Project involving yarn, Pig, grant, etc.
5. Visualization of Spreadsheet Models
6. Oracle Database Connectivity using Python experiment.
7. Visualization of Semi-Structured Data.
8. Introduction to Tableau and Aggregation Methods in Tableau.
9. Visual Encodings and Basic Dashboards in Tableau.
10. Interactive Plots in Python.
11. Hierarchical and Topographical Data Visualizations in Tableau.
12. Calendar Heatmaps and Flow Data Visualizations in Python.
13. Time Series Data Visualization in Python.
14. Dashboards, Actions, and Story Telling in Tableau.

(Total Periods:45)

ADPL403 OPERATING SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Programming language, Data Structures and Algorithms

Course Objective:

- The program execution and requirements processes, threads, memory management, files and to impart Hands-on practical experience in different OS concepts.

Course Outcomes:

- To understand the role, functionality and layering of the system software components.
- To understand the design and usage of OS API and OS services.
- To understand the details of the abstractions and interfaces provided by the OS for program.
- To understand problems arising due to concurrency and related synchronization based solutions.
- To demonstrate the usage of OS API and basics of OS services.

LIST OF EXPERIMENTS

1. Usage of tools — unix shell commands (file commands, ps, ls, top), text editor (nano, vi, gedit, emacs)
2. C programming language refresher — header files, compilation and linking using GCC, program execution, functions, argument passing, structures, pointers, file handling.
3. Usage of tools — GCC, GDB, Objdump, shell scripts
4. Simple strace usage to showcase different interfaces (stdlib, system call)
5. Tools usage — ps, pstree, top
6. Usage of process control system calls to identity process identifiers, create process hierarchies, launch new executables, control exit sequence of parent and child processes.
7. Familiarity with files in the / proc / pid/ directory
8. (Virtual) addresses of variables and initialized pointers.
9. Use of malloc() and demonstration of per-process virtual addresses
10. Tools usage — strace, free, top, htop, vmstat, /proc/pid/maps
11. Free memory statistics correlated with malloc(). Number of system calls and malloc() usage.
12. Implement a custom memory allocator using system calls
13. User mode programs to demonstrate LDE
14. Demonstration of process execution interleaving in different orders
15. Simulation based analysis of scheduling policies
16. Tools usage — nice/proc/pid/status
17. Creation of threads using the pthread API and modification of shared variables with and without Synchronization
18. Using spinlock, mutexes and condition variables to implement semaphores, barriers (using the threads API)

19. Implement solutions to the producer-consumer, readerwriters problems using the different synchronization primitives
20. Develop synchronization solutions for applications that use shared data (e.g., ordering of threads, concurrent hash tables, etc.)
21. Using shared memory and semaphores implement synchronized access to a shared memory area across processes (e.g., a message queue).
22. Command line tools usage - state, file, du, df, fsck
23. Implementation of file utilities (e.g., find, grep) using the system call API.
24. Implement a simple file system to handle files on an emulated disk (via a large file) — file system API, superblock, inode and data block management.

(Total Periods:45)

ADPC501 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Basic Mathematics and Basic Programming Skills

Course Objectives:

- To search and discover intelligent characteristics of existing AI projects, Intelligent agents.
- To understand different search strategies for a problem.
- To understand different Knowledge Representation schemes for typical AI problems.

Course Outcomes:

At the end of this Course, a Student should be able to:

- Capability to develop intelligent systems
- Apply heuristic concepts to design efficient algorithms that help to attain the goals in a satisfactory manner
- Design applications related to Natural Language Processing and Web applications.
- To design and implement a typical AI problem to be solved Using Machine Learning Techniques.
- To get familiar with the advances in Artificial intelligence.

UNIT I (9 Hrs)

INTRODUCTION: Introduction: History of AI - problem spaces and search- Heuristic Search techniques – Best-first search- Problem reduction-Constraint satisfaction-Means Ends Analysis. Intelligent agents: Agents and environment – the structure of agents and their functions.

UNIT II (9 Hrs)

KNOWLEDGE REPRESENTATION: Approaches and issues in knowledge representation Propositional Logic –Predicate logic-Forward and backward reasoning - Unification Resolution- Weak slot-filler structure – Strong slot-filler structure- Knowledge- Based Agent.

UNIT III (9 Hrs)

REASONING UNDER UNCERTAINTY: Logics of non-monotonic reasoning-Implementation- Basic probability notation - Bayes rule – Certainty factors and rule-based systems-Bayesian networks – Dempster - Shafer Theory - Fuzzy Logic.

UNIT IV (9 Hrs)

PLANNING AND LEARNING: Planning with state space search-partial order planning-planning graphs-conditional planning-continuous planning-Multi-Agent planning. Forms of learning inductive learning-learning decision trees-ensemble learning-Neural Net learning and Genetic learning.

UNIT V (9 Hrs)

ADVANCED TOPICS: Game Playing: Minimax search procedure-Adding alpha-beta cutoffs Expert System: Representation Expert System shells-Knowledge Acquisition. Robotics: Hardware-Robotic Perception-Planning Application domains

TEXT BOOKS:

1. SElaine Rich and Kevin Knight and Shivashankar B.Nair, "Artificial Intelligence", 3rd edition, Tata Mc Graw Hill, 2017.
2. Ben Coppin, "Artificial Intelligence Illuminated", Jones and Bartlett Publishers, 1st edition, 2004.
3. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education Asia, 2nd edition, 2015.
4. N.P.Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2nd edition, 2005.

REFERENCES:

1. Rajendra Akerkar, "Introduction to Artificial Intelligence", Prentice Hall of India, 2005.
2. Patrick Henry Winston, "Artificial Intelligence", 3rd edition Pearson Education, Inc., 2001.

Online /NPTEL COURSES:

1. Artificial Intelligence: https://nptel.ac.in/courses/106102220
2. Artificial Intelligence: Search Methods for Problem-Solving: https://nptel.ac.in/courses/106106126

ADPC502 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in computer.

Course Objective:

- To learn the fundamental concepts of networks and OSI layers. To analyze various routing algorithms and security algorithms in networks.

Course Outcomes:

- To understand the fundamentals of network and transmission media.
- To understand the error detection, correction codes and datalink layer protocols.
- To understand the various routing algorithms and Internetworking.
- To enhance the knowledge of sockets and congestion control techniques.
- To enhance the knowledge in IDS and cryptographic techniques.

UNIT I (9 Hrs)

PHYSICAL LAYER: Introduction- Uses, Network Hardware, Software, Reference Models - Theoretical Basis for Communication - Electromagnetic Spectrum, Radio Transmission, Digital Modulation, Baseband Transmission - Transmission Media, Wireless Transmission.

UNIT II (9 Hrs)

DATALINK LAYER: Design Issues - Services, Framing, Error Control, Flow Control - Error Detection and Correction Codes, Hamming Code, Cyclic Redundancy Check - Data Link Layer Protocols, Simplex Protocol , Sliding Window Protocols - Medium Access Control Sublayer, Channel Allocation Problem, Multiple Access Protocols, ALOHA, CSMA Protocols, Collision-Free Protocols, Wireless LAN Protocols - Ethernet MAC Sublayer Protocol, 802.11 MAC Sublayer Protocol - Data Link Layer Switching, Uses of Bridges, Learning Bridges, Repeaters, Hubs, Bridges, Switches, Routers and Gateways.

UNIT III (9 Hrs)

NETWORK LAYER: Design Issues- Routing Algorithms, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing - Congestion Control Approaches, Traffic-Aware Routing, Admission Control, Traffic Throttling, Load Shedding - Internetworking, Tunneling, Internetwork Routing, IPv4, IP Addresses, IPv6.

UNIT IV (9 Hrs)

TRANSPORT LAYER: Services- Berkeley Sockets, Example - Elements of Transport Protocols Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, UDP – TCP Segment Header, Connection Establishment, Connection Release, Sliding Window, Timer Management - Congestion Control.

UNIT V (9 Hrs)

APPLICATION LAYER: DNS, E-Mail, WWW, Architecture, HTTP, Content Delivery, Server Farms and Web Proxies, Peer-To-Peer Networks, Firewalls - Intrusion Detection System - Network Security - Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, Public Key Algorithms, RSA, Symmetric Algorithm.

Text Books:

1. A.S.Tanenbaum and D.J.Wetherall, "Computer Networks" , Pearson, 6th Edition, 2021.
2. Behrouz A. Ferouzon "Data Communication and Networking with TCP/IP Protocol Suite", McGraw Hill, 6th Edition, 2022.

References:

1. J.F.Kurose and K.W. Ross, "Computer Networking: A Top-down approach", Pearson, 7th Edition , 2017.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks- A System Approach", Elsevier, 5th Edition, 2012.

ONLINE / NPTEL Courses:

1. Computer Networks: https://nptel.ac.in/courses/106105080
2. Emergence of Networks & Reference Models: https://nptel.ac.in/courses/106105081
3. Introduction on Computer Networks: https://nptel.ac.in/courses/106106091

ADPC503 LARGE DATA SETS MANAGEMENT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Database systems.

Course Objectives:

- To provide an introduction to large-scale distributed data analysis abstractions.
- To give an introduction to relational databases and understand their limitations.
- To get familiar with the challenges of unstructured big data and the tools to handle them.

Course Outcomes:

- To understand the fundamentals of Big Data analytic.
- To investigate the Hadoop framework and Hadoop Distributed File system.
- To demonstrate the Map-Reduce programming model to process the big data along with Hadoop tools.
- To use Machine Learning algorithms for real-world big data.
- To analyze web contents and Social Networks to provide analytic with relevant visualization tools.

UNIT I (9 Hrs)

INTRODUCTION TO BIG DATA ANALYTIC: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytic Applications and Case Studies.

UNIT II (9 Hrs)

INTRODUCTION TO HADOOP: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, Map-Reduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands. Essential Hadoop Tools: Use Apache Pig, Hive, Sqoop, Flume, Oozie, and HBase.

UNIT III (9 Hrs)

NO-SQL BIG DATA MANAGEMENT, MONGODB AND CASSANDRA: Introduction, No-SQL Data Store, No-SQL Data Architecture Patterns, No-SQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.

UNIT IV (9 Hrs)

MAP-REDUCE, HIVE, AND PIG: Introduction, Map-Reduce Map Tasks, Reduce Tasks and Map-Reduce Execution, Composing Map-Reduce for Calculations and Algorithms, Hive, HiveQL, Pig.

UNIT V (9 Hrs)

MACHINE LEARNING ALGORITHMS FOR BIG DATA ANALYTIC: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Item-sets and Association Rule Mining. Text, Web Content, Link, and Social Network Analytic: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytic, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs, and Social Network Analytic.

TEXT BOOKS:

1. Raj Kamal and Preeti Saxena, "Big Data Analytic Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966.
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1st Edition, Pearson Education, 2016. ISBN13: 978-9332570351.

REFERENCES:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, OReilly Media, 2015, ISBN-13: 978- 9352130672.
2. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577.

Online /NPTEL COURSES:

1. Big Data Computing: https://nptel.ac.in/courses/106104189

ADHS504 ENTREPRENEURSHIP AND STARTUPS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basics of Data Structures and Algorithms.

Course Objectives:

- The students should study the development of start-up projects in the realm of globalisation, crowdsourcing and the emergence of ”open-source” innovations. They should be able to search for the governmental means of support for open innovation projects, private investment resources, and assess the level of maturity of the project.

Course Outcomes:

- To understand economic models in the digital environment and types of monetisation used for open innovations.
- To understand and develop a valuable business model in the open-knowledge environment.
- To understand and distinguish organization management.
- To create start-up environment.
- To understand operation and strategy management.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Entrepreneurship Strategy: from Ideation to Exit, identifying the trade-offs, Intellectual activity & knowledge economy, sharing economy – approach to construct social- economic models, Business as construction of value creation chain in the context of open knowledge.

UNIT II (9 Hrs)

DIGITAL TECHNOLOGIES AS AN OPEN INNOVATION’S ENVIRONMENT: Transaction costs: trust and reviewing system (personification), Hard & software - Robotics and Intelligence: Computing Recognition and Decision Making, Infrastructure Building, Cyberphysical systems as a product and as an infrastructure.

UNIT III (9 Hrs)

THE ORGANIZATION AND MANAGEMENT OF OPEN INNOVATION PROJECTS: History the emergence of open innovation, Analysis of elements of open innovation in the traditional management, Agile – flexible project management. Methodologies within agile approach, from project to product: steps of converting ideas into goods, Stakeholders of open innovation project: customers, investors, employees etc. Indicators of effectiveness for the various groups of stakeholders.

UNIT IV (9 Hrs)

START-UP ENVIRONMENT: INSTITUTIONS THAT SUPPORT AND FINANCE INNOVATIVE PROJECTS: Types of financing, Infrastructure supporting small innovative enterprises and start-ups, Programs to support innova- tive projects at the federal and regional level.

UNIT V (9 Hrs)

OPERATIONAL AND STRATEGY MANAGEMENT: Introduction to Operations Management: Operations Analysis, Coordination and Planning, Quality Management, Project Management, and Logistics and Supply Chain Management, strategy management, technological strategy.

Text Books:

1. Peter F. "Drucker Innovation and Entrepreneurship", (Classic Drucker Collection), 2007.

References:

1. Perihan Hazel, Joseph A. "Schumpeter's views on entrepreneurship and innovation", 2012.

ADAU505 INDIAN CONSTITUTION

L	T	P	C
3	0	0	0

Course Pre-requisite:

- Knowledge of roles and rights of citizens and powers of governments and its organs.

