

B.Sc. COMPUTER SCIENCE (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)

CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum and Syllabus

Regular (2021 – 2022)



DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF ARTS, SCIENCE AND HUMANITIES

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

(Established Under Section 3 of UGC Act, 1956)

Eachanari (Post), Coimbatore – 641 021.

Tamilnadu, India

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KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

FACULTY OF ARTS, SCIENCE AND HUMANITIES UNDER – GRADUATE PROGRAMMES (REGULAR PROGRAMME)

REGULATIONS (2021)

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FACULTY OF ARTS, SCIENCE AND HUMANITIES

UNDER-GRADUATE PROGRAMMES

REGULAR MODE

REGULATIONS - 2021

The following Regulations are effective from the academic year 2021-2022 and are applicable to candidates admitted to Under Graduate Degree (UG) programmes in the Faculty of Arts, Science, and Humanities, Karpagam Academy of Higher Education (KAHE) from the academic year 2021-2022 onwards.

1 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

1.1 U.G. Programmes Offered

A candidate may undergo a programme in any one of the under graduate programme approved by the KAHE as given below.

S. No.	DEGREE	DISCIPLINE
1	B. Sc.	Biochemistry
2	B. Sc.	Biotechnology
3	B. Sc.	Computer Science
4	B.Sc.	Mathematics
5	B.Sc.	Physics
6	B. Sc.	Chemistry
7	B. Sc.	Microbiology
8	B. Sc.	Information Technology
9	B. Sc.	Computer Technology
10	B.Sc.	Computer Science (Cognitive Systems)
11	B.Sc.	Computer Science (Artificial Intelligence and Data Science)
12	BCA	Computer Application
13	B.Sc.	Applied Science (Material Science)
14	B.Sc.	Applied Science (Foundry Science)
15	B. Com.	Commerce
16	B.Com (CA)	Commerce with Computer Applications
17	B. Com. (PA)	Commerce with Professional Accounting
18	B. Com. (BPS)	Commerce with Business Process Services

19	B.B.A.	Business Administration
20	B. Com	Financial Analytics
21	B. Com	International Accounting and Finance

1.2 Mode of Study

Full-Time

All programs are offered under Full-Time Regular mode. Candidates admitted under '**Full-Time**' should be present in the KAHE during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

1.3 Admission Requirements (Eligibility)

A candidate for admission to the first year of the UG Degree programme shall be required to have passed the Higher Secondary Examination (10 + 2) [Academic or Vocational] prescribed by the Government of Tamil Nadu Board or any similar examination of any other Board accepted by the KAHE as equivalent thereto.(Annexure I)

2. DURATION OF THE PROGRAMMES

2.1 The minimum and maximum period for the completion of the U.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
B.Sc., B.Com, BCA, BBA	6	12

2.2 Each semester normally consists of 90 working days or 450 Instructional hours of study. Examination shall be conducted at the end of every semester for the respective courses.

3. CHOICE BASED CREDIT SYSTEM

3.1. All programmes are offered under Choice Based Credit System with a total credit of 140 for UG Programmes.

3.2. Credits

Credit means the weightage given to each course by the experts of the Board of Studies concerned. Total credits 140 as per UGC Guidelines for the UG programme (Three Years).

4. STRUCTURE OF THE PROGRAMME

4.1 Tamil or any one of the Indian / Foreign Languages viz, Malayalam,

Hindi, Sanskrit, French are offered as an additional course for Arts & Science Programmes. Four credits are awarded for each course and the examinations will be conducted at the end of each semester.

- 4.2. Core Course, Discipline Specific Elective, Generic Elective, Skill Enhancement Course, Project, Ability Enhancement Course are part of curricular structure.

4.2.1. Core Course

Core course consists of theory and practical for Department domains for which examinations shall be conducted at the end of each semester. The students have to study 22 Core Courses compulsorily. Students have to earn 70 Credits in Core Course.

4.2.2. Discipline Specific Electives (DSE)

DSE is offered in the fifth and sixth semesters of third year. The examination shall be conducted at the end of each semester. Final year students (V and VI Semesters) will have to choose the elective courses in V semester and VI Semester from the list of elective courses given in the curriculum, in addition to the project work. Students have to earn 26 Credits in Discipline Specific Electives.

4.2.3. Generic Elective

Generic elective is an elective course chosen generally from an unrelated discipline/subject, with an intention to provide exposure in other areas of interest also to students.

The students have to choose two Generic Electives- one each in the First year (3 or 4 courses) and second year (3 or 4 courses) of the programme from the list of elective courses given in the curriculum.

Note: A particular elective course will be offered only if at least one third of the students in a class choose that course. If less, the elective selected has to be studied as a self-study course only. Students have to earn 19 Credits in Generic Elective and 13 Credits in Allied Courses.

4.2.4. Skill Enhancement Courses

Skill Enhancement Courses are offered in the third and fourth semesters of second year programme and in the fifth and sixth semesters of the third year programme. Second year students (III and IV Semesters) will have to choose atleast one elective course each in both III and IV Semesters from the list of elective courses given in the curriculum. Similarly final year students (V and VI Semesters) will have to choose

at least one elective course each in both V and VI Semesters from the list of elective courses given in the curriculum. The examination shall be conducted at the end of each semester. Students have to earn 12 Credits in Skill Enhancement Courses.

Note: A particular elective course will be offered only if at least one third of the students in a class choose that course. If less, the elective selected has to be studied as a self-study course only.

4.2.5. Project Work

The project work shall start at the beginning of sixth semester and the Project Report has to be submitted at the end of the sixth semester. The project may be an individual or group task. The Head of Department concerned shall assign a project supervisor who in turn shall monitor the project work of the student(s). A project/ dissertation work may be given *in lieu* of a discipline-specific elective paper. Maximum number of students per project batch is 2.

4.2.6. Ability Enhancement Course

Ability Enhancement Course-1

The course (English I & II for Science Programmes / Communicative English I & II for Arts Programmes) shall be offered during the first and second semester for which examinations shall be conducted at the end of the semester. Four credits are awarded for each course and the examinations will be conducted at the end of each semester.

Ability Enhancement Compulsory Course-2

Students shall study the course Environmental Studies in the First / Second Semester for which examinations shall be conducted at the end of the semester.

4.2.7. Internship

The student shall undergo 15 days internship in the end of II and IV semester.

5.0 Value Added Courses

Courses of varying durations but not less than 30 hours which are optional and offered outside the curriculum that add value and help the students for getting placement. Students of all programmes are eligible to enroll for the value-added courses. The student can choose one Value-added course per semester from the list of Value-added courses available in

KAHE. The examinations shall be conducted at the end of the value added course at the Department level and the student has to secure a minimum of 50% of marks to get a pass. The certificate for the value added course for the passed students shall be issued duly signed by the HOD and Dean of the Faculty concerned.