Course Objectives:

- To acquaint the students with basic principles of the Constitution of India and its working.

Course Outcomes:

- To understand the constitution of India and its salient features.
- To understand the fundamental rights and duties.
- To understand and discuss India's Parliamentary System of Governance.
- To understand the Directive Principles of State Policy.
- To understand and abide the rules of the Indian constitution and to appreciate different culture among the people.

UNIT I

THE CONSTITUTION - INTRODUCTION: The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation- State Policy Principles.

UNIT II

UNION GOVERNMENT: Structure of the Indian Union-President, Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.

UNIT III

STATE GOVERNMENT: Governor, Role and Power, Chief Minister and Council of Ministers, State Secretariat.

UNIT IV

LOCAL ADMINISTRATION: District Administration, Municipal Corporation, Zila Panchayat.

UNIT V

ELECTION COMMISSION: Role and Functioning, Chief Election Commissioner, State Election Commission.

Text Books:

1. Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, New Delhi, 2008.
2. B.L.Fadia Sahitya Bhawan, "The Constitution of India", New Edition, 2017.

References:

1. DD Basu Lexis Nexis, "Introduction to the Constitution of India", 23rd Edition, 2018.

ADPL501 ARTIFICIAL INTELLIGENCE LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Good knowledge of Programming knowledge, Strong Analytical skills, and Ability to understand complex algorithms.

Course Objectives:

- To introduce students to diverse Artificial Intelligence (AI) applications across various fields.
- To focus on tackling common challenges within these domains, including data pre-processing, feature engineering, model development, and evaluation techniques.

Course Outcomes:

- To describe the various applications of AI in several fields.
- To formulate problems in specific fields of interest such as Speech analytics, graph analytics, Image Analytics, Video Analytics, Natural Language Processing, etc.

List of Exercises:

1. Study to collect data via web-scraping, APIs, and data connectors from suitable sources as specified by the instructor.
2. Study and implementation of various types of data cleaning operations on the data collected in the previous lab using data exploration, imputation, etc
3. Implementation of speech recognition dataset, compute features, and develop models to recognize words.
4. study and implement graph dataset, compute features and develop models to identify clusters/communities.
5. Develop models to identify various classes such as hand-written numerals or characters, and objects.
6. Study and development of models for sentiment analysis
7. Study of Natural language processing.
8. Representation of Knowledge using Predicate logic and Query.
9. Developing a spell check.
10. Development of Expert system.

(Total Periods:45)

ADPL502 COMPUTER NETWORKS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Programming Language

Course Objective:

- Practice the tools like ping and trace route to explore various Internet paths to popular servers using NS-2/NS-3 simulator to evaluate performance of network under various conditions.

Course Outcomes:

- To understand the network configuration of the computer.
- To write socket programming for client server using TCP/UDP.
- To gain knowledge in how to Install and configure some network applications.
- To gain knowledge in how to use tools like ping and trace route to explore various Internet paths to popular server.
- To gain knowledge in how to use NS-2/NS-3 to simulate a mesh of at least 4 nodes and 3 links to evaluate performance under various conditions.

LIST OF EXPERIMENTS

1. Use Linux tools like ifconfig, dig, ethtool, route, netstat, nslookup, and ip to understand the networking configuration of the computer that the student is working on.
2. Check the connectivity of a computer using the ping command.
3. Print the computers that are forwarding the packets from your computer to the server using the command traceroute.
4. Mount the volume of a remote computer using the “net use” command.
5. Examine the packets in the network using Wireshark application.
6. Send messages from one machine to another machine using Socket.
7. Simulate a chatting application using Socket.
8. Implement File Transfer Protocol in Java language.
9. Examine the log files of a web server and find the frequently visited websites.
10. Analyse the Distance Vector Routing protocol in NS2.
11. Analyse the Link State Routing protocol in NS2.
12. Use a tool like Wireshark to capture packets and examine the packets
13. Implementation of a Program For CRC and Hamming Code for Error Handling.
14. Socket programming: write a simple client server program using TCP and UDP sockets.
15. Implementation of a socket program for Echo/Ping/Talk commands.
16. Use tools like ping and trace route to explore various Internet paths to popular servers.
17. Write a code simulating ARP /RARP protocols.

(Total Periods:45)

ADPL503 LARGE DATA SETS MANAGEMENT LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Knowledge in Database

Course Objectives:

- To provide hands-on training in writing programs to analyze, model, and visualize large datasets.
- To solve common data analysis problems using datasets from a variety of domains: web search, e-commerce, social networking, machine learning, etc.

Course Outcomes:

At the end of this course, a student should be able to:

- Write, run, and debug Map reduce programs to solve a variety of data analysis tasks.
- Write, run, and debug programs to analyze and build models from streaming and nonstreaming data efficiently using systems like Apache Spark.

List of Exercises:

1. Implement a map reduce program to compute descriptive statistics such as mean, median, mode, and standard deviation from a large dataset. Measure the runtime and study its scaling behavior as more nodes are added to the cluster.
2. Implement a map-reduce program to compute box plots and histograms of all the numerical variables in a large multi-variate dataset. Measure the runtime and study its scaling behavior as more nodes are added to the cluster.
3. Implement a map-reduce program to compute correlation metrics between pairs of all the numerical variables in a large multi-variate dataset. Measure the runtime and study its scaling behavior as more nodes are added to the cluster.
4. Implement a spark program to compute box plots and histograms of all the numerical variables in a large dataset. Measure the runtime and study its scaling behavior as more nodes are added to the cluster.
5. Implement a map-reduce program to perform the classification of a large multi-variate dataset into two or more classes. Measure the runtime and study its scaling behavior as more nodes are added to the cluster.
6. Implement a spark program to compute box plots and histograms of all the numerical variables in a large dataset. Measure the runtime and study its scaling behavior as more nodes are added to the cluster.
7. Implement a spark program to perform classification in a large dataset. Measure the runtime and study its scaling behavior as more nodes are added to the cluster.

(Total Periods:45)

ADPC601 INTRODUCTION TO IoT AND EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Microprocessor and controller, Python, C, C++, embedded C, Knowledge of sensor transducer actuator interfacing some networking concepts.

Course Objectives:

- To learn fundamental aspects of IoT, emphasizing the significance of machine-to-machine communication.
- To focus on contemporary IoT communication protocols, software implementation for embedded systems, and real-world applications via case studies.

Course Outcomes:

- To program an embedded computing divide such as Arduino and Raspberry Pi.
- To build an IoT system for sensing and decision-making.
- To understand the communication between machine to machine.
- To implement standard communication protocols for IoT to build large systems.
- To understand the implementation of IoT in systems such as home automation, smart lighting, and smart parking.

UNIT I (9 Hrs)

INTRODUCTION: Definition , Characteristics and Architecture of IoT Devices - Trends in the Adoption of IoT in Modern Applicants, Risks, Privacy, Security.

UNIT II (9 Hrs)

IOT ENABLING TECHNOLOGIES: Sensor Networks - Sensors and actuators - Analog / Digital Conversion Communication Protocols - Embedded Computing Systems - Cloud Computing.

UNIT III (9 Hrs)

IOT COMMUNICATION PROTOCOLS: Communication stack for IoT - Machine to machine communication (M2M), Introduction to various protocols: Message Queue Telemetry Transport (MQTT) - Constrained Application Protocol (COAP) - 6LOPAN - Routing protocols - autonomous routing - hierarchical architectures and routing protocols to connect with infrastructure networks.

UNIT IV (9 Hrs)

BASICS OF NETWORKING: Machine-to-Machine interaction – UDP – TCP, Applications of IoT, Case studies: IoT Application Development - Solution Framework for IoT - Advanced topics - Data Analytics for IoT - Fault Tolerance in IoT - based Systems - IoT Security.

UNIT V (9 Hrs)

INTRODUCTION TO EMBEDDED COMPUTING: Software development systems - embedded software - programming environments for IoT software development - Categories of embedded computing.

TEXT BOOKS:

1. Jeeva Jose, “Internet of Things”,1st Edition, Khanna Book Publishing Company,2021.
2. Peter Waher, “Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3”, 1st Edition, Packt Publishing Ltd, 2018.
3. Samuel Greengard, “The Internet of Things”, 1st Edition, MIT Press, 2015.

REFERENCES:

1. Peter Waher, Pradeeka Seneviratne, Brian Russell, and Drew Van Duren, “IoT: Building Arduino-Based Projects”, 1st Edition, Packt Publishing Ltd, 2016.

Online /NPTEL COURSES:

1. Optical Wireless Communications for Beyond 5G Networks and IoT:https://nptel.ac.in/courses/108106190
2. Advanced IOT Applications Link:https://nptel.ac.in/courses/108108123
3. Embedded System Design with ARM Link:https://nptel.ac.in/courses/106105193

ADPC602 DATA AND INTERNET SECURITY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Network security.

Course Objectives:

- To learn the Data Security and to understand the Hash Functions and algorithm
- To learn the Cryptography technique and to gain knowledge about Protocols and Firewalls
- To identify the attacks and safeguard the IT infrastructure from threats using mechanisms such as firewalls, IPS, IDS, etc.

Course Outcomes:

At the end of this Course, a Student should be able to:

- Understand and explain with examples the concepts of confidentiality, integrity and availability.
- Explain the use of cryptography to achieve the goals of security.
- Analyze symmetric and asymmetric key cryptography.
- Evaluate the digital signature mechanisms using the public key cryptosystems.
- Evaluate the threats to a computer network and protection mechanisms for them including Firewall, IDS, IPS, etc.

UNIT I (9 Hrs)

INTRODUCTION TO DATA SECURITY: Data Security Goals of Confidentiality - Integrity and Availability - Access Control - Attacks and threats - Chosen Plaintext Attack - Chosen Ciphertext Attacks - Attack vectors - Symmetric Key Cryptography - Asymmetric Key Cryptography - applications of cryptography - symmetric key ciphers - AES - asymmetric key ciphers - RSA - ECC.

UNIT II (9 Hrs)

ONE-WAY HASH FUNCTIONS: Weak and Strong one-way functions, Pseudo-random Generators (PRG) - True random number generators - use of Hash functions in random number generations, MD5, SHA1, SHA2 and SHA3 - compute power vs weakness of hashing.

UNIT III (9 Hrs)

CRYPTOGRAPHY TECHNIQUES: Block Ciphers and stream ciphers - modes of encryption: ECB, CBC, Counter mode, Message Authentication Codes (MACs) - Formal Definition of Weak and Strong MACs - Encryption and decryption - integrity - Cryptographic checksums - HMAC - encrypted hashes - authentication mechanism - passwords and secrets, challenge-response and biometrics.

UNIT IV (9 Hrs)

PUBLIC KEY SIGNATURE SCHEMES: Formal Definitions - Signing and Verification - Public Key Signature Schemes - Shamir's Secret Sharing Scheme - Zero Knowledge Proofs and Protocols - public key trust establishment - Internet protocols: PGP- IPSEC, SSL notion of third party or trust, certifying authority, X.509 certificates, concept of self-signed certificate, root CA, HTTP and other protocols.

UNIT V (9 Hrs)

NETWORK THREATS AND PROTECTION: Port scanning and exploitation of weaknesses of the server misconfigurations denial of service attacks - protection against attacks - firewall and protection mechanisms for unauthorized/malicious access - Intrusion detection and Intrusion Prevention, Issues related to such mechanism.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, Prentice Hall 2017.

Reference Books:

1. Yuri Diogenes, Dr. Erdal Ozkaya, "Cybersecurity, Attack, and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics", 1st Edition, 2018.
2. V.K. Jain, "Cryptography and Network Security", Khanna Book Publishing Company, 1st Edition 2017.
3. Gupta & Gupta, Information Security and Cyber Laws, Khanna Book Publishing Company, Delhi,1st Edition, 2019.

Online /NPTEL COURSES:

1. Cryptography and Network Security: https://nptel.ac.in/courses/106105031.

ADPC603 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Operating Systems and Computer Networks

Course Objectives:

- To impart the principles and paradigm of Cloud Computing
- To understand the Service Model concerning Cloud Computing
- To comprehend the Cloud Computing architecture and implementation and helps
- To realize the role of Virtualization Technologies along with gaining knowledge on Cloud Computing management and security

Course Outcomes:

- To describe the concept, evolution, architecture, pros, and cons of Cloud Computing.
- To explore the Concept of Cloud Computing
- To know how hypervisors are used in Virtual Machines.
- To secure and perform identity management in the Cloud.
- to access and use the services in the Cloud.

UNIT I (9 Hrs)

INTRODUCTION TO CLOUD COMPUTING: Overview, Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Assessing the role of Open Standards.

UNIT II (9 Hrs)

CLOUD ARCHITECTURE, SERVICES, AND APPLICATIONS: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frameworks, Software as a Service, Identity as a Service, Compliance as a Service.

UNIT III (9 Hrs)

ABSTRACTION AND VIRTUALIZATION: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT IV (9 Hrs)

MANAGING & SECURING THE CLOUD: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence.

UNIT V (9 Hrs)

CASE-STUDIES: Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services.

TEXT BOOKS:

1. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", 1st Edition, John Wiley & Sons, 2011.
2. Sosinsky B., "Cloud Computing Bible", 1st Edition, Wiley Edition, 2011.

Reference Books:

1. Miller Michael, "Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online", Pearson Education India
2. Smooth S., Tan N., "Private Cloud Computing", Morgan Kauffman, First Edition, 2011.
3. Linthicum D., "Cloud Computing and SOA Convergence in Enterprise", Pearson Education India.