6.0 Online Course

Student shall study at least one online course from SWAYAM / NPTEL / MOOC in any one of the first five semesters for which examination shall be conducted at the end of the course by the respective external agencies if any. The student can register to the courses which are approved by the Department. The student shall produce a Pass Certificate from the respective agencies before the end of the fifth semester. The credit(s) earned by the students will be considered as additional credit(s) over and above the credits minimum required to earn a particular degree.

7.0 Extension Activities

Every student is encouraged to participate in at least any one of the following Extension activities:

- NSS
- NCC
- Sports / Mass drill
- YRC
- Club activities
- Other Co-curricular and Extra curricular activities

The student's performance shall be examined by the staff in-charge of Extension Activities along with the faculty mentor and the Head of the respective department on the following parameters.

- 75 % weightage for active participation in Extension Activities in / out of the KAHE.
- 25 % weightage for Exemplary Awards / Honours / Prizes secured.

8.0 Marks for Co-curricular and Extra-curricular shall be sent to the CoE before the commencement of the Sixth End Semester Examinations.

The above activities shall be conducted outside the regular working hours of the KAHE.

5. MEDIUM OF INSTRUCTION

The medium of instruction and examinations for the courses under Language I – Tamil / Hindi / Malayalam / French / Sanskrit shall be in the language concerned. For all other courses, the medium of instruction and examination should be in English.

6. MAXIMUM MARKS

Each of the theory and practical courses shall carry a maximum of 100 marks. Out of which 40 marks is awarded for Continuous Internal Assessment (CIA) and 60 marks for End Semester Examinations (ESE).

Evaluation: Evaluation in the courses comprises two parts, one is the Continuous Internal Assessment (CIA) and the other one is the End Semester Examination (ESE).

7. REQUIREMENTS TO APPEAR FOR THE END SEMESTER EXAMINATION

a. Ideally, every student is expected to attend all classes and should secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to attend at least 75% of the classes and the conduct of the candidate has been satisfactory during the course.

b. A candidate who has secured attendance between 65% and 74% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) or due to participation in University / District / State / National / International level sports or due to participation in Seminar / Conference / Workshop / Training Programme / Voluntary Service / Extension activities or similar programmes with prior permission from the Registrar shall be given exemption from prescribed minimum attendance requirements and shall be permitted to appear for the examination on the recommendation of the Head of Department concerned and Dean to condone the shortage of attendance. The Head of Department has to verify and certify the genuineness of the case before recommending to the Dean concerned. However, the candidate has to pay the prescribed condonation fee to the KAHE.

c. However, a candidate who has secured attendance less than 64% in the current semester due to any reason shall not be permitted to appear for the current semester examinations. But he/she will be permitted to appear for his/her supplementary examinations, if any and he/she has to re-do the same semester with the approval of the “Students’ Affairs Committee” and Registrar.

8. a. FACULTY MENTOR

To help students in planning their courses of study and for general advice on the academic programme, the HoD shall allot twenty students to a faculty who will function as faculty mentor throughout their period of study. Faculty mentor shall advise the students and monitor their behavior and academic performance. Problems if any shall be counseled by them periodically. The Faculty mentor is also responsible to inform the parents of their wards' progress. Faculty mentor shall display the cumulative attendance particulars of his / her ward students' periodically (once in 2 weeks) on the Notice Board to enable the students, know their attendance status and satisfy the **clause 7** of this regulation.

b. ONLINE COURSE COORDINATOR

To help students in planning their online courses and for general advice on online courses, the HOD shall nominate a coordinator for the online courses. The Online course coordinator shall identify the courses which students can select for their programme from the available online courses offered by the different agencies periodically and inform the same to the students. Further, the coordinators shall advise the students regarding the online courses and monitor their course.

9. CLASS COMMITTEE

Every class shall have a Class Committee consisting of the faculty members of the various courses of the class concerned, student representatives (Minimum 2 boys and 2 girls of various capabilities and Maximum of 6 members) and the concerned HoD / senior faculty as Chairperson. The objective of the Class Committee Meeting is all about the teaching – learning process. Class Committee shall be convened at least once in a month. The functions of the Class Committee shall include

- Analysing and solving problems experienced by students in the class room and in the laboratories.
- Analyzing the performance of the students of the class after each test and finding the ways and means to improve the performance.
- The Class Committee of a particular class of any department is normally constituted by the HoD / Chairperson of the Class Committee. However, if the students of different departments are mixed in a class, the Class Committee shall be constituted by the respective Dean of the Faculty.
- The class committee shall be constituted during the first week of each semester.

- The HoD / Chairperson of the Class committee is authorized to convene the meeting of the class committee.
- The respective Dean of the Faculty has the right to participate in any Class committee meeting.
- The Chairperson is required to prepare the minutes of every meeting, and submit the same to Dean concerned within two days after having convened the meeting. Serious issues if any shall be brought to the notice of the Registrar by the HoD / Chairperson immediately.

10. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or department shall have a “Course Committee” comprising all the teachers handling the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the respective Dean depending upon whether all the teachers handling the common course belong to a single department or to various other departments. The ‘Course Committee’ shall meet in order to arrive at a common scheme of evaluation for the tests to ensure a uniform evaluation of the tests. If feasible, the course committee shall prepare a common question paper for the Internal Assessment test(s). Course Committee Meeting is conducted once in a semester.

11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

11.1 Attendance and assessment: Every Faculty is required to maintain an **Attendance and Assessment Record (Log book)** which consists of attendance of students marked for each lecture / practical / project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the HoD once in a fortnight for checking the syllabus coverage and the records of test marks and attendance. The HoD shall sign with date after due verification. The same shall be submitted to respective Dean once in a month. After the completion of the semester the HoD should keep this record in safe custody for five years. Because records of attendance and assessment shall be submitted for Inspection as and when required by the KAHE / any other approved body.

11.2 Continuous Internal Assessment (CIA): The performance of students in each course will be continuously assessed by the respective faculty as per the guidelines given below:

Theory Courses

S. No.	Category	Maximum Marks
1.	Assignment*	5
2.	Attendance	5
3	Seminar	5
4.	Test – I (1 ½ units- Unit I and II)	8
5	Test – II (1 ½ units Unit II and III)	8
6	Test III (2 units Unit IV and V)	9
Continuous Internal Assessment : Total		40

* Two Assignments (Assignment I before Internal Test – I and assignment II before Internal Test – II).

Practical Courses

S. No.	Category	Maximum Marks
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Model Examination	20
5.	<i>Viva – voce</i> [Comprehensive]*	5
Continuous Internal Assessment: Total		40

* Includes *Viva- voce* conducted during the model Exam practical.

Every practical Exercise / Experiment shall be evaluated based on the conduct of Exercise/ Experiment and records maintained.

11.3 Pattern of Test Question Paper

Portions for Internal Test – I : First 1 ½ Units (Unit I and II)

Portions for Internal Test – II : Second 1 ½ Units (Unit II and III)

Portions for Internal Test – III : Two units (Unit IV and V)

Instruction	Remarks
Maximum Marks	50 marks
Duration	2 Hours
Part – A	Objective type (20x1=20)
Part - B	Short Answer Type (3 x 2 = 6)
Part - C	3 Eight mark questions 'either – or' choice (3 x 8 = 24 Marks)

11.4 Attendance

Marks Distribution for Attendance

S. No.	Attendance (%)	Maximum Marks
1	91 and above	5.0
2	81 - 90	4.0
3	76 - 80	3.0
4	Less than 75	0

12. ESE EXAMINATIONS

12.1 End Semester Examination (ESE): End Semester Examination will be held at the end of each semester for each course. The question paper is for a maximum 60 marks.

Pattern of ESE Question Paper:

Instruction	Remarks
Maximum Marks	60 marks for ESE.
Duration	3 hours ($\frac{1}{2}$ Hr for Part – A Online & 2 $\frac{1}{2}$ Hours for Part – B and C
Part - A	20 Questions of 1 mark each ($20 \times 1 = 20$ Marks) Question No. 1 to 20 Online Multiple Choice Questions
Part- B	5 Questions of 2 marks each ($5 \times 2 = 10$ Marks) Covering all the five units of the syllabus Question No. 21 to 25
Part- C	5 six marks Questions of 6 marks each ($5 \times 6 = 30$ Marks.) Question No. 26 to 30 will be ‘either-or’ type, covering all five units of the syllabus; i.e., Question No. 26: Unit - I, either 26 (a) or 26 (b), Question No. 27: Unit - II, either 27 (a) or 27 (b), Question No. 28: Unit - III, either 28 (a) or 28 (b), Question No. 29: Unit - IV, either 29 (a) or 29 (b), Question No. 30: Unit - V, either 30 (a) or 30 (b)

12.2 Practical: There shall be combined valuation. The pattern of distribution of marks shall be as given below.

Experiments	: 40 Marks
Record	: 10 Marks
<i>Viva-voce</i>	: 10 Marks
Total	: 60 Marks

Record Notebooks for Practical Examination

Candidate taking the practical examination should submit Bonafide Record Notebook prescribed for the practical examination; failing which the candidate will not be permitted to take the practical examination.

In case of failures in Practical Examination, the marks awarded for the Record at the time of first appearance of the Practical Examination shall remain the same at the subsequent appearance also by the candidate.

12.3. Evaluation of Project Work

12.3.1 The project work shall carry a maximum of 100 marks. (CIA - 40 and ESE – 60*)

*Combined valuation of Internal and External Examiners.

12.3.2 The project report prepared according to the approved guidelines and duly signed by the supervisor(s) shall be submitted to HoD.

12.3.3 The evaluation of the project will be based on the project report submitted and a *viva-voce* Examination by a team consisting of the supervisor, who will be the Internal Examiner and an External Examiner who shall be appointed by the COE. In case the guide is not available, the HoD shall act as an Internal Examiner for the same.

12.3.4 If a candidate fails to submit the project report on or before the specified date given by the Examination Section, the candidate is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

If a candidate fails in the respective viva-voce examinations he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. For this purpose the same Internal and External examiner shall evaluate the resubmitted report.

12.3.5 Copy of the approved project report after the successful completion of *viva-voce* examination shall be kept in the KAHE library.

13. PASSING REQUIREMENTS

13.1 Passing minimum: There is a passing minimum 20 marks out of 40 marks for CIA and the passing minimum is 30 marks out of 60 marks in ESE. The overall passing in each course is 50 out of 100 marks (Sum of the marks in CIA and ESE examination).

13.2 If a candidate fails to secure a pass in a particular course (either CIA or ESE or Both) as per clause 13.1, it is mandatory that the candidate has to register and reappear for the examination in that course during the subsequent semester when examination is conducted for the same till he / she receives a pass both in CIA and ESE (vide Clause 2.1).

- 13.3 Candidate failed in CIA will be permitted to improve CIA marks in the subsequent semesters by writing tests and by re-submitting Assignments.
- 13.4 CIA marks (if it is pass) obtained by the candidate in the first appearance shall be retained by the Office of the Controller of Examinations and considered valid for all subsequent attempts till the candidate secures a pass in ESE
- 13.5 Candidate who is absent in ESE in a Course / Practical / Project Work after having enrolled for the same shall be considered to have **failed** in that examination.

14. IMPROVEMENT OF MARKS IN THE COURSES ALREADY PASSED

Candidates desirous to improve the marks secured in a passed course in their first attempt shall reappear once (**only in ESE**) in the subsequent semester. **The improved marks shall be considered for classification but not for ranking.** If there is no improvement there shall be no change in the marks awarded earlier.

15. AWARD OF LETTER GRADES

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

Letter grade	Marks Range	Grade Point	Description
O	91 - 100	10	OUTSTANDING
A+	81- 90	9	EXCELLENT
A	71-80	8	VERY GOOD
B+	66- 70	7	GOOD
B	61 – 65	6	ABOVE AVERAGE
C	55 - 60	5	AVERAGE
D	50 - 54	4	PASS
RA	<50	-	REAPPEARANCE
AAA	-	-	ABSENT

16. GRADE SHEET

After the declaration of the results, Grade Sheets will be issued to each student which will contain the following details:

- i. The list of courses enrolled during the semester and the grade scored.
- ii. The Grade Point Average (**GPA**) for the semester and
- iii. The Cumulative Grade Point Average (**CGPA**) of all courses enrolled from first semester onwards.
- iv. Remark on Extension Activities (only in the 6th Semester Grade Sheet)

GPA of a Semester and CGPA of a programme will be calculated as follows.

$$\text{GPA of a Semester} = \frac{\text{Sum of the product of the GP by the corresponding credits of the courses offered in that Semester}}{\text{Sum of the credits of the courses of that Semester}}$$

$$\text{i.e. GPA of a Semester} = \frac{\sum_i C_i G P_i}{\sum_i C_i}$$

Sum of the product of the GPs by the corresponding credits of the courses offered for the entire programme

$$\text{CGPA of the entire programme} = \frac{\text{Sum of the product of the GPs by the corresponding credits of the courses offered for the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

$$\text{i.e. CGPA of the entire programme} = \frac{\sum_n \sum_i C_{ni} G P_{ni}}{\sum_n \sum_i C_{ni}}$$

where,

C_i is the credit fixed for the course 'i' in any semester
 $G P_i$ is the grade point obtained for the course 'i' in any semester
 'n' refers to the Semester in which such courses are credited.