Online /NPTEL COURSES:

1. Cloud Computing: https://nptel.ac.in/courses/106105167
2. Google Cloud Computing Foundation Course: https://nptel.ac.in/courses/106105223

ADPC604 MACHINE LEARNING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in AI, algorithm design, basics of probability & statistics.

Course Objectives:

- To understand the machine learning theory
- To implement linear and non-linear learning models
- To implement distance-based clustering techniques
- To build tree and rule-based models

Course Outcomes:

- To evaluate machine learning theory in problem-solving
- To implement linear and non-linear learning models
- To implement distance-based clustering techniques
- To demonstrate tree and rule-based models
- To explain reinforcement learning techniques

UNIT I (9 Hrs)

INTRODUCTION: machine learning applications – Basic definitions- types of learning: unsupervised learning – Reinforcement Learning – Supervised Learning – Learning a class from examples – hypothesis space and inductive bias- Vapnik-Chervonenkis (VC)Dimension – Probably Approximately Correct (PAC) Learning – Noise – Learning multiple classes – Model selection and Generalization-Evaluation and Cross-validation.

UNIT II (9 Hrs)

LINEAR REGRESSION: Introduction to decision trees-Learning decision trees-Issues Pruning Overfitting, k Nearest neighbour-Feature selection: Metrics, Feature Reduction: Dimensionality reduction, Subset selection, Principal component analysis, Factor analysis, Multidimensional scaling, Linear discriminant analysis.

UNIT III (9 Hrs)

BAYESIAN LEARNING: Bayes theorem-Maximum Likelihood-Bayes optimal classifier-Gibbs Algorithm-Na¨ıve Bayes Classifier- Bayesian Belief networks-Clustering: Mixture Densities – K Means Clustering – Expectation Maximization – Hierarchical clustering.

UNIT IV (9 Hrs)

LINEAR DISCRIMINATION: Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination – Discrimination by Regression – Multilayer Perceptrons: Introduction – Perceptron – Training a Perceptron – Learning Boolean Functions – Multilayer Perceptrons – Backpropagation Algorithm.

UNIT V (9 Hrs)

KERNEL MACHINES: SVM-Optimal Separating Hyperplane – kernel trick –Hidden Markov Models – Evaluation-Model selection –Introduction to Ensembles- Bagging – Boosting.

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", Third Edition, PHI, 2015.
2. Tom M. Mitchell, "Machine Learning", Mc Graw Hill, 2013.

REFERENCES:

1. Kevin P. Murphy, "Probabilistic Machine Learning: An Introduction (Adaptive Computation and Machine Learning series)",1st Edition, MIT Press,2022.
2. Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, MIT Press, 2020.
3. Navin Kumar Manaswi, "Deep Learning with Applications using Python", 1st Edition, Apress, 2018.

Online /NPTEL COURSES:

1. Introduction to Machine Learning Link: https://nptel.ac.in/courses/106105152
2. Machine Learning for Earth System Sciences Link: https://nptel.ac.in/courses/106105238
3. Introduction to Machine Learning (Tamil) Link: https://nptel.ac.in/courses/106106236

ADPL601 IOT AND EMBEDDED SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Microprocessor and controller, Python, C, C++, embedded C, Knowledge of sensor transducer actuator interfacing, and some networking concepts.

Course Objectives:

- To provide an overview of the historical evolution of statistics, covering data presentation, descriptive measures, and mathematical curve fitting.
- To equip students with quantitative skills for addressing business-related numerical challenges.

Course Outcomes:

- To Program an embedded computing divide such as Arduino and Raspberry Pi.
- To demonstrate the probabilities for various events.
- To critically evaluate the underlying assumptions of analysis tools.
- To understand and critically discuss the issues surrounding sampling and significance.
- To Solve a range of problems using the techniques covered.

List of Exercises:

1. Study and Install Python in Eclipse and WAP for data types in Python.
2. Write a Program for arithmetic operations in Python.
3. Write a Program for logical operation using Embedded C / Advanced C.
4. Write a Program for looping statements in Python.
5. Study and Install the IDE of Arduino and different types of Arduinos.
6. Write a program using Arduino IDE for Blink LED.
7. Write a Program for RGB LED using Arduino.
8. Study the HTTP, CoAP, MQTT, AMQP, 6LoWPAN, and IoT Cloud Infrastructure.
9. Study and Implement RFID, and NFC using Arduino.
10. Study and implement microcontroller programming using Arduino.
11. Study and Configure Raspberry Pi.
12. WAP for LED blink using Raspberry Pi.
13. Study and implement home automation, City application, smart irrigation, and Pollution monitoring.
14. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.

ADPL602 MACHINE LEARNING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Knowledge in Programming languages (C, C++, Python).

Course Objectives:

- To equip students with the ability to apply machine learning algorithms using real-world datasets.
- To gain valuable research experience by utilizing cutting-edge machine-learning software.

Course Outcomes:

- To Understand the machine learning algorithms through Python programming.
- To apply structured thinking to unstructured problems.
- To design and evaluate the unsupervised models through Python inbuilt functions.
- To design and apply various reinforcement algorithms to solve real-time complex problems.
- To develop an appreciation for what is involved in learning from data.

List of Exercises:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file.
2. Implement and demonstrate for a given set of training data examples stored in a.CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the na¨ıve Bayesian classifier for a sample training data set stored as a.CSV file.
6. Assuming a set of documents that need to be classified, use the na¨ıve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using a standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a . CSV file. Use the same data set for clustering using the k-means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API to the program.
9. Write a program to implement the k-nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm to fit data points.

(Total Periods:45)

ADH01 DATA WRANGLING

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Knowledge of basic Programming skills, Linear Algebra, and Differential Equations.

Course Objectives:

- To learn different methods for Data Cleanup.
- To learn the basics of Python.
- To learn Data aggregation Techniques.
- To learn about packages Numpy and pandas.
- To learn concepts of Web scraping

Course Outcomes:

- To apply methods for Data Cleanup.
- To gain knowledge on Python
- To understand the usage of various packages in Python.
- To demonstrate knowledge of Web Scraping.
- To perform the computations with Excel and PDF files.

UNIT I (12 Hrs)

INTRODUCTION TO DATA WRANGLING AND IT TOOLS: Importance of Data Wrangling in Data Science - Data Wrangling Tools - Python: Python Language Basics, IPython, and Jupyter Notebooks, Python Interpreter, IPython Basics, Running the IPython, Running the Jupyter Notebook, Built-in Data Structures, Functions.

UNIT II (12 Hrs)

INSTALLING PYTHON PACKAGES AND LIBRARIES: NumPy Basics: The NumPy array: A Multidimensional Array Object Creating arrays, Data Types for arrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing. Pandas: Introduction to Pandas Data Structures, Essential Functionality

UNIT III (12 Hrs)

DATA LOADING, STORAGE, AND FILE FORMATS: Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Reading Microsoft Excel Files, Interacting with Web APIs, Interacting with Databases.

UNIT IV (12 Hrs)

DATA CLEANING AND PREPARATION: Handling Missing Data, Filtering Out Missing Data, Filling In Missing Data, Data Transformation, Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization, and Binning, Detecting and Filtering Outliers Permutation and Random Sampling, Computing Indicator/Dummy Variables, String Manipulation String Object Methods, Regular Expressions, Vectorized String Functions in pandas

UNIT V (12 Hrs)

DATA WRANGLING: Join, Combine, and Reshape: Hierarchical Indexing, Reordering, and Sorting Levels Summary Statistics by Level, indexing with a Data Frame's columns, Combining and Merging Datasets, Database-Style Data Frame Joins, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap. **Data Aggrega- tion and Group Operations:** Group by Mechanics, Iterating Over Groups, selecting a Column or Subset of Columns, Grouping with Dicts and Series, Grouping with Functions, Grouping by Index Levels, Data Aggregation, Column- Wise and Multiple Function Application, Returning Aggregated Data Without Row Indexes

Text Books:

1. Wes McKinney, "Python for Data Analysis", O'Reilly Media, 2017.
2. Jacqueline Kazil & Katharine Jarmul, Data Wrangling with Python, O'Reilly Media, Inc, 2016.

References:

1. Jason W. Osborne, "Best Practices in Data Cleaning: A Complete Guide to Everything You Need to Do Before and After Collecting Your Data", 2013.
2. Tye Rattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras," Principles of Data Wrangling: Practical Techniques for Data Preparation", O'Reilly Media, Inc, 2017.
3. Allan Visochek, "Practical Data Wrangling", Packt Publishing Ltd,2017
4. Dr. Tirthajyoti Sarkar, Shubhadeep," Data Wrangling with Python: Creating actionable data from raw sources", Packt Publishing Ltd, 2019.

ONLINE/NPTEL Courses:

1. Data Analytics with Python: https://onlinecourses.nptel.ac.in/noc20 cs46/preview

ADH02 DATA MINING AND WAREHOUSING

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Knowledge of Basic Database system.

Course Objectives:

- To Provide the student with an understanding of the concepts of data warehousing and to Study the dimensional modeling technique for designing a data warehouse.

Course Outcomes:

- To design data warehouse architecture for various Problems
- To apply the OLAP Technology
- To analyze the partitioning strategy
- To critically analyze the differentiation of various schema for a given problem
- To frame roles of process manager & system manager

UNIT I (12 Hrs)

INTRODUCTION TO DATA WAREHOUSE : Data Warehouse Introduction – Data Warehouse components- Operational Database vs. Data Warehouse – Data Warehouse Architecture – Three-tier Data Warehouse Architecture – Autonomous Data Warehouse- Autonomous Data Warehouse vs. Snowflake – Modern Data Warehouse

UNIT II (12 Hrs)

ETL AND OLAP TECHNOLOGY: What is ETL – ETL Vs ELT – Types of Data warehouses – Data warehouse Design and Modeling -Delivery Process – Online Analytical Processing (OLAP) – Characteristics of OLAP – Online Transaction Processing (OLTP) Vs OLAP – OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III (12 Hrs)

META DATA, DATA MART AND PARTITION STRATEGY : Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management – Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition

UNIT IV (12 Hrs)

DIMENSIONAL MODELING AND SCHEMA: Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star vs. Snowflake schema- Fact constellation Schema- Schema Definition – Process Architecture- Types of Data Base Parallelism – Datawarehouse Tools

UNIT V (12 Hrs)

SYSTEM & PROCESS MANAGERS: Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager – System Event Manager – System Database Manager – System Backup Recovery Manager – Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing

Text Books:

1. Alex Berson and Stephen J. Smith Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, Thirteenth Reprint 2013.
2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third edition, 2013.

References:

1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

ONLINE/NPTEL Courses:

1. Data Mining: https://nptel.ac.in/courses/106105174

ADH03 DATA VISUALIZATION TECHNIQUES

L	T	P	C
3	1	0	4

Course Objectives:

- To understand various data visualization techniques.

Course Outcomes:

- To Visualize the objects in different dimensions.
- Design and process the data for Virtualization.
- Apply visualization techniques in physical sciences, computer science, applied mathematics, and medical science.
- Apply the virtualization techniques for research projects. (K1, K3).

UNIT I (12 Hrs)

INTRODUCTION AND DATA FOUNDATION: Basics - Relationship between Visualization and Other Fields - The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structurewithin and between Records - Data Preprocessing - Data Sets

UNIT II (12 Hrs)

FOUNDATIONS FOR VISUALIZATION: Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson‘s Affordance theory – A Model of Perceptual Processing.

UNIT III (12 Hrs)

VISUALIZATION TECHNIQUES: Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data: Point-Based Techniques - Line- Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT IV (12 Hrs)

CONDITIONALS AND CONTROL FLOW: Interaction Concepts and Techniques: Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space - Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control

UNIT V (12 Hrs)

RESEARCH DIRECTIONS IN VIRTUALIZATIONS: Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications.

Text Books:

1. Matthew Ward, Georges Grinstein, and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
2. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Margon Kaufmann Publishers, 2004.

References:

1. Robert Spence "Information visualization – Interaction design", Pearson Education, 2nd Edition, 2007.
2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.

ONLINE/NPTEL Courses:

1. Data Visualization with R: https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/

ADH04 IMAGE PROCESSING AND COMPUTER VISION

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Knowledge of basic Programming skills, Linear Algebra, and Differential Equations.

Course Objectives:

- To give an introduction to the concepts and applications of image processing and computer vision.
- To teach the fundamental techniques for image processing tasks such as image restoration, segmentation, and compression.

Course Outcomes:

- To recognize and describe both the theoretical and practical aspects of computing with images.
- To understand object segmentation met
- To understand shape representation methods.
- To apply object recognition and optimization techniques.
- To understand motion analysis in video.

UNIT I (12 Hrs)

INTRODUCTION TO DIGITIZED IMAGE: Basic Concepts, Image Digitization, Sampling, Quantization, color images, digital image properties, Image data representation, Traditional data structure, Hierarchical data structure, Image Pre, processing, Pixel brightness transformation, geometric transformation, Image smoothing, Edge Detectors, Scaling, Canny Edge Detector, edges in multispectral images, image restoration, Inverse filtration, wiener filtration.

UNIT II (12 Hrs)

OBJECT SEGMENTATION: Thresholding, Edge-based segmentation, edge image thresholding, edge relaxation, border tracing, Hough transforms, border detection, region construction from borders, region growing segmentation, region merging, region splitting, splitting and merging, matching.

UNIT III (12 Hrs)

SHAPE REPRESENTATION: Region identification, contour-based shape representation, simple geometric border representation, Fourier transform of boundaries, Shape invariants, region-based shape representation, simple scalar region descriptors, moments, convex hull, region decomposition, region neighborhood graphs.