Note: RA grade will be excluded for calculating **GPA** and **CGPA**.

17. REVALUATION

A candidate can apply for revaluation and re-totaling of his / her semester examination answer script (**theory courses only**), within 2 weeks from the date of declaration of results, on payment of a prescribed fee. For the same, the prescribed application has to be sent to the Controller of Examinations through the HoD. **A candidate can apply for revaluation of answer scripts not exceeding 5 courses at a time.** The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the HoD concerned. Revaluation is not permitted for supplementary theory courses.

18. TRANSPARENCY AND GRIEVANCE COMMITTEE

Revaluation and Re-totaling is allowed on representation (clause 17). Student may get the Xerox copy of the answer script on payment of prescribed fee, if he / she wishes. The student may represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HoD, the Dean of another Faculty nominated by the KAHE), The HoD of Department concerned, the faculty of the course and Dean from other discipline nominated by the KAHE and the CoE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External examiner will be final. The student has to pay the prescribed fee for the same.

19. ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the conferment of the Degree if he / she has

- Successfully completed all the components prescribed under Part I to Part IV in the CBCS pattern to earn the minimum required credits as specified in the curriculum corresponding to his / her programme within the stipulated period vide class 2.1.
- Not any disciplinary action pending against him / her.
- The award of the degree must be approved by the Board of Management.

20. CLASSIFICATION OF THE DEGREE AWARDED

20.1 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses in his / her first appearance, within the specified minimum number of semesters and securing a **CGPA not less than 8** shall be declared to have passed the examination in the **First Class with Distinction**.

20.2 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses within the specified maximum number of semesters (vide clause 2.1), securing a **CGPA not less than 6.5** shall be declared to have passed the examination in the **First Class**.

20.3 All other candidates (not covered in clauses 20.1 and 20.2) who qualify for the award of the degree (vide Clause 19) shall be declared to have passed the examination in the **Second Class**.

21. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

21.1 Candidate due to valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

21.2 Such withdrawal shall be permitted only once during the entire period of study of the degree programme.

21.3 Withdrawal of application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the HoD / Dean concerned and approved by the Registrar.

21.3.1 Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

21.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during **VI semester**.

21.5 Withdrawal from the End semester examination is **NOT** applicable to arrears courses of previous semesters.

21.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.

22. PROVISION FOR AUTHORISED BREAK OF STUDY

22.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission

may be granted based on the merits of the case provided he / she applies to the Registrar, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Department stating the reasons therefore and the probable date of rejoining the programme.

- 22.2 The candidate thus permitted to rejoin the Programme after the break shall be governed by the Curriculum and Regulations in force at the time of rejoining. Such candidates may have to do additional courses as per the Regulations in force at that period of time.
- 22.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. (Vide Clause 20). However, additional break of study granted will be counted for the purpose of classification.
- 22.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 2.1 irrespective of the period of break of study (vide clause 22.1) in order that he/she may be eligible for the award of the degree.
- 22.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Break of Study' or 'Withdrawal' (Clause 21 and 22) is not applicable for this case.

23. RANKING

A candidate who qualifies for the UG Degree programme passing all the Examinations in the first attempt, within the minimum period prescribed for the programme of study from Semester I through Semester VI to the programme shall be eligible for ranking. Such ranking will be confined to 10% of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

24. SUPPLEMENTARY EXAMINATION

Supplementary Examination will be conducted only for the final semester students within ten days from the date of publication of results for students who have failed in one theory course only. Such students shall apply with prescribed fee to the Controller of Examinations within the stipulated time.

25. DISCIPLINE

25.1. If a student indulges in malpractice in any of the Internal / External Examinations he / she shall be liable for punitive action as prescribed by the KAHE from time to time.

25.2. Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the KAHE. The erring students will be referred to the disciplinary committee constituted by the KAHE, to enquire into acts of indiscipline and recommend the disciplinary action to be taken.

26. REVISION OF REGULATION AND CURRICULUM

Karpagam Academy of Higher Education may from time to time revise, amend or change the Regulations, Scheme of Examinations and syllabi if found necessary.

Annexure I

S.No	Programme	Subject	Eligibility
1	B. Sc.	Biochemistry	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Biology or Botany or Zoology or chemistry as subjects at the Higher Secondary level.
2	B. Sc.	Biotechnology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Biology or Botany or Zoology as subjects at the Higher Secondary level.
3	B. Sc.	Computer Science	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3-year diploma after 10 th or 10+2 pattern of education taking computer science/maths as one of the subject.
4	B.Sc.	Mathematics	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Mathematics /statistics as subjects at the Higher Secondary level. (OR) 3 year diploma after 10 th or 10+2 pattern of education taking maths as one of the subject.
5	B.Sc.	Physics	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10 th or 10+2 pattern of education taking physics as one of the subject.
6	B. Sc.	Chemistry	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Chemistry as one of the subjects at the Higher Secondary level.
7	B. Sc.	Microbiology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Biology or Botany or Zoology as subjects at the Higher Secondary level.

S.No	Programme	Subject	Eligibility
8	B. Sc.	Information Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10 th or 10+2 pattern of education taking computer science/maths as one of the subject.
9	B. Sc.	Computer Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10 th or 10+2 pattern of education taking computer science/maths as one of the subject.
10	B.Sc.	Computer Science(Cognitive Systems)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3-year diploma after 10 th or 10+2 pattern of education taking computer science/maths as one of the subject.
11	B.Sc.	Computer Science (Artificial Intelligence and Data Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10 th or 10+2 pattern of education taking computer science/maths as one of the subject.
12	BCA	Computer Application	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
13	B.Sc.	Applied Science (Material Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10 th or 10+2 pattern of education taking the respective subject as one of the subject.
14	B.Sc.	Applied Science (Foundary Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or

S.No	Programme	Subject	Eligibility
			Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10 th or 10+2 pattern of education taking the respective subject as one of the subject.
15	B. Com.	Commerce	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
16	B.Com (CA)	Commerce with Computer Applications	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern.
17	B. Com. (PA)	Commerce with Professional Accounting	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
18	B. Com. (BPS)	Commerce with Business Process Services	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
19	B.B.A.	Business Administration	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
20	B. Com	Financial Analytics	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
21	B. Com	International Accounting and Finance	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .

PROGRAM OUTCOMES: The program must enable students to attain by the time of graduation

- a) An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline
- b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
- c) An ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs.
- d) An ability to function effectively on teams to accomplish a common goal
- e) An understanding of professional, ethical, legal, security and social issues and responsibilities
- f) An ability to communicate effectively with a range of audiences
- g) An ability to use current techniques, skills and tools necessary for computing practice
- h) An ability to use and apply current technical concepts and practices in the core information technologies of human computer interaction, information management, programming, networking and web systems and technologies
- i) An ability to effectively integrate IT-based solutions into the user environment
- j) An understanding of best practices and standards and their application

PROGRAM SPECIFIC OUTCOME (PSOs)

- k) Understand analyze and develop computer programs in the areas related to Database systems and Big data Analytics, cloud computing, soft computing, IoT, Image processing, Green computing, web designing, mobile computing and networking for efficient design of computer based system of varying complexity.
- l) Apply standard software Engineering practices and strategies in software project development using open-source programming environment to deliver a quality for business success.
- m) Be acquainted with the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems.
- n) An ability to produce cost effective, quality and maintainable software products and solutions (services) meeting the global standards and requirements with the knowledge acquired and using the emerging techniques, tools and software engineering methodologies and principles and able to comprehend and write effective project reports in multidisciplinary environment in the context of changing technologies.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- PEO I : To be a working Information Technology (IT) professional with core competencies that can be used on multi-disciplinary projects
- PEO II : To understand the importance of relationship building within the IT industry
- PEO III : To understand the need for lifelong learning in the exploration and journey in IT
- PEO IV : To understand, evaluate and practice ethical behavior within the IT industry
- PEO V : To be cognizant of security issues and their impacts on industry

MAPPING of PEOs and POs

POs	a	b	C	d	e	f	F	h	i	J	k	l	m	n
PEO I	X	X	X				X	X	X				X	
PEO II				X	X	X								X
PEO III	X	X						X		X	X			
PEO IV			X	X	X				X			X		
PEO V					X					X		X		

DEPARTMENT OF COMPUTER SCIENCE
FACULTY OF ARTS, SCIENCE AND HUMANITIES
UG PROGRAM (CBCS) – B.Sc. Computer Science (Artificial Intelligence and Data Science)
(2021–2022 Batch and onwards)

Course code	Name of the course	Objectives and out comes		Instruction hours / week			Credit(s)	Maximum Marks			Category	Page No
		PEOs	POs	L	T	P		CIA	ESE	Total		
SEMESTER – I												
21LSU101	Language – I	IV	d,e	4	-	-	4	40	60	100	AEC	1
21ENU101	English-I	I	a,b,c	4	-	-	4	40	60	100	AEC	4
21ADU101	Object Oriented Programming using C++	I	b,c,g	4	-	-	4	40	60	100	Core	5
21ADU102	Web Designing	III	h,j	4	-	-	4	40	60	100	Core	7
21ADU103	Numerical Methods	I	a,b,c,g	4	-		4	40	60	100	Allied	9
21ADU111	Object Oriented Programming using C++ - Practical	I	a,c,g	-	-	4	2	40	60	100	Core	11
21ADU112	Web Designing - Practical	I	a,c,g	-	-	3	2	40	60	100	Core	13
21ADU113	Numerical Methods - Practical	I	a,c,g	-	-	3	2	40	60	100	Allied	15
Semester Total				20	-	10	26	320	480	800		
SEMESTER – II												
21LSU201	Language – II	IV	d,e	4	-	-	4	40	60	100	AEC	16
21ENU201	English –II	II	d,f	4	-	-	4	40	60	100	AEC	19
21ADU201	Programming in JAVA	I	c,h,i	6	-	-	6	40	60	100	Core	20
21ADU202	Probability and Statistics	IV	e,i	5	-	-	5	40	60	100	Allied	22
21ADU211	Programming in JAVA - Practical	IV	e,i	-	-	4	2	40	60	100	Core	24
21ADU212	Probability and Statistics-Practical	I	a,c,h,i	-	-	4	2	40	60	100	Allied	26
21AEC201	Environmental Studies	IV	d,e	3	-	-	3	40	60	100	AEC	28
Semester Total				22	-	8	26	280	420	700		
SEMESTER – III												
21ADU301	Data Structures	I	a,b,g,h	4	-	-	4	40	60	100	Core	-

21ADU302	Fundamentals of Data Science	III	a,b,h,k	4	-	-	4	40	60	100	Core	-
21ADU303	Operating Systems	III	a,b,h,k	4			4	40	60	100	Core	-
21ADU304A	Programming in Python	I	a,b,c,m	3	-	-	3	40	60	100	SEC	-
21ADU304B	PHP Programming	I	a,b,g,h									
21ADU311	Data Structures - Practical	III	a,b,h,k	-	-	4	2	40	60	100	Core	-
21ADU312	Fundamentals of Data Science using R - Practical	III	a,b,j,k	-	-	4	2	40	60	100	Core	-
21ADU313	Operating Systems - Practical	III	a,b,j,k	-	-	4	2	40	60	100	Core	-
21ADU314A	Programming in Python - Practical	I	a,b,c,m	-	-	3	1	40	60	100	SEC	-
21ADU314B	PHP Programming - Practical	I	a,b,g,h									
Semester Total				15	-	15	22	320	480	800		
SEMESTER – IV												
21ADU401	Data Communication and Networks	III	a,b	4	-	-	4	40	60	100	Core	-
21ADU402	Relational Database Management Systems	III	a,b,j,k	4	-	-	4	40	60	100	Core	-
21ADU403	Fundamentals of Artificial Intelligence	I	a,b,c,m	4	-	-	4	40	60	100	Core	-
21ADU404A	Cloud Computing Techniques	III	a,b,h,j,k	3	-	-	3	40	60	100	SEC	-
21ADU404B	Mobile and Pervasive Computing	III	a,b,h,j,k									
21ADU411	Data Communication and Networks - Practical	I	a,b,c	-	-	4	2	40	60	100	Core	-
21ADU412	Relational Database Management Systems – Practical	IV	c,d,e,l	-	-	4	2	40	60	100	Core	-
21ADU413	Fundamentals of Artificial Intelligence-Practical	IV	c,d,e,l	-	-	4	2	40	60	100	Core	-
21ADU414A	Cloud Computing Techniques - Practical	I	a,b,g	-	-	3	1	40	60	100	SEC	-
21ADU414B	Mobile and Pervasive Computing - Practical	I	a,b,g									