UNIT IV (12 Hrs)

OBJECT RECOGNITION: Knowledge representation, statistical pattern recognition, Syntactic pattern recognition, optimization techniques in recognition, Mathematical Morphology, Morphological transformation, dilation, erosion, opening and closing, homotopic transformation, skeleton, thinning and thickening.

UNIT V (12 Hrs)

TEXTURE AND MOTION ANALYSIS: Statistical texture description, Synthetic texture description, hybrid texture description, texture recognition, Motion Analysis, Optical flow method, detection of interest points.

Text Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle "Image Processing, Analysis, and Machine Vision", 4th Edition, Springer US,2013
2. E.R.Davies, "Computer & Machine Vision", 4th Edition, Academic Press, 2012

References:

1. E.R. Davies, "Computer and Machine Vision: Theory, Algorithms, Practicalities", 4th Edition, Academic Press, 2005
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer, 2020.

ONLINE/NPTEL Courses:

1. Computer Vision and Image Processing: https://nptel.ac.in/courses/108103174

ADH05 INTRODUCTION TO ROBOTICS

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Sound knowledge of programming languages such as Python and R.

Course Objectives:

- The students will be able to understand the basic concepts and fundamentals of robotics. They will also be able to use AI in the field of robotics.

Course Outcomes:

- To understand the basics of robotics.
- To understand game-playing concepts involving robotics and AI.
- To understand the way to use robotics to build robot-driven systems.
- Understand, Examine, and connect robots to AI and use them in real-world applications.
- To understand and use fundamental AI algorithms.

UNIT I (12 Hrs)

INTRODUCTION: Introduction to Robotics Fundamentals of Robotics, Robot Kinematics: Position Analysis, Dynamic Analysis, and Forces, Robot Programming languages and systems: Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

UNIT II (12 Hrs)

NEED OF AI IN ROBOTICS: NEED OF AI IN ROBOTICS: History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, and structure of agents.

UNIT III (12 Hrs)

GAME PLAYING: AI and game playing, plausible move generator, static evaluation move generator, game playing strategies, problems in game playing.

UNIT IV (12 Hrs)

ROBOTICS FUNDAMENTALS: Robot Classification, Robot Specification, notation, kinematic representations and transformations, dynamics techniques; trajectory planning and control.

UNIT V (12 Hrs)

ROBOTICS AND ITS APPLICATIONS: DDD concept, Intelligent robots, Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot-Speed of Robot, Robot joints and links-Robot classifications- Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system.

Text Books:

1. Peter Corke, Robotics, "Vision and Control: Fundamental Algorithms in MATLAB", Springer, 2011.
2. Peter McKinnon, "Robotics: Everything You Need to Know About Robotics from Beginner to Expert", Create Space Independent Publishing Platform, 2016.
3. Robin R. Murphy, "Introduction to AI Robotics", 2nd Edition, MIT Press, 2001.
4. Francis X. Govers, "Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques", Packt Publishers, 2018.

References:

1. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution", Crabtree Publishing Company, 1992.
2. Brooks, Rodney. "Achieving Artificial Intelligence through Building Robots". Boston: Massachusetts Institute of Technology, 1986.

ONLINE/NPTEL Courses:

1. INTRODUCTION TO ROBOTICS: https://nptel.ac.in/courses/108103174

ADM01 FOUNDATION OF DATA SCIENCE

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Knowledge in Computer Programming.
- Basics of Computers.

Course Objectives:

- To gain knowledge in the basic concepts of Data Analysis and acquire skills in data preparatory and preprocessing steps using the tools and packages in Python for data science.

Course Outcomes:

- To understand and apply the skills of data inspecting and cleansing.
- To understand the relationship between data dependencies using statistics.
- To understand and handle data using primary tools used for data science in Python.
- To understand about data describing and visualization using tools.
- To understand the knowledge in matplotlib.

UNIT I (12 Hrs)

INTRODUCTION: Need for data science – Benefits and Uses – Facets of Data – Data Science Process – Setting Goal – Retrieving Data – Cleansing - integrating - Transforming data – Exploratory Data Analysis – Build the Models – Presenting and Building applications.

UNIT II (12 Hrs)

FREQUENCY DISTRIBUTIONS: Outliers – Relative Frequency Distributions – Cumulative Frequency Distributions – Frequency Distributions for nominal data – Interpreting Distributions – Graphs – Averages – Mode – Median – Mean.

UNIT III (12 Hrs)

PYTHON FOR DATA HANDLING: Basics of Numpy Arrays – Aggregations – Computations on Arrays – Comparisons - Masks, Boolean logic – Fancy Indexing – Structured Arrays – Data manipulation with Pandas – Data Indexing and Selection.

UNIT IV (12 Hrs)

DESCRIBING DATA II: Normal distributions – Z Scores – Normal Curve Problems – Finding Proportions – Finding Scores – More about Z Scores – Correlation – Scatter Plots – Correlation Coefficient for Quantitative Data – Computational Formula for Correlation Coefficient – Regression – Regression Line – Least Squares Regression Line.

UNIT V (12 Hrs)

PYTHON FOR DATA VISUALIZATION: Visualization with matplotlib – Line Plots – Scatter Plots – Visualizing Errors – Density and Contour Plots – Histograms - Binnings and Density – Three Dimensional Plotting – Geographic Data – Data Analysis using State Models and Seaborn – Graph plotting using Plotly.

Text Books:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I)
2. Robert S. Witte and John S. Witte, "Statistics",Wiley Publications, 11th Edition, 2017. (Chapters 1–7 for Units II and III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Chapters 2– 4 for Units IV and V)

References:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

ONLINE/NPTEL Courses:

1. Data Science for Engineers: https://nptel.ac.in/courses/106106179

ADM02 DATA ANALYTICS WITH R

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Any programming language

Course Objectives:

- To learn R. Programming language, data analytics, data visualization, and statistical model for data analytics. By completion of this course, students will be able to become data analysts.

Course Outcomes:

- To learn Data Analysis Concept
- Ability to apply statistical techniques using R Programming for data analytics and decision-making.
- To get familiar with Visualizing data using R.
- To understand the concepts of statistics with R.
- By the completion of this course, students will be able to become a data analyst

UNIT I (12 Hrs)

INTRODUCTION TO DATA ANALYSIS: Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics.

UNIT II (12 Hrs)

R PROGRAMMING BASICS: Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages.

UNIT III (12 Hrs)

DATA VISUALIZATION USING R: Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, and Excel files. Working with R Charts and Graphs: Histograms, Boxplots, BarCharts, Line Graphs, Scatterplots, and Pie Charts.

UNIT IV (12 Hrs)

STATISTICS WITH R: Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression, Survival Analysis.

UNIT V (12 Hrs)

PRESCRIPTIVE ANALYTICS: Creating data for analytics through designed experiments, Creating data for analytics through active learning, Creating data for analytics through reinforcement learning.

Text Books:

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith, and the R Development Core Team. Version 3.0.1 (2013-05-16).

References:

1. Jared P Lander, "R for everyone: advanced analytics and graphics", Pearson Education, 2013
2. Dunlop, Dorothy D., and Ajit C. Tamhane, "Statistics and data analysis: from elementary to intermediate", Prentice Hall, 2022.
3. G Casella and R.L. Berger, "Statistical Inference", Thomson Learning 2002.
4. P. Dalgaard, "Introductory Statistics with R", 2nd Edition. (Springer 2008)
5. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer
6. Hastie, Trevor, et al."The elements of statistical learning", Vol. 2. No. 1. New York: Springer, 2009.

ONLINE/NPTEL Courses:

1. Data Analytics with Python: https://nptel.ac.in/courses/106107220

ADM03 PROGRAMMING IN PYTHON

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Knowledge in Basic Programming

Course Objectives:

- To Learn the syntax and semantics of Python Programming Language, To Write Python functions to facilitate code reuse and manipulate strings
- To Illustrate the process of structuring the data using lists, tuples, and dictionaries
- To Demonstrate the use of built-in functions to navigate the file system, To Appraise the need for working on web scraping.

Course Outcomes:

- To demonstrate the concepts of control structures in Python.
- To implement Python programs using functions and strings.
- To implement methods to create and manipulate lists, tuples, and dictionaries.
- To apply the concepts of file handling and reusing packages.
- To illustrate the working of scraping websites with CSV.

UNIT I (12 Hrs)

INTRODUCTION, PYTHON BASICS: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting our Program. Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys. exit().

UNIT II (12 Hrs)

FUNCTIONS: def Statements with Parameters, Return Values, and Return Statements, The None Value, Keyword Arguments, and print(), Local and Global Scope, The global Statement, Exception Handling. Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods.

UNIT III (12 Hrs)

DICTIONARIES AND STRUCTURING DATA: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things. Manipulating Strings - Working with Strings, Useful String Methods.

UNIT IV (12 Hrs)

PATTERN MATCHING WITH REGULAR EXPRESSIONS: Finding Patterns of Text without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and greedy Matching, The find all() Method, Character Classes, Making Your Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re.IGNORECASE, re.DOTALL, and re.VERBOSE. Reading and Writing Files: Files and File Paths, The os. path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.pformat() Function. Organizing Files: The shuttle Module, Walks a Directory Tree, Compressing Files with the zip file Module.

UNIT V (12 Hrs)

WEB SCRAPING: Web Scraping: Project: MAPIT.PY with the web browser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML. Working with Excel Spreadsheets: Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts.

Text Books:

1. Al Sweigart, "Automate the Boring Stuff with Python", William Pollock, 2015, ISBN: 978-1593275990.

References:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.
2. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.
5. ReemaThareja, "Python Programming using problem-solving approach", Oxford University Press, 2017. ISBN-13: 978-0199480173
6. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.

ONLINE/NPTEL Courses:

1. Programming, Data Structures and Algorithms using Python: https://nptel.ac.in/courses/106106145

ADM04 FOUNDATION OF AI

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Basic Programming Concepts.

Course Objectives:

- To learn the basic concepts and techniques of Artificial Intelligence.

Course Outcomes:

- To understand AI algorithms for solving practical problems.
- To understand and differentiate between Human Intelligence and AI
- To understand Propositional and Predicate Logics.
- To understand and employ the fundamentals of Fuzzy logic and neural networks.
- Understand, describe and use Expert Systems.

UNIT I (12 Hrs)

INTRODUCTION: Artificial Intelligence and its applications - Artificial Intelligence Techniques -Level of models - Criteria of Success - Intelligent Agents - Nature of Agents - Learning Agents- AI Techniques - Advantages and Limitations of AI - Impact and Examples of AI - Application domains of AI - AI Ladder.

UNIT II (12 Hrs)

PROBLEM SOLVING TECHNIQUES: State space search - Control Strategies - Heuristic Search - Problem Characteristics - Production System Characteristics - Generate and test - Hill climbing - Best First Search - A* search - Constraint Satisfaction Problem - Mean-end Analysis - Min-Max Search - Alpha-Beta Pruning - Additional refinements - Iterative Deepening - Local Search Algorithms & Optimization Problems: Hill climbing - Search, Simulated Annealing Search, Local Beam Search.

UNIT III (12 Hrs)

LOGIC: Propositional logic - Predicate logic - Resolution - Resolution in Proportional Logic and Predicate Logic - Clause form - Unification Algorithm.

UNIT IV (12 Hrs)

KNOWLEDGE REPRESENTATION SCHEMES AND REASONING: Probability and Bays' Theorem - Certainty Factors and Rule-Base Systems - Bayesian Networks - Mapping between facts and representations - Approaches to knowledge representation - Procedural vs Declarative Knowledge - Forward vs Backward Reasoning - Matching - Conflict Resolution - Non-monotonic Reasoning, Default reasoning, Statistical Reasoning, Fuzzy Logic Weak and Strong Filler Structures - Semantic Nets - Frame - Conceptual Dependency - Scripts.

UNIT V (12 Hrs)

PLANNING: The Planning problem - Planning with State Space Search - Partial Order Planning - Planning Graphs - Planning with Propositional Logic - Analysis of Planning approaches - Hierarchical planning - Conditional Planning - Continuous and Multi Agent planning.

Text Books:

1. M.C. Trivedi, "A Classical Approach to Artificial Intelligence", Khanna Book Publishing, 2019.
2. Stuart Russel, "Artificial Intelligence: A modern approach", Pearson Education, 2010.
3. Rich and Knight, "Artificial Intelligence", The McGraw Hill, 2017.
4. Nils and Nilson, "Artificial Intelligence: A new synthesis", Elsevier, 1997.

References:

1. Luger "Artificial Intelligence", Pearson Education, 2002.
2. https://www.edx.org/course/artificial-intelligence-ai
3. https://www.udemy.com/course/artificial-intelligence-az

ONLINE/NPTEL Courses:

1. An Introduction to Artificial Intelligence: https://nptel.ac.in/courses/106102220

ADM05 INTRODUCTION TO BIG DATA

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Programming Skills, Data Structures and Algorithms

Course Objectives:

- To provide in-depth coverage of various topics in big data from data generation, storage, management, and transfer.
- To analytics, with a focus on the state-of-the-art technologies, tools, architectures, and systems that constitute big-data computing solutions in high-performance networks.

Course Outcomes:

- To introduce Big Data and Grid Computing.
- To get familiar with Big Data and concepts.
- To get familiar with Big data tools.
- To understand the concepts of Methods of Big Data.
- To explore advanced topics of Big Data.