Semester Total				15	-	15	22	320	480	800		
SEMESTER –V												
21ADU501	Advanced Data Science	I	b,e,m	4	-	-	4	40	60	100	Core	-
21ADU502A	Data Visualization	III	a,b,h,j	4	-		4	40	60	100	DSE	-
21ADU502B	Data Mining	IV	c,d,e,l									
21ADU503A	Machine Learning	III	a,b,h	4	-	-	4	40	60	100	DSE	-
21ADU503B	Natural Language Processing	III	a,b,h									
21ADU504A	Software Engineering and Testing	IV	c,e,i,l	3	-	-	3	40	60	100	DSE	-
21ADU504B	Software Project Management	III	b,h,j,k									
21ADU511	Advanced Data Science - Practical	I	b,e,m	-	-	4	2	40	60	100	Core	-
21ADU512A	Data Visualization using Tableau - Practical	III	a,b,h,j	-	-	4	2	40	60	100	DSE	-
21ADU512B	Data Mining- Practical	III	a,b,h,j									
21ADU513A	Machine Learning - Practical	III	a,b,h,j	-	-	4	2	40	60	100	DSE	-
21ADU513B	Natural Language Processing- Practical	III	a,b,h,j									
21ADU514A	Software Engineering & Testing - Practical	I	a,b,g,h	-	-	3	1	40	60	100	DSE	-
21ADU514B	Software Project Management - Practical	I	a,b,g									
Semester Total				15		15	22	320	480	800		
SEMESTER –VI												
21ADU601	Deep Learning	V	e,j,l	4	-	-	4	40	60	100	Core	-
21ADU602A	Artificial Intelligence for Cyber Security	I	a,d,g,m	4	-	-	4	40	60	100	DSE	-
21ADU602B	Cyber Forensics	I	a,d,g									
21ADU603A	Big Data Analytics	I	a,c,g	3	-	-	3	40	60	100	DSE	-
21ADU603B	Soft Computing in Data Science	III	a,b,h,j,k									
21ADU611	Deep Learning- Practical	IV	c,d,e	-	-	4	2	40	60	100	Core	-

21ADU612A	Artificial Intelligence for Cyber Security - Practical	I	a,d,g,m	-	-	4	2	40	60	100	DSE	-
21ADU612B	Cyber Forensics - Practical	I	a,d,g	-	-	4	2	40	60	100	DSE	-
21ADU613A	Big Data Analytics - Practical	I	a,c,g,m	-	-	3	1	40	60	100	DSE	-
21ADU613B	Soft Computing in Data Science - Practical	III	a,b,h,j,k	-	-	3	1	40	60	100	DSE	-
21ADU691	Project	II	d,e,f	8	-	-	6	40	60	100		-
ECA / NCC / NSS / Sports / General interest etc		Good										
Semester Total				19	-	11	22	280	420	700		
Grand Total				106	-	74	140	1840	2760	4600		

Ability Enhancement Courses (AEC)		
Semester	Course Code	Name of the Course
I	21LSU101	Language –I
	21ENU101	English– I
II	21LSU201	Language –II
	21ENU201	English-II
	21AEC201	Environmental Studies

Generic Elective Courses (GE) /Allied Courses		
Semester	Course Code	Name of the Course
I	21ADU103	Numerical Methods
	21ADU113	Numerical Methods - Practical
II	21ADU202	Probability and Statistics
	21ADU212	Probability and Statistics - Practical

Core Courses (CC)		
Semester	Course Code	Name of the Course
I	21ADU101	Object Oriented Programming using C++
	21ADU102	Web Designing
	21ADU111	Object Oriented Programming using C++ - Practical
	21ADU112	Web Designing - Practical
II	21ADU201	Programming in JAVA
	21ADU211	Programming in JAVA - Practical

III	21ADU301	Data Structures
	21ADU302	Fundamentals of Data Science
	21ADU303	Operating Systems
	21ADU311	Data Structures - Practical
	21ADU312	Fundamentals of Data Science using R- Practical
	21ADU313	Operating Systems - Practical
IV	21ADU401	Data Communication and Networks
	21ADU402	Relational Database Management Systems
	21ADU403	Fundamentals of Artificial Intelligence
	21ADU411	Data Communication and Networks - Practical
	21ADU412	Relational Database Management Systems – Practical
	21ADU413	Fundamentals of Artificial Intelligence-Practical
V	21ADU501	Advanced Data Science
	21ADU511	Advanced Data Science - Practical
VI	21ADU601	Deep Learning
	21ADU611	Deep Learning - Practical
	21ADU691	Project

Skill Enhancement Courses(SEC)		
Semester	Course Code	Name of the Course
III	21ADU304A	Programming in Python
	21ADU304B	PHP Programming
	21ADU314A	Programming in Python - Practical
	21ADU314B	PHP Programming - Practical
IV	21ADU404A	Cloud Computing Techniques

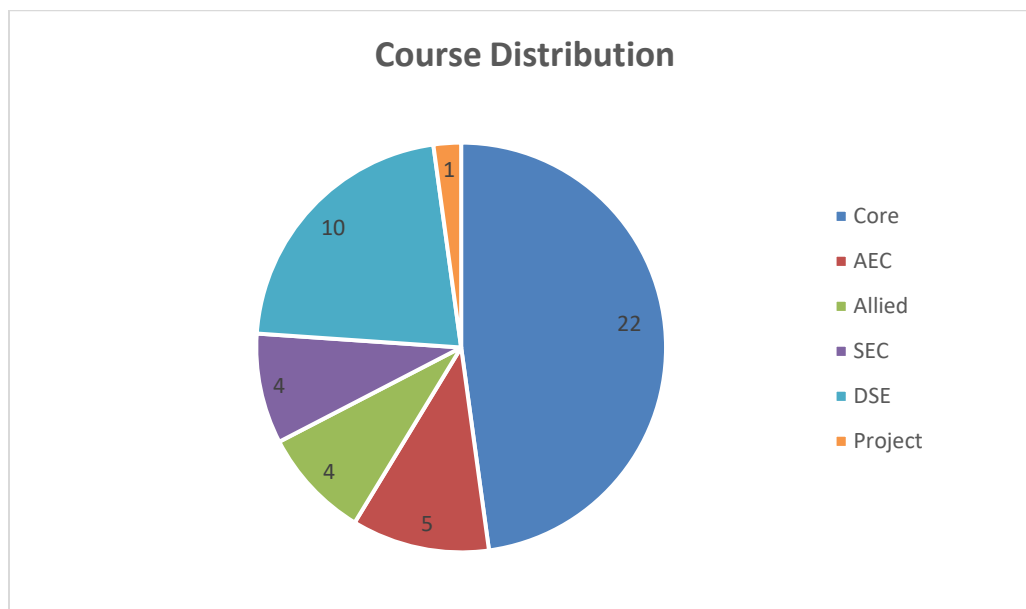
	21ADU404B	Mobile and Pervasive Computing
	21ADU414A	Cloud Computing Techniques - Practical
	21ADU414B	Mobile and Pervasive Computing - Practical