UNIT I (12 Hrs)

INTRODUCTION, PYTHON BASICS: Introduction: Trends of Computing for Big Data - High-performance Computing (Supercomputers and Clusters), Grid Computing, Cloud Computing, Mobile Computing.

UNIT II (12 Hrs)

FUNCTIONS: Big Data Overview: Drivers of Big Data, Big Data Attributes, Data Structures, Big Data Ecosystem, Examples of Data Analytics.

UNIT III (12 Hrs)

BIG DATA TOOLS, TECHNIQUES, AND SYSTEMS: HDFS, HBase, and NoSQL (Document Store, Graph DB, etc.), MapReduce, Spark, Oozie, Tez, Hive, Pig, etc., Hadoop 1 and Hadoop 2 (YARN)

UNIT IV (12 Hrs)

ANALYTICAL THEORY AND METHODS FOR BIG DATA: Hadoop/Mahout, Machine Learning, Recommendation, Clustering, Classification, Regression.

UNIT V (12 Hrs)

ADVANCED TOPICS: Big Data Volume and Information Visualization, High-performance Networking for Big Data Movement, Big Data Scientific Workflow Management and Optimization.

Text Books:

1. Big Data Technologies for Business. By Arben Asllani, Prospect Press, 2020.

References:

1. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph. By David Loshin, Elsevier, August 23, 2013.

ONLINE/NPTEL Courses:

1. Introduction to Big Data: https://onlinecourses.nptel.ac.in/noc20cs92

ADPE001 DATA MINING

L	T	P	C
2	1	0	3

Course Pre-Requisite:

- Basic Knowledge in Database Management System.
- Knowledge of Probability and Statistics.

Course Objectives:

The objective of this course is to provide students with a comprehensive understanding of Data Mining Concepts, with a specific focus on Association Rules Mining, Classification Algorithms, and Clustering Techniques.

Course Outcomes:

At the end of this course, a student should be able to:

- Understand the Basic Concepts of Data Mining.
- Understand the methodologies used for the Analysis of Data.
- Deals with the various Techniques that Enhance the Data Modeling.
- Know and Compare various Approaches with other Techniques in Data Mining.
- Understand basic concepts in Mining Data Streams.

UNIT I (9 Hrs)

DATA MINING: Data, Types of Data, Data Mining Functionalities, Interestingness Patterns, Classification of Data Mining systems, Data mining Task primitives, Integration of Data mining system with a Data warehouse, Major issues in Data Mining, Data Preprocessing.

UNIT II (9 Hrs)

ASSOCIATION RULE MINING: Mining Frequent Patterns, Associations and Correlations, Mining Methods, Mining Various kinds of Association Rules, Correlation Analysis, Constraint-based Association Mining, Graph Pattern Mining, SPM.

UNIT III (9 Hrs)

CLASSIFICATION: Classification and Prediction, Basic Concepts, Decision Tree Induction, Bayesian classification, Rule based classification, Lazy learner.

UNIT IV (9 Hrs)

CLUSTERING AND APPLICATIONS: Cluster analysis–Types of Data in Cluster Analysis–Categorization of Ma- jor Clustering Methods– Partitioning Methods, Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

UNIT V (9 Hrs)

ADVANCED CONCEPTS: Basic concepts in Mining data streams–Mining Time–series data––Mining sequence patterns in Transactional databases– Mining Object– Spatial– Multimedia–Text and Web data – Spatial Data mining– Multimedia Data mining–Text Mining– Mining the World Wide Web.

Laboratory/ Practicals:

1. Demonstration of preprocessing on the dataset.
2. Demonstrate performing association rule mining on data sets.
3. Demonstrate performing classification on data sets.
4. Demonstrate performing clustering on data sets.
5. Demonstrate mining data streams, object, spatial, multimedia, text and web data.

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei Professor, "Data Mining: Concepts and Techniques", Morgan Kaufmann, 3rd Edition, 2011.
2. Pang-Ning Tan Michael Steinbach Anuj Karpatne Vipin Kumar, Introduction to Data Mining, 2nd Edition, Pearson,2021.

References:

1. Arun K Pujari, "DATA MINING TECHNIQUES", 4th Edition, The Orient Blackswan, 2016.
2. Author Mahendra Tiwari, Author Ramjee Dixit, Author Abhishek Kesharwani, "Data Mining Principles Process Model and Applications English", 1st Edition, Educreation, 2017.
3. Vikram Pudi, "Data Mining: Concepts and Techniques", 1st Edition, Oxford University, 2009.

ONLINE/NPTEL Courses:

1. Data Mining: https://nptel.ac.in/courses/106105174

ADPE002 INTERACTIVE DATA VISUALIZATION

L	T	P	C
2	1	0	3

Course Pre-requisite:

- Basic Knowledge in Data Visualization.

Course Objectives:

- To provide students with the foundations necessary for understanding and extending the current state of the art in Data visualization.

Course Outcomes:

At the end of this course, a student should be able to:

- Understand key visualization techniques and theory, including data models, graphical perception, and methods for visual encoding and interaction.
- Understand the concepts of Interactive design.
- Explore the common data domains and corresponding analysis tasks, including Multivariate data, Geospatial Data, and Networks.
- Gain Practical experience in building and evaluating visualization systems.
- Obtain the ability to read and discuss research papers from the visualization literature.

UNIT I (9 Hrs)

Introduction to Technology Fundamentals: The data and Image Models, EDA, Visual Encoding, Graphical Perception, Color, Animation, and Graph Layout.

UNIT II (9 Hrs)

Introduction and Interaction Design: Selection, Storing Selections, Filtering Selections Based on Data, Drawing divs, Random data, Drawing SVG, Reactivity, Responsiveness.

UNIT III (9 Hrs)

Interactive Navigation: Geomapping, Paths, Projections, Adding points, Panning, Zooming, Value Labels, Preparing Raw Geo data, Exporting the Images, Bit maps, PDF, SVG.

UNIT IV (9 Hrs)

Multiview Coordination: Juxtaposing, Developer Tools, Rendering and the Box Model, CSS, JavaScript, SVG, Layering and Drawing Order, Domains and Ranges, Scaling the Scatterplot, Refining the plot, Partitioning, Layout, Pie Layout, Force Layout, Stack Layout.

UNIT V (9 Hrs)

Data Reduction: Data Preparation, Scale Setup, Dealing with Missing Data, Refining the Visuals, Filtering, and Aggregation of items, Filtering selections, Perceptual principles, Color Theory, Rules of thumb, and Usability testing.

Laboratory/ Practicals:

1. Demonstrate the basic Python visualization tools.
2. Implement different types of Charts and Graphs.
3. Implement visualization of Numerical Data.
4. Implement visualization of Non-Numerical Data
5. Implement basic functions of Matplotlib, pandas, seaborn, ggplot, pyplot.

Text Books:

1. Scott Murray, "Interactive Data Visualization for the Web", 2nd Edition, O'Reilly Media, 2017.

References:

1. Edward R. Tufte, "The Visual Display of Quantitative Information", 2nd Edition, Graphics Press USA , 2022.
2. Julie Steele, Noah Iliinsky, "Beautiful Visualization", 1st Edition, O'Reilly Media, 2017.

ONLINE/NPTEL Courses:

1. Interactive Data Visualization: https://nptel.ac.in/courses/106105174

ADPE003 ROBOTIC PROCESS AUTOMATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Software Engineering, Programming Skills

Course Objectives:

- To familiarize about the basic concepts of Robotic Process Automation and to expose to the key RPA design and development strategies and methodologies. They should learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA and to deploy and Maintain the software bot.

Course Outcomes:

- To enunciate the key distinctions between RPA and existing automation techniques and platforms.
- To use UiPath to design control flows and work flows for the target process.
- To implement recording, web scraping andprocess mining by automation.
- To use uiPath Studio to detect, and handle exceptions in automation processes.
- To use and implement Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

UNIT I (9 Hrs)

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Emergence of Robotic Process Automation (RPA) - Evolution of RPA - Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II (9 Hrs)

AUTOMATION PROCESS ACTIVITIES: Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events.

UNIT III (9 Hrs)

APP INTEGRATION, RECORDING AND SCRAPING: App Integration - Recording - Scraping - Selector - Workflow Activities. Recording mouse and keyboard actions to perform operation - Scraping data from website and writing to CSV. Process Mining.

UNIT IV (9 Hrs)

EXCEPTION HANDLING AND CODE MANAGEMENT: Exception handling - Common exceptions - Logging-Debugging techniques - Collecting crash dumps - Error reporting. Code management and maintenance: Project organization - Nesting workflows - Reusability - Templates - Commenting techniques - State Machine.

UNIT V (9 Hrs)

DEPLOYMENT AND MAINTENANCE: Publishing using publish utility - Orchestration Server - Control bots - Orchestration Server to deploy bots - License management - Publishing and managing updates. RPA Vendors - Open Source RPA - Future of RPA.

LIST OF EXPERIMENTS

Setup and Configure a RPA tool and understand the user interface of the tool:

1. Create a Sequence to obtain user inputs display them using a message box.
2. Create a Flowchart to navigate to a desired page based on a condition;
3. Create a State Machine workflow to compare user input with a random number.
4. Build a process in the RPA platform using UI Automation Activities.
5. Create an automation process using key System Activities, Variables and Arguments.
6. Also implement Automation using System Trigger
7. Automate login to (web)Email account.
8. Recording mouse and keyboard actions.
9. Scraping data from website and writing to CSV
10. Implement Error Handling in RPA platform.
11. Web Scraping.
12. Email Query Processing.

Text Books:

1. Alok Mani Tripathi, "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool", UiPath, Packt Publishing, 2018.
2. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.

References:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author) and Lauren Livingston (Author), "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Richard Murdoch, "Robotic Process Automation: Guide To Building Software Robots", Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018.
3. A Gerardus Blokdyk, "Robotic Process Automation Rpa A Complete Guide", 2020.

ONLINE/ NPTEL Courses:

1. Introduction to Robotics : https://nptel.ac.in/courses/112101098

ADPE004 MACHINE LEARNING TOOLS

L	T	P	C
2	1	0	3

Course Pre-requisite:

- Basic Knowledge in Machine Learning.

Course Objectives:

- To provide hands-on training with some of the important software libraries used in machine learning, e.g., Scikit-learn, Tensorflow, and Pytorch.

Course Outcomes:

At the end of this course, a student should be able to:

- Understand the basics of Machine Learning Concepts.
- Learn about Machine Learning Tools.
- Get Familiar with Scikit-Learn.
- Understand the concepts of TensorFlow.
- Get familiar with the basics of NLP using Pytorch.

UNIT I (9 Hrs)

Introduction to Machine Learning: Basic Concepts, Machine Learning vs Traditional Learning, Types of Machine Learning Systems, Challenges of Machine Learning, Testing, and validating.

UNIT II (9 Hrs)

Machine Learning Tools: Introduction about TensorFlow, Neural Network in TensorFlow, Recurrent Neural Networks, Regression with TensorFlow, Fundamentals of Scikit-learn, Basics of Keras, Introduction to PyTorch

UNIT III (9 Hrs)

Scikit-learn: An Introduction to Scikit-learn, What Is Simple Linear Regression? Evaluating the Model, KNN, Classification with KNN, Regression with KNN, Multiple Linear Regression, Polynomial Regression, Regularization, Applying Linear Regression, Gradient Descent, Binary Classification with Logistic Regression, Multi-Class Classification, Bayes' Theorem, Generative and Discriminative Models, Naive Bayes with Scikit-learn, Decision Trees, Bagging, Boosting, Stacking.

UNIT IV (9 Hrs)

TensorFlow: Custom Models and Training with TensorFlow, Customizing Models and Training Algorithms, TensorFlow Functions and Graphs, Loading and Preprocessing Data with TensorFlow, Deep Computer Vision Using Convolutional Neural Networks, Processing Sequences Using RNNs and CNNs, Natural Language Processing with RNNs and Attention.

UNIT V (9 Hrs)

Natural Language Processing with PyTorch: Pytorch basics, Concepts of NLP, Foundational components of Neural Networks, Feed-Forward Networks for NLP: CNN, CNN Hyper-Parameters, Implementing CNNs in Pytorch. Sequence Modelling for NLP.

Laboratory/ Practicals:

1. Building and training an RNN for text generation by using tensorflow/Pytorch.
2. Building and training a neural network using TensorFlow.
3. Building a CNN for Image classification.
4. Building a simple feed-forward neural network for classification tasks using Pytorch.
5. To implement Sentimental Analysis using Pytorch.

Text Books:

1. Dilip Rao, Brian McMahan, "Natural Language Processing with PyTorch", 1st Edition, O'Reilly Press, 2019.

REFERENCES:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, Shroff/O'Reilly, 2019.

ONLINE/ NPTEL Courses:

1. Practical Machine Learning with Tensorflow : https://nptel.ac.in/courses/106106213

ADPE005 AI IN HEALTHCARE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in AI.
- Basic Neural Network Structures.

Course Objectives:

- To understand transforming the practice of Health Care.
- To apply machine learning to concrete problems in Health Care.

Course Outcomes:

- To understand and apply on tree-based machine learning to estimate patient survival rates.
- To understand Picture classification and segmentation models.
- To understand the way to extract information from unstructured medical data using Natural Language Processing.
- To understand different types of prognosis models related to different diseases.
- To understand and analyze data from the randomized control trail.

UNIT I (9 Hrs)

DISEASE DETECTION WITH COMPUTER VISION: Medical Image Diagnosis, Eye Disease and Cancer Diagnosis, Building and Training a Model for Medical Diagnosis, Training, prediction, and loss, Image Classification and Class Imbalance, Generating More Samples, Model Testing.

UNIT II (9 Hrs)

EVALUATING MODELS: Sensitivity, Specificity, and Evaluation Metrics, Accuracy in terms of conditional probability, Confusion matrix, ROC curve and Threshold. **IMAGE SEGMENTATION ON MRI IMAGES:** Medical Image Segmentation, MRI Data and Image Registration, Segmentation, 2D U-Net and 3D U-Net Data augmentation and loss function for segmentation, Different Populations and Diagnostic Technology, External validation.

UNIT III (9 Hrs)

LINEAR PROGNOSTIC MODELS: Medical Prognosis, Atrial fibrillation, Liver Disease Mortality, Risk of heart disease, Evaluating Prognostic Models, Concordant Pairs, Risk Ties, Permissible Pairs.

UNIT III (9 Hrs)

PROGNOSIS WITH TREE-BASED MODELS: Decision trees for prognosis, fix overfitting, Different distribu- tions, Missing Data example, Imputation.

UNIT IV (9 Hrs)

SURVIVAL MODELS AND TIME: Survival Model, Survival function, collecting time data, Estimating the survival function. **BUILD A RISK MODEL USING LINEAR AND TREE-BASED MODELS:** Hazard Functions, Relative risk, Individual vs. baseline hazard, Survival Trees, Nelson Aalen estimator.

UNIT V (9 Hrs)

MEDICAL TREATMENT EFFECT ESTIMATION: Analyze data from a randomized control trial, Average treatment effect, Conditional average treatment effect, T-Learner, S-Learner, C-for-benefit.

Laboratory/ Practicals:

1. Hands on with building and training a model for medical image diagnosis.
2. Hands on with medical image segmentation (2D U-Net and 3D U-Net Data augmentation).
3. Hands on with linear prognosis models for liver and heart diseases.
4. Hands on with tree-based prognosis models and computing accuracy.
5. Hands on building a risk model based on prognosis models.

Text Books:

1. Eric Topol, "Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again", Basic Books, 1st Edition 2019.
2. Arjun Panesar, "Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes", Apress, 1st Edition, 2019.

References:

1. "Artificial Intelligence in Healthcare", ISBN 978-0-12-818438-7, Elsevier Inc., 2020.

ONLINE/ NPTEL Courses:

1. Applied Accelerated Artificial Intelligence : https://onlinecourses.nptel.ac.in/noc22 cs83/preview

ADPE006 COMPUTATIONAL INTELLIGENCE

L	T	P	C
2	1	0	3

Course Pre-requisite:

- Basic Knowledge in AI.

Course Objectives:

This course offers a valuable opportunity to delve into the fascinating realms of pattern matching and genetic algorithms (GAs).

Course Outcomes:

At the end of this course, a student should be able to:

- Understand Artificial intelligence and its Algorithms.
- Explore Knowledge Representation and Reasoning.
- Understand Fuzzy Logic Concepts
- Understand about various learning models.
- Explore various applications in AI.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Artificial Intelligence-Search-Heuristic Search-A* algorithm-Game Playing-Alpha-Beta Pruning-Expert systems-Inference-Rules-Forward Chaining and Backward Chaining- Genetic Algorithms.

UNIT II (9 Hrs)

KNOWLEDGE REPRESENTATION AND REASONING: Proposition Logic — First Order Predicate Logic — Unification — Forward Chaining -Backward Chaining — Resolution — Knowledge Representation — Ontological Engineering — Categories and Objects — Events — Mental Events and Mental Objects — Reasoning Systems for Categories — Reasoning with Default Information — Prolog Programming.

UNIT III (9 Hrs)

UNCERTAINTY: Non monotonic reasoning-Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning-Neural Networks-Neuro-fuzzy Inference.

UNIT IV (9 Hrs)

LEARNING: Probability basics — Bayes Rule and its Applications — Bayesian Networks — Exact and Approximate Inference in Bayesian Networks — Hidden Markov Models — Forms of Learning — Supervised Learning — Learning Decision Trees — Regression and Classification with Linear Models — Artificial Neural Networks — Nonparametric Models — Support Vector Machines — Statistical Learning — Learning with Complete Data — Learning with Hidden Variables- The EM Algorithm — Reinforcement Learning.

UNIT V (9 Hrs)

INTELLIGENCE AND APPLICATIONS: Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-All applications — Language Models — Information Retrieval — Information Extraction — Machine Translation — Machine Learning — Symbol-Based — Machine Learning: Connectionist — Machine Learning.

Laboratory/ Practicals:

1. Implementation of Fuzzy Operations.
2. Implementation of Simple Neural Network (McCulloh-Pitts model)
3. Implementation of Fuzzy Relations (Max-min Composition)
4. Classifying Data Using Support Vector Machines (Svms): Svm-Rbf Kernels
5. Program to train a neural network to classify two clusters in a 2-dimensional space

Text Books:

1. Stuart Russell, Peter Norvig, —Artificial Intelligence: A Modern Approach||, Third Edition, Pearson Education / Prentice Hall of India, 2010.
2. Elaine Rich and Kevin Knight, —Artificial Intelligence||, Third Edition, Tata McGrawHill, 2010.

REFERENCES:

1. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
2. Dan W.Patterson, —Introduction to Artificial Intelligence and Expert Systems||, PHI, 2006.
3. Nils J. Nilsson, —Artificial Intelligence: A new Synthesis||, Harcourt Asia Pvt. Ltd., 2000.

ONLINE/ NPTEL Courses:

1. Artificial Intelligence: Knowledge Representation And Reasoning : https://onlinecourses.nptel.ac.in/noc23 cs09/preview
2. Natural Language Processing : https://onlinecourses.nptel.ac.in/noc19 cs56/preview

ADPE007 SPEECH PROCESSING

L	T	P	C
2	1	0	3

Course Pre-requisite:

- Knowledge in Normal Speech and Language Development.

Course Objectives:

Students will be given an Introduction to Spoken Language Technology and will be taught how to apply deep learning and other methods for automatic speech recognition.

Course Outcomes:

At the end of this course, a student should be able to:

- Understand the fundamentals of speech processing, its models, and feature extraction.
- Appreciate various applications of speech recognition and synthesis in daily life.
- Apply machine learning to perform speech recognition and convert text to speech.
- Perform sentiment analysis on speech.
- Learn the fundamental challenges of building a dialog system.

UNIT I (9 Hrs)

Speech Source and Representation: Speech Fundamentals, Articulatory Phonetics, Production and Classification of Speech Sounds, Acoustic, Phonetics, Acoustics of speech production, Argmax-based computations.

UNIT II (9 Hrs)

Speech Features: Speech Analysis, Features, Feature Extraction, Pattern Comparison Techniques, Speech distortion measures, mathematical and perceptual, Spectral Distance, Cepstral Distances, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization, Dynamic Time Warping, Multiple Time, Alignment Paths.

UNIT III (9 Hrs)

Speech Recognition: Speech Modeling, Hidden Markov Models: Markov Processes, HMMs, Evaluation, Optimal State Sequence, Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues, Architecture of a large vocabulary continuous speech recognition, system, acoustics and language models, N-grams, context-dependent sub-word units, Applications and present status, Speech Recognition Framework.

UNIT IV (9 Hrs)

Speech Synthesis: Speech Synthesis, Text-to-Speech Synthesis, Concatenative, and waveform synthesis methods, subword units for TTS, Intelligibility and Naturalness, Role of prosody, Applications, and present status, Speech synthesis framework.

UNIT V (9 Hrs)

Applications: Speaker Recognition, Verification, Voice biometrics, Music processing, Issues, Representation, Pitch, Melody, Timbre, Music Features, Singer identification, Instrument identification.

Laboratory/ Practicals:

1. Identification of Speech Sound.
2. Identification of Speech Signal Features.
3. Speech Modelling using HMM.
4. Implementation of Concatenative Speech Synthesis.
5. Implementation of Speaker Recognition.

Text Books:

1. Dan Jurafsky and James H. Martin, " Speech and Language Processing ", 3rd Edition, Pearson Education, 2023.

REFERENCES:

1. Mark Gales and Steve Young, "The application of hidden Markov models in speech recognition, Foundations and Trends in Signal Processing", 1st Edition, now publishers Inc, 2008.
2. Geoffrey Hinton, Li Deng, Dong Yu, George E. Dahl, Abdel-rahman Mohamed, Navdeep Jaitly, Andrew Senior, Vincent Vanhoucke, Patrick Nguyen, Tara N. Sainath, and Brian Kingsbury," Deep Neural Networks for Acoustic Modeling in Speech Recognition", 1st Edition, IEEE Signal Processing Magazine, 2012.
3. Rajesh Ranganath, Dan Jurafsky, and Daniel A. McFarland, "Detecting friendly, flirtatious, awkward, and assertive speech in speed-dates. Computer Speech and Language ", 1st Edition, 2013.

ONLINE/ NPTEL Courses:

1. Digital Speech Processing : https://archive.nptel.ac.in/courses/117/105/117105145/

ADPE008 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Artificial Intelligence and Neural Networks

Course Objective:

- To read, understand and decode human words in a valuable manner.

Course Outcomes:

- To understand given text with basic Language features.
- To design an innovative application using NLP components.
- To implement a rule based system to tackle morphology/syntax of a language.
- To design a tag set to be used for statistical processing for real-time applications.
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I (9 Hrs)

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology- Transducers for lexicon and rules- Tokenization, Detecting and Correcting Spelling Errors-Minimum Edit Distanceg.

UNIT II (9 Hrs)

WORD LEVEL ANALYSIS: Unsmoothed N-grams- Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging- Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III (9 Hrs)

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG- Probabilistic CYK-Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT IV (9 Hrs)

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis-Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V (9 Hrs)

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer- Lemmatizer- Penn Treebank, Brill's Tagger-WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

List of Experiments:

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams Smoothing
5. POS Tagging: Hidden Markov Model
6. POS Tagging: Viterbi Decoding

Text Books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: "An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. Steven Bird, Evan Klein and Edward Loper, "Natural Language Processing with Python", O'Reilly Media, 1st Edition, 2009.
3. S.N.Sivanandham and M Paulraj, "Introduction to Artificial Neural Networks", Vikas Pubishing, 2023.

References:

1. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Richard M Reese, "Natural Language Processing with Java||", O'Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Chapman and Hall/CRC Press,2nd Edition, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

ONLINE/ NPTEL Courses:

1. Applied Natural Language Processing : https://nptel.ac.in/courses/106106211
2. Natural Language Processing : https://nptel.ac.in/courses/106105158

ADPE009 BUSINESS INTELLIGENCE & ANALYTICS

L	T	P	C
2	1	0	3

Course Pre-requisite:

- Knowledge in DBMS.

Course Objectives:

- To understand the business analytics Life Cycle and to comprehend the process of acquiring Business Intelligence. To understand various types of analytics for Business Forecasting and supply chain management for Analytics.

Course Outcomes:

- Understand real-world business problems and models with analytical solutions.
- Understand and identify the business processes for extracting Business Intelligence.
- Understand and apply predictive analytics for business forecasting.
- Understand and apply analytics for supply chain and logistics management.
- Understand and use analytics for marketing and sales.

UNIT I (9 Hrs)

INTRODUCTION TO BUSINESS ANALYTICS: Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.

UNIT II (9 Hrs)

BUSINESSS INTELLIGENCE: Data Warehouses and Data Mart - Knowledge Management – Types of Decisions – Decision-Making Process - Decision Support Systems – Business Intelligence – OLAP – Analytic functions.

UNIT III (9 Hrs)

BUSINESS FORECASTING: Introduction to Business Forecasting and Predictive Analytics - Logic and Data- Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive Analytics.

UNIT IV (9 Hrs)

HR AND SUPPLY CHAIN ANALYTICS: Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR Supply Chain. and Sales.

UNIT V (9 Hrs)

MARKETING & SALES ANALYTICS: Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales.

Text Books:

1. R. Evans James, "Business Analytics", 2017.
2. R N Prasad, Seema Acharya, " Fundamentals of Business Analytics", 2016.
3. Philip Kotler and Kevin Keller, "Marketing Management", PHI, 15th Edition, 2016.

References:

1. VSP RAO, "Human Resource Management", 3rd Edition, Excel Books, 2010.
2. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education, 2018.

ONLINE/ NPTEL Courses:

1. Business Analytics & Text Mining Modeling Using Python: https://nptel.ac.in/courses/110107129
2. Business Analytics & Text Mining Modeling Using Python: https://www.shiksha.com/online-courses/business-statistics-by-nptel-course-nptel45

ADPE010 VIRTUAL REALITY AND AUGMENTED REALITY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Java Programming
- Multimedia and Animation

Course Objective:

- Learn the basic principles of virtual reality applications, different gaming toolkits and to develop AR/VR applications.

Course Outcomes:

- To understand the basic concepts of AR and VR.
- To understand the tools and technologies related to AR/VR.
- To gain knowledge on VR programming.
- To develop AR/VR applications in different domains.
- To gain knowledge about AR/VR.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Virtual Reality and Augmented Reality – Definition, Introduction to Trajectories and Hybrid Space, Three I's of Virtual Reality , Virtual Reality Vs 3D Computer Graphics, Benefits of Virtual Reality, Components of VR System, Introduction to AR- AR Technologies-Input Devices, 3D Position Trackers, Types of Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces, Types of Gesture Input Devices, Output Devices, Graphics Display, Human Visual System, Personal Graphics Displays, Large Volume Displays,Sound Displays, Human Auditory System.