Discipline Specific Elective Courses (DSE)		
Semester	Course Code	Name of the Course
V	21ADU502A	Data Visualization
	21ADU502B	Data Mining
	21ADU503A	Machine Learning
	21ADU503B	Natural Language Processing
	21ADU504A	Software Engineering and Testing
	21ADU504B	Software Project Management
	21ADU512A	Data Visualization using Tableau- Practical
	21ADU512B	Data Mining- Practical
	21ADU513A	Machine Learning- Practical
	21ADU513B	Natural Language Processing- Practical
	21ADU514A	Software Engineering and Testing- Practical
	21ADU514B	Software Project Management- Practical
VI	21ADU602A	Artificial Intelligence for Cyber Security
	21ADU602B	Cyber Forensics
	21ADU603A	Big Data Analytics
	21ADU603B	Soft Computing in Data Science
	21ADU612A	Artificial Intelligence for Cyber Security - Practical
	21ADU612B	Cyber Forensics - Practical
	21ADU613A	Big Data Analytics - Practical

	21ADU613B	Soft Computing in Data Science - Practical
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Course Distribution Table:

Category	No. of Courses		Total
	Theory	Practical	
Core	11	11	22
AEC	5	0	5
Allied	2	2	4
SEC	2	2	4
DSE	5	5	10
Project	1	0	1
Total	26	20	46



21LSU101

Language – I

Semester – I
4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனை மேம்படுத்துதல்.
- ஆய்வு நோக்கை மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப் பயன் விளைவு

1. இந்திய குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற, 'தமிழ்இலக்கியவரலாறு' குறித்தமுழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத்தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின் வளர்ச்சித்துறையாகிய, 'அறிவியல்தமிழ்'; இணைய தமிழ் குறித்த பன்னோக்கு அணுகு முறையிலான ஆய்வுச் சிந்தனை மேம்பாடு.
4. வேலைவாய்ப்புக்குரிய சுயதிறன்மேம்பாட்டுடன், படைப்பாக்கத் திறன் மேம்பாடும் பெற்றிருத்தல் .
5. சமுதாயமற்றும்வாழ்வியல்மதிப்புகளைப்பேணுவதற்குக்கருவியாகஇலக்கியங்களைநாடுகின்றமனப்பான்மைவளர்ச்சி.
6. மொழிபெயப்புத்துறை சார்ந்த வேலைவாய்ப்புத் திறன் பெற்றிருத்தல்

அலகு – I : தமிழ் இலக்கிய வரலாறு- I (8மணிநேரம்)

முச்சங்க வரலாறு-சங்க இலக்கியத்தொகுப்பு-பாட்டும் தொகையும்-சங்கஇலக்கியச் சிறப்பியல்புகள்-சங்கம் மருவிய காலம்-பதினெண்கீழ்க்கணக்கு நூல்கள்-திருக்குறள்-நாலடியார்-நான்மணிக்கடிகை-பழமொழிநானூறு – பிற்கால அறஇலக்கியங்கள்-கொன்றைவேந்தன் – நீதிநூல்-காப்பியங்கள்-தமிழில் காப்பிய இலக்கணம்- தமிழில் பெருங்காப்பியங்களும் சிறு காப்பியங்களும்- இரட்டைக்காப்பியங்களாகச்சிலம்பும் மேகலையும்.

அலகு - II:சங்கஇலக்கியம்**(12 மணிநேரம்)****அ).எட்டுத்தொகை****நற்றிணை:**கொண்டல் மாமழை – குறிஞ்சி-தலைவன்கூற்று - 140**குறுந்தொகை:**வாரார் ஆயினும், வரினும் –முல்லை- தலைவி கூற்று-110**ஐங்குறுநூறு :**மருதம் –தோழி கூற்று-வேட்கைப்பத்து:வாழிஆதன் வாழி அவினி - 6**பதிற்றுப்பத்து:** சிதைந்தது மன்ற- 27**பரிபாடல்:**புறத்திரட்டு- மதுரை நகர்ச்சிறப்பு –

உலகம் ஒரு நிறையாத்தான்-7, மாயோன் கொப்பூழ்-8, செய்யாட்கு இழைத்த-9, கார்த்திகை காதில்-10, ஈவாரைக் கொண்டாடி-11.

கலித்தொகை:பாலைக்கலி-செவிலி – எறித்தரு கதிர்தாங்கி-9**அகநானூறு:**அன்னை அறியினும் அறிக-தோழி - நெய்தல் - 110**புறநானூறு :**யாதும் ஊரே யாவருங் கேளிர்-பொதுவியல்- 192**ஆ).பத்துப்பாட்டு:** நெடுநல்வாடை- கார்காலச் சிறப்பு : வையகம் பனிப்ப -1-70**அலகு - III: அறஇலக்கியம்****(10மணிநேரம்)**

1. திருவள்ளுவர்- திருக்குறள்- அதிகாரம் 67 – வினைத்திட்டம், அதிகாரம் 100 - பண்புடைமை

2. முன்றுறையரையனார் – பழமொழி நானூறு5 பாடல்கள்

உணற்கு இனிய 5, பரந்த திறலாரை 32, நெடியது காண்கிலாய் 46, இனியாரும் 153, உரைசான்ற 195.

3. ஔவையார் – கொன்றை வேந்தன் (1- 50 பாடல்கள்)

அன்னையும் பிதாவும் – புலையும் கொலையும் களவும் தவிர்

4. வேதநாயகம்பிள்ளை - நீதிநூல் – (அதிகாரம்-7-தாய்தந்தையரைப் போற்றுதல்-

தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள்)

சின்னவோர் பொருள், கடவுளை வருந்தி, எப்புவிகளும், வைத்தவர், ஈன்றவர்

அலகு - IV :காப்பிய இலக்கியம்**(10மணிநேரம்)****(அ). சிலப்பதிகாரம்(5 மணிநேரம்)****மங்கல வாழ்த்துப் பாடல்:** (21-29)- நாக நீள் நகரொடு-கண்ணகி என்பாண் மன்னோ . வழக்குரை காதை, (48-56) - நீர்வார் கண்ணை-புகா ரென்பதியே .**வஞ்சின மாலை:** (5-34) - வன்னிமரமும் – பிறந்த பதிப் பிறந்தேன்.

நடுகற் காதை: (207-234) - அருத்திற லரசர் - மன்னவ ரேறென்

வாழ்த்துக்காதை: (9) - என்னையிஃ தென்னே - மீவிசும்பிற் றோன்றுமால்.

(ஆ). மணிமேகலை

(5 மணிநேரம்)

பசியின் கொடுமை: பாத்திரம் பெற்ற காதை:

‘போதி நீழல்’ - ‘பெருகியதன்றோ’ , ‘ஆற்றுநர்க்களிப்போர்’ - ‘நல்லறம் கண்டனை’ (73-98).