UNIT II (9 Hrs)

VR MODELING: Modeling – Geometric Modeling, Virtual Object Shape, Object Visual Appearance, Kinematics Modeling – Transformation Matrices, Object Position, Transformation Invariants, Object Hierarchies, Viewing the 3D World, Physical Modeling, Collision Detection, Surface Deformation – Force Computation, Force Smoothing and Mapping, Behavior Modeling, Model Management.

UNIT III (9 Hrs)

VR PROGRAMMING: VR Programming – Toolkits and Scene Graphs, World ToolKit, Java 3D, Comparison of World ToolKit and Java 3D

UNIT IV (9 Hrs)

APPLICATIONS: Human Factors in VR – Methodology and Terminology, VR Health and Safety Issues, VR and Society-Medical Applications of VR, Education, Arts and Entertainment, Military VR Applications, Emerging Applications of VR – VR Applications in Manufacturing, Applications of VR in Robotics, Information Visualization, VR in Business,VR in Entertainment, VR in Education.

UNIT V (9 Hrs)

AUGMENTED REALITY: Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation- Navigation-Wearable devices

List of Experiments:

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop simple MR enabled gaming applications.

Text Books:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018.
2. William R. Sherman, Alan B.Craig, "Understanding Virtual Reality – Interface, Application,Design ", Morgan Kaufmann, 2nd Edition, 2018.
3. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016.

References:

1. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.
2. Paul E. Proctor, "The Practical Intrusion Detection Handbook", Prentice Hall , 2001.
3. Ankit Fadia and Mnu Zacharia, "Intrusiion Alert", Vikas Publishing house Pvt., Ltd, 2007.
4. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

Online/ NPTEL courses:

1. Augmented and Virtual Reality courses- https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/
2. Virtual Reality- https://archive.nptel.ac.in/courses/121/106/121106013/

ADPE011 OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Artificial Intelligence and Machine Learning

Course Objective:

- To introduce the basic concepts of linear,non-programming a interior point and dynamic programming.

Course Outcomes:

- To understand the linear programming model and acquire management skills.
- To apply the theory of optimization methods and algorithms.
- To understand non linear programming.
- To analyze karmarkar's algorithm and applying optimization techniques in problems of Engineering and Technology.
- To understand dynamic programming and appreciate variety of performance measures for various optimization problems.

UNIT I (9 Hrs)

LINEAR PROGRAMMING: Introduction- Formulation of linear programming model- Graphical solution- Solving LPP using simplex algorithm-Revised Simplex Method.

UNIT II (9 Hrs)

ADVANCES IN LPP: Dual theory- Dual simplex method- Sensitivity analysis- Transportation problems- Assignment problems- Traveling sales man problem- Data Envelopment Analysis.

UNIT III (9 Hrs)

NON LINEAR PROGRAMMING: Classification of Non Linear programming-Lagrange multiplier method- Karush, Kuhn Tucker conditions- Reduced gradient algorithms-Quadratic programming method-Penalty and Barrier method.

UNIT IV (9 Hrs)

INTERIOR POINT METHODS: Karmarkar's algorithm- Projection Scaling method-Dual affine algorithm-Primal affine algorithm Barrier algorithm.

UNIT V (9 Hrs)

DYNAMIC PROGRAMMING: Formulation of Multi stage decision problem- Characteristics- Concept of sub- Optimization and the principle of optimality-Formulation of Dynamic programming- Backward and Forward recursion-Computational procedure-Conversion of final value problem in to Initial value problem.

List of Experiments:

1. Formulate engineering system design problem as an optimization problem.
2. Problem formulated in Experiment No. 1 should be solved graphically and identify the nature of problem.
3. By using excel solver solve unconstrained and constrained optimization problems by creating excel worksheets.
4. Solve LPP by two-phase simplex method numerically and verify the results by using simulation software
5. Solve quadratic programming problem numerically and verify results by using simulation software.
6. Verify the descent conditions for a given search direction for unconstrained optimization problem and calculate step size along search direction using Equal Interval Search method numerically and verify results by using simulation software
7. Solve nonlinear optimization problems by using numerical optimization methods (indirect) Newtons methods verify the results by using simulation software.

Text Books:

1. Sultan Chand and Sons, "Operations Research", Sultan Chand and Sons, 2019.
2. L. R. Foulds,"Optimization Techniques",Softcover reprint of the original, 1st Edition, 2011.
3. Chander Mohan and Kusum Deep,"Optimization Techniques", New Age Science Ltd, 2009.

References:

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2019.
2. Ronald L.Rardin, "Optimization in Operation Research", Pearson Education Pvt.Ltd., 2018.

ONLINE/ NPTEL Courses:

1. Linear Programming Problems : https://nptel.ac.in/courses/111102012
2. Nonlinear programming: https://nptel.ac.in/courses/111107104

ADPE012 DEEP LEARNING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Artificial Neural networks
- Machine Learning

Course Objective:

- To enable design and deployment of deep learning models for machine learning problems.

Course Outcomes:

- To understand basics of deep learning.
- To implement various deep learning models.
- To realign high dimensional data using reduction techniques.
- To analyze optimization and generalization in deep learning.
- To explore the deep learning applications.

UNIT I (9 Hrs)

INTRODUCTION TO MACHINE LEARNING: Linear models (SVMs and logistic regression)- Intro to Neural Nets: Shallow network - Connect and Train a network: loss functions, Back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT II (9 Hrs)

HISTORY OF DEEP LEARNING : A Probabilistic Theory of Deep Learning- Back propagation and regularization- Batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN)- Semi supervised Learning.

UNIT III (9 Hrs)

LINEAR AND MANIFOLDS: Auto encoders and CNN - Introduction to Convent - Architectures – AlexNet, VGG, Inception, ResNet -Training a Convent: Weights initialization, Batch normalization, Hyper parameter optimization.

UNIT IV (9 Hrs)

OPTIMIZATION IN DEEP LEARNING: Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks-LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning.

UNIT V (9 Hrs)

APPLICATIONS OF DEEP LEARNING: Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models –Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks –Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

List of Experiments:

1. Write a program to implement Support Vector Machine algorithm to classify the iris data set. Print both correct and wrong predictions.
2. Build a simple neural network model for regression.
3. Write a program to implement deep learning Techniques for image segmentation.
4. Build a feed forward neural network for prediction of logic gates.
5. Write a program for Time-Series Forecasting with the LSTM Model.
6. Write a program to predict a caption for a sample image using LSTM.

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.
3. CosmaRohillaShalizi, "Advanced Data Analysis from an Elementary Point of View", 2015.

References:

1. Jon Krohn, Beyleveld Grant and Bassens Aglaé, "Deep Learning Illustrated: A Visual, Interactive, Guide to Artificial Intelligence", Addison-wesley, 2019.
2. Hyatt Saleh, "Applied Deep Learning with PyTorch", Packt Publishing, 2019.
3. Pradeep Pujari, Md. and Rezaul Karim, Mohit Sewak, "Practical Convolutional Neural Networks",Packt Publishing, February 2018.
4. Ragav Venkatesan and Baoxin Li, "Convolutional Neural Networks in Visual Computing (Data Enabled Engineering)", CRC Press, September 2017.

ONLINE/ NPTEL Courses:

1. Deep Learning : https://nptel.ac.in/courses/106105215
2. Deep Learning : https://nptel.ac.in/courses/106106201

ADPE013 BIG DATA ANALYTICS

L	T	P	C
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Course Pre-requisite:

- Basis of Programming
- Database Management System

Course Objectives:

- To learn the concepts of data analytics, data management and practice in various applications like HDFS, MapReduce, Hadoop, YARN etc.,

Course Outcomes:

- To describe big data and use cases from selected business domains
- To explore NoSQL big data management
- To install, configure, and run Hadoop and HDFS
- To perform map-reduce analytics using Hadoop
- To use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

UNIT I (9 Hrs)

UNDERSTANDING BIG DATA: Introduction to Big Data - Convergence of key trends, Unstructured Data, Industry Examples of Big Data, Web Analytics, Big Data Applications, Big Data Technologies. Introduction to Hadoop – Open Source Technologies, Cloud and Big Data, Mobile Business Intelligence, Crowd Sourcing Analytics, Inter and Trans Firewall Analytics.

UNIT II (9 Hrs)

NoSQL DATA MANAGEMENT: Introduction to NoSQL - Aggregate Data Models, Key-Value and Document Data Models, Relationships, Graph databases, Schemaless Databases, Materialized Views. Distribution Models - Master-Slave Replication, Consistency. Cassandra - Cassandra Data Model, Cassandra Examples, Cassandra Clients

UNIT III (9 Hrs)

MAPREDUCE APPLICATIONS: MapReduce Workflows - Unit Tests with MRUnit, Test Data and Local Tests, Anatomy of MapReduce Job Run, classic Map-reduce, YARN, Failures in Classic Map-Reduce and YARN, Job Scheduling, Shuffle and Sort, Task Execution, MapReduce Types, Input Formats, Output Formats.

UNIT IV (9 Hrs)

BASICS OF HADOOP: Data Format – Analyzing Data with Hadoop, Scaling out, Hadoop Streaming, Hadoop Pipes, Design of Hadoop Distributed File system (HDFS),HDFS Concepts, Java Interface, Data Flow, Hadoop I/O, Data Integrity, Compression, Serialization, Avro – File-Based Data Structures, Cassandra, Hadoop Integration. Introducing Apache Spark - Spark Shell, Spark Context.

UNIT V (9 Hrs)

HADOOP RELATED TOOLS: Hbase – Data Model and Implementations, HBase clients, HBase Examples, Praxis.Pig – Grunt, Pig Data Model, Pig Latin, Developing and Testing Pig Latin scripts.Hive, Data types and File Formats, HiveQL Data Definition, HiveQL Data Manipulation, HiveQL Queries.

List of Experiments:

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
6. Installation of HBase, thrift Practice examples
7. Practice importing and exporting data from various databases.
8. Distributed Cache and Map Side Join, Reduce side Join and Running a Spark Application Word count in Hadoop and Spark Manipulating RDD
9. Inverted Indexing in Spark Sequence alignment problem in Spark Implementation of Matrix algorithms in Spark SQL programming, Building Spark Streaming application.

Text Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", O'Reilley, 3rd Edition, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

References:

1. Seema Acharya, Subashini Chellappan " Big Data and Analytics", Wiley India Pvt. Ltd, 2nd Edition 2019.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

ONLINE/NPTEL Courses:

1. Big Data Concepts: https://onlinecourses.nptel.ac.in/noc20cs92

ADPE014 SOFT COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- A strong mathematical background.
- Proficiency with algorithms.
- Programming skills in C, C++, or Java, MATLAB, etc.
- Critical thinking and problem solving skills.

Course Objectives:

- Students should be able to understand soft computing concepts and techniques and foster their abilities in designing and implementing soft computing-based solutions for real-world problems.

Course Outcomes:

- To Understand, Identify and describe soft computing techniques and their roles in building intelligent machines.
- To understand soft computing methodology for a particular problem.
- To understand, analyse and compare solutions by various soft computing approaches for a given problem.
- To understand genetic algorithms to combinatorial optimization problems.
- To understand, evaluate and compare solutions by various soft computing approaches for a given problem.

UNIT I (9 Hrs)

INTRODUCTION TO NEURAL NETWORKS: Structure and working of Biological Neural Network, Fundamentals of Artificial Neural Networks & Applications, Characteristics of Artificial Neural Networks, History of neural network research, characteristics of neural networks terminology.

UNIT II (9 Hrs)

NEURAL NETWORKS MODELS AND LEARNING METHODS: Models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture, Multilayer Neural Networks, Learning Methods, Backpropagation, Counter propagation, ART, BAM, Associative memories.

UNIT III (9 Hrs)

INTRODUCTION OF FUZZY LOGIC AND NEURO FUZZY SYSTEMS: Introduction, Fuzzy sets, Fuzzy model, Fuzzy rule generation Fuzzy inference system, Defuzzification, Architecture of a Neuro-Fuzzy system and its applications.

UNIT IV (9 Hrs)

MACHINE LEARNING: Supervised learning: Primitive algorithms, Generative algorithms, Support Vector Machine, Ensemble methods. Unsupervised learning: K-means, Principal component analysis, Independent component analysis. Reinforcement learning and control.

UNIT V (9 Hrs)

APPLICATIONS: Applications of GA & GP, Hybrid systems.

Laboratory/ Practicals:

1. Basics of python programming.
2. Implement Pitts Model.
3. Implement Adaline Model.
4. Basics of ML-supervised models.
5. Basics of ML-Unsupervised models.

Text Books:

1. Jang, "Neuro fuzzy and soft computing", Pearson Education, 1996.
2. Vojislav Kecman, "Learning and Soft Computing", Pearson Education, 2001.
3. Ikvinderpal Singh, "Soft Computing", Khanna Book Publishing, 2015.

References:

1. Klir and Yuan, "Fuzzy Sets and Fuzzy Logic", PHI, 1995
2. Fu,"Neural Network in computer Intelligence", TMH, 2003
3. Dario Floreano, "Bio-Inspired Artificial Intelligence", PHI, 2008

ONLINE/NPTEL Courses:

1. Introduction to Soft Computing: https://onlinecourses.nptel.ac.in/noc20 cs17/preview

ADPE015 KNOWLEDGE ENGINEERING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basics of Artificial Intelligence

Course Objective:

- To deal with knowledge acquisition, representation, validation, inference, explanation and maintenance.

Course Outcomes:

- To understand the basics of Knowledge Engineering.
- To apply methodologies and modelling for agent design and development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT I (9 Hrs)

REASONING UNDER UNCERTAINTY: Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II (9 Hrs)

METHODOLOGY AND MODELING : Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III (9 Hrs)

ONTOLOGIES DESIGN AND DEVELOPMENT: Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV (9 Hrs)

REASONIING WITH ONTOLOGIES AND RULES: Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V (9 Hrs)

LEARNING AND RULE LEARNING: Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

List of Experiments:

1. Implementation of Missionaries and Cannibals Problem using rule-based approach.
2. Implementation of First Order Logic
3. Implementation of Bayesian networks.
4. Implementation of Semantic Networks.
5. Developing a Fuzzy Inference system
6. Construction of Ontology for a given domain.
7. Implementation of Frames.
8. Develop an expert system for classification of Animals with Property Inheritance
9. Mini Project using Fuzzy Rules and Machine Learning

Text Books:

1. Ela Kumar, "Knowledge Engineering", IK International Publisher House, 2018.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, "Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning", Cambridge University Press, 1st Edition, 2016.

References:

1. Michael K. Bergman,"Knowledge Representation and Reasoning", 2018.
2. King , "Knowledge Management and Organizational Learning", Springer, 2009.
3. Ronald J. Brachman, Hector J. Levesque,"Knowledge Representation and Reasoning", Morgan Kaufmann, 2004.

ONLINE/ NPTEL Courses:

1. Knowledge Management: https://nptel.ac.in/courses/110105076
2. Knowledge Representation and Reasoning: https://nptel.ac.in/courses/106106140

ADOE001 INTRODUCTION TO DATA SCIENCE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Computer Programming.
- Basics of Computers.

Course Objectives:

- To gain knowledge in the basic concepts of Data Analysis.
- To acquire skills in data preparatory and preprocessing steps.
- To learn the tools and packages in Python for data science.
- To understand the classification and Regression Model.
- To acquire knowledge in data interpretation and visualization techniques.

Course Outcomes:

- To understand and apply the skills of data inspecting and cleansing.
- To determine the relationship between data dependencies using statistics.
- To handle data using primary tools used for data science in Python.
- To apply the knowledge for data description and visualization using tools.
- To understand the knowledge in matplotlib.

UNIT I (9 Hrs)

INTRODUCTION: Need for data science, benefits and uses, facets of data, data science process, setting their search goal, retrieving data, cleansing, integrating, and transforming data, exploratory data analysis, build the models, presenting and building applications.

UNIT II (9 Hrs)

DESCRIBING DATA I: Frequency distributions, Outliers, relative frequency distributions, cumulative frequency distributions, frequency distributions for nominal data, interpreting distributions, graphs, averages, mode, median, mean, averages for qualitative and ranked data, describing variability, range, variance, standard deviation, degrees of freedom, interquartile range, variability for qualitative and ranked data.

UNIT III (9 Hrs)

PYTHON FOR DATA HANDLING: Basics of Numpy arrays, aggregations, computations on arrays, comparisons, masks, Boolean logic, fancy indexing, structured arrays, Data manipulation with Pandas, data indexing and selection, operating on data, missing data, hierarchical indexing, combining datasets, aggregation and grouping, pivot tables.

UNIT IV (9 Hrs)

DESCRIBING DATA II: Normal distributions, z scores, normal curve problems, finding proportions, finding scores,more about z scores, correlation, scatter plots, correlation coefficient for quantitative data, computational formula for correlation coefficient. Regression: regression line, least squares regression line, standard error of estimate, interpre- tation of r2, Multiple regression equations, regression toward the mean.

UNIT V (9 Hrs)

PYTHON FOR DATA VISUALIZATION: Visualization with matplotlib, line plots, scatter plots, visualizing errors – density and contour plots – histograms, beginnings, and density – three-dimensional plotting – geographic data – data analysis using state models and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh.

Text Books:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (First two chapters for Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", 11th Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Chapters 2– 4 for Units IV and V)

References:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

ONLINE/ NPTEL Courses:

1. Data Science for Engineers : https://nptel.ac.in/courses/106106179

ADOE002 R PROGRAMMING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in Statistics.

Course Objectives:

- The students can learn R for statistical programming, computation, graphics, and modeling.

Course Outcomes:

At the end of this course, a student should be able to:

- Demonstration and implementation of basic R programming framework and data structures
- Explain critical R programming language concepts such as control structures and recursion
- Applying mathematical and statistical operations data structures in R
- Examine data sets to create testable hypotheses and identify appropriate statistical tests
- Make use of appropriate statistical tests using R and Create and edit visualizations with Regression models

UNIT I (9 Hrs)

Introduction: How to run R, R Sessions, and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT II (9 Hrs)

R Programming Structures: Control Statements, Loops, Looping Over Nonvector Sets-If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return, Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation, Extended Extended Example: A Binary Search Tree.

UNIT III (9 Hrs)

Math and Simulation in R: Math Function, Extended Example Calculating Probability - Cumulative Sums and Products Minima and Maxima - Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product, Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT IV (9 Hrs)

Graphics using R: Creating Graphs, The Workhorse of R Base Graphics, the plot() Function –Customizing Graphs, Saving Graphs to Files.

UNIT V (9 Hrs)

Probability Distributions: Normal Distribution, Binomial Distribution, Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, ANOVA. Linear Models - Simple Linear Regression, Multiple Regression Generalized Linear Models, Logistic Regression, Poisson Regression, other Generalized Linear Models, Survival Analysis, Nonlinear Models, Splines-Decision, Random Forests.

TEXT BOOKS:

1. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", 1st Edition, Kindle, 2011.
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", 2nd Edition, Pearson Education, 2021.

REFERENCES:

1. Dr. Rob Kabacoff, "R in Action: Data Analysis and Graphics with R", 2nd Edition, Manning, 2015.
2. y JD Long, Paul Teetor, "R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics", 2nd Edition, Kindle Edition, 2019.

ONLINE/ NPTEL Courses:

1. Foundations of R Software : https://onlinecourses.nptel.ac.in/noc23 ma96/preview
2. Introduction to R Software : https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-ma75/

ADOE003 PYTHON FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Objectives:

- To provide learners with an insight into Python programming in a scientific computation context and develop Programming skills to solve engineering problems.
- To develop web applications, Machine Learning, and Artificial Intelligence-based applications and tools, Data Science, and Data Visualization applications.

Course Outcomes:

- To write, test, and debug Python programs.
- To illustrate uses of conditional (if, if-else, if-elif-else, and switch-case) and iterative (while and for) statements in Python programs.
- To develop programs by utilizing the modules Lists, Tuples, Sets, and Dictionaries in Python.
- To implement Object-oriented programs with exception handling.
- To analyze, Interpret, and Visualize data according to the target application.

UNIT I (9 Hrs)

BASICS OF PYTHON: Getting Started with Python Programming - Running code in the interactive shell, Editing, Saving, and Running a script. Using editors - IDLE, Jupyter. Basic coding skills - Working with data types, Numeric data types and Character sets, Keywords, Variables and Assignment statements, Operators, Expressions, Working numeric data, Type conversions, Comments in the program, Input Processing, and Output, Formatting output. How Python works. Detecting and correcting syntax errors. Using built-in functions and modules in the math module.Control statements - Selection structure - if-else, if-elif-else. Iteration structure - for, while. Testing the control statements. Lazy evaluation.

UNIT II (9 Hrs)

FUNCTIONS AND PYTHON DATA STRUCTURES: Functions - Hiding redundancy and complexity, Arguments and return values, Variable scopes, and parameter passing, Named arguments, Main function, Working with recursion, Lambda functions. Strings - String function. Lists - Basic list Operations and functions, List of lists, Slicing, Searching and sorting lists, and List comprehension. Work with tuples. Sets. Dictionaries -Dictionary functions, dictionary literals, adding and removing keys, accessing and replacing values, traversing dictionaries, reverse lookup.

UNIT III (9 Hrs)

OBJECT ORIENTED PROGRAMMING: Design with classes,Objects and Classes, Methods, Instance Variables, Constructor, Accessors and Mutators. Structuring classes with Inheritance and Polymorphism, Abstract Classes, Exceptions Handle a single exception, Handle multiple exceptions.

UNIT IV (9 Hrs)

VISUALIZATION AND FILE HANDLING: Plotting - An Interactive Session with PyPlot, Basic Plotting, Logarithmic Plots, More AdvancedGraphical Output, Plots with multiple axes, Mathematics and Greek symbols, The Structure of matplotlib, Contour and Vector Field Plots. File Processing - The os and sys modules, Introduction to file I/O, Reading and writing text files, Working with CSV files.

UNIT V (9 Hrs)

SCIENTIFIC COMPUTING: Numerical Routines. SciPy and NumPy - Basics, Creating arrays, Arithmetic, Slicing, Matrix Operations, Special Functions, Random Numbers, Linear Algebra, Solving Nonlinear Equations, Numerical Integration, Solving ODEs. Data Manipulation and Analysis – Pandas: Reading Data from Files Using Pandas, Data Structures: Series and Data Frame, Extracting Information from a Data Frame, Grouping, and Aggregation.

TEXT BOOKS:

1. Kenneth A Lambert., "Fundamentals of Python: First Programs", 2nd Edition, Cengage Publishing, 2016.
2. David J. Pine, "Introduction to Python for Science and Engineering", 1st Edition, CRC Press, 2021.

ONLINE/ NPTEL Courses:

1. The Joy of Computing using Python : https://onlinecourses.nptel.ac.in/noc19_cs41/preview
2. Python for Data Science :https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-ma75/

REFERENCES:

1. Wes McKinney, "Python for Data Analysis", 2nd Edition, O'Reilly, 2017.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Schroff, 2016.

ADOE004 PRINCIPLES OF ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Programming Concepts.

Course Objectives:

- To Understand the various characteristics of a problem-solving agent, Learn about the different strategies involved in problem-solving and Learn about solving problems with various constraints.
- To apply AI to various applications like expert systems, etc., Understand the different models of learning

Course Outcomes:

- To have basic knowledge representation, problem-solving, and learning methods of artificial intelligence
- To provide the apt agent strategy to solve a given problem
- To represent a problem using first-order and predicate logic
- To design applications like expert systems and chat-bot
- To Suggest supervised, unsupervised, or semi-supervised learning algorithms for any given problem.

UNIT I (9 Hrs)

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND PROBLEM-SOLVING AGENT: Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of the environment, the structure of agents, goal-based agents, utility-based agents, and learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.

UNIT II (9 Hrs)

SEARCH TECHNIQUES: Problem-solving agents, searching for solutions; uniform search strategies: breadth-first search, depth-first search, depth-limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

UNIT III (9 Hrs)

CONSTRAINT SATISFACTION PROBLEMS AND GAME THEORY: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT IV (9 Hrs)

KNOWLEDGE & REASONING: STATISTICAL REASONING: Probability and Bays' Theorem, Certainty Fac- tors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge represen- tation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.

UNIT V (9 Hrs)

INTRODUCTION TO MACHINE LEARNING: Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks, and deep learning.

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, 3rd Edition, 2015.
2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998.

REFERENCES:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd Edition,2017.
2. Patterson, "Introduction to Artificial Intelligence & Expert Systems", Pearson, 1st Edition, 2015.
3. Saroj Kaushik, "Logic & Prolog Programming", New Age International, 1st Edition, 2002.
4. Joseph C. Giarratano, Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2007.

ONLINE/ NPTEL Courses:

1. An Introduction to Artificial Intelligence : https://onlinecourses.nptel.ac.in/noc22 cs56/preview
2. Fundamentals Of Artificial Intelligence :https://onlinecourses.nptel.ac.in/noc23 ge40/preview

ADOE005 SOCIAL MEDIA ANALYTICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge of using software tools.

Course Objectives:

- To build Social Media and opportunities that exist today to leverage the power of the web and social media.

Course Outcomes:

- To obtain basic knowledge about Marketing analysis.
- To understand the history and evolution of the social media community.
- To get an idea of the emergence of social media.
- To be familiar with Web analytics.
- To gain knowledge about search engines and online security.

UNIT I (9 Hrs)

MARKETING ANALYTICS : Marketing Budget and Marketing Performance Measure, Marketing Geographical Mapping, Data Exploration, Market Basket Analysis.

UNIT II (9 Hrs)

COMMUNITY BUILDING AND MANAGEMENT: History and Evolution of Social Understanding Science of Social Media, Goals for using Social Media, Social Media Audience and Influencers, Digital PR, Promoting Social Media Pages Linking Social Media Accounts, The Viral Impact of Social Media.

UNIT III (9 Hrs)

SOCIAL MEDIA POLICIES AND MEASUREMENTS: Social Media Policies, Etiquette, Privacy, Ethical problems posed by emerging social media technologies, The Basics of Tracking Social Media.

UNIT IV (9 Hrs)

WEB ANALYTICS: Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT V (9 Hrs)

SEARCH ANALYTICS: Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, and data visualization.

TEXT BOOKS:

1. K.M.Shrivastava, "Social Media in Business and Governance", 1st Edition, Sterling Publishers Private Limited, 2013.

REFERENCES:

1. Christian Fuchs, "Social Media a critical introduction", 1st Edition, SAGE Publications Ltd, 2014.
2. Bittu Kumar, "Social Networking", 1st Edition, V&S Publishers, 2013.
3. Avinash Kaushik, "Web Analytics - An Hour a Day", 1st Edition, Wiley Publishing, 2007.
4. Ric T. Peterson, "Web Analytics Demystified", 1st Edition, Celilo Group Media and Cafe´ Press 2004.
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