சிறைக்கோட்டம் அறக்கோட்டமாக்கிய காதை: மாவண் கிள்ளிக்கு காவலன் உரைத்தவை: ‘பைஞ்சேறு மெழுகாப் பசும்பொன் மண்டபத்து - அறவோர்க் காக்கினன் அரசாள் வேந்தன்’ (116-163).

அலகு- V : அடிப்படை இலக்கணமும் பயன்பாட்டுத்தமிழும் - I

(8 மணிநேரம்)

அ). எழுத்து, சொல், பொருள் இலக்கணங்கள்

(4 மணிநேரம்)

1. முதல் மற்றும் சார்பெழுத்துகள்- பெயர், வினை, இடை, உரிச்சொல் முதலான அடிப்படை இலக்கண விளக்கப் பயிற்சிகள்
- 2). அகத்திணை மற்றும் புறத்திணை இலக்கணங்கள்

ஆ). கடிதப்பயிற்சி

(4 மணிநேரம்)

1. தன்விவரக் குறிப்புடன் வேலை வேண்டி விண்ணப்பம் எழுதுதல்
2. பல்கலைக்கழகப் பன்னாட்டுக்கருத்தரங்கச் செய்தியை நாளிதழில் வெளியிடவேண்டி நாளிதழின் பதிப்பாசிரியருக்குக் கடிதம்
3. கருத்தரங்கப் பங்கேற்புக்கு அனுமதிக் கடிதம்
4. பல்கலைக்கழக விழாவுக்குத் தலைமையேற்க வேண்டி, மாவட்ட ஆட்சியருக்கு விண்ணப்பம்
5. கல்விகடன் வேண்டி வங்கிமேலாளருக்கு விண்ணப்பம்
6. வசிப்பிடத்திற்கு அடிப்படை வசதி வேண்டி வட்டாட்சியருக்கு விண்ணப்பம்
7. தேசியவிருது பெற்ற நண்பனுக்குப் பாராட்டுக் கடிதம்
8. புத்தகங்கள் அனுப்பி உதவவேண்டி, பதிப்பகத்தாருக்கு விண்ணப்பம்

பாடநூல்: கற்பகச்சோலை - தமிழ்ஞ.

கற்பகம் உயர்கல்வி கலைக்கழகத்தமிழ்த்துறை வெளியீடு.

21ENU101**English - I****Semester – I
4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

Course Objectives

- To give basic knowledge on grammar.
- To train communication in real life situation.
- To be familiar with the four basic skills of English.
- To train students to acquire proficiency in English by reading different genres of literature and learning grammar.
- To provide aesthetic pleasure through literature.
- To develop the moral values of students.

Course Outcomes (COs)

1. Retrieve fundamentals of English language to construct error free sentences.
2. Develop the knowledge of interpersonal skills.
3. Establish and maintain social relationships.
4. Develop communication skills in business environment.
5. Refine communication competency through LSRW skills.
6. Improving intrapersonal skills through literary works.

Unit I- Grammar

Types of Sentences, Subject and Predicate, Parts of Speech, Tenses, Preposition and Articles

Unit II- Communication Exercise

Importance of Business Language- Words often Confused- Words often Misspelt- Common Errors in English-Charts and Pictorial Writing.

Unit III- Interpersonal Skills

Greetings & Introduction- Giving & Denying Permission- Telephone Etiquette- Oral Presentation – Plan, PowerPoint Presentation- Preparation of Speech- Audience psychology- Secrets of Good Delivery

Unit IV- LSRW Skills

Listening- Listening and its types, Basic Listening Lessons

Speaking- Basics of speaking, Regular English, Business English, Interview English

Reading- Reading and its purposes, Types of Reading, Reading Techniques

Writing- Types of Writing, Components of Writing, Language and Style with accordance to the contexts

Unit V- Literature

Prose: Let's Do What India Needs from Us -Dr.A.P.J. Abdul Kalam

Poem: A Prayer for My Daughter - W.B. Yeats

Short Story: Sparrows- K. Ahmad Abbas

Suggested Reading:

1. Haines Simon. (2015). Advanced Skills, A resource Book of Advanced- Level Skill Activities"
2. Hewings Martin.(2013). Advanced Grammar in Use, Cambridge University Press

21ADU101 Object Oriented Programming Using C++**Semester – I
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To understand how C++ improves C with object-oriented feature.
- To learn the syntax and semantics of classes in C++ programming language.
- To learn how to perform operator overloading and inheritance.
- To learn how to design C++ using pointers.
- To learn file handling in C++.
- To use the basic object-oriented design principles in computer problem solving.

Course Outcomes (COs)

Upon completion of this course the students will be able to :

1. Understand the difference between top-down and bottom-up approach.
2. Apply the concepts of object-oriented programming in constructor and destructor.
3. Understand how to apply the major object-oriented concepts to implement inheritance and polymorphism.
4. Apply pointer concepts in C++
5. Learn the basics of file handling mechanism that is essential for understanding the concepts in database management systems
6. Use the concepts of preprocessor directives and macros.

Unit I - Introduction to C and C++

History of C and C++, Overview of Procedural Programming and Object-Orientation Programming, Benefits of OOPs – Applications of OOPs, Using main () function.

Data Types, Variables, Constants, Operators and Basic I/O: Declaring, Defining and Initializing Variables, Compiling and Executing Simple Programs in C & C++, Scope of Variables, Input and Output Statements in C & C++, Using Named Constants, Keywords, Data Types, Casting of Data Types.

Expressions, Conditional Statements and Iterative Statements: Simple Expressions, Operators, Understanding Operators Precedence, Conditional Statements, Iterative Statements, use of break and continue in Loops, Using Nested Statements

Unit II - Classes and Objects

Classes and Objects: Specifying a class – Creating Objects – Accessing Class Members – Defining Member Functions – Static Data Members – Static Member Functions - Array of Objects – Utility of functions, Call by Value, Call by Reference - Friend Functions. Constructors and Destructors: - Constructors – Parameterized Constructors - Multiple Constructors in a Class – Constructors with Default Arguments - Copy Constructor - Dynamic Constructor – Destructors.

Unit III - Operator Overloading and Inheritance

Operator overloading: Defining operator overloading – overloading unary operators – overloading binary operators – overloading binary operators using friends – type conversions. Inheritance: - Inheritance – defining derived classes – single, multilevel, multiple, hierarchical inheritance- hybrid inheritance – virtual base classes – abstract classes.

Unit IV - Pointers and I/O Operations

Pointers: Pointers to objects – this pointer – pointers to derived classes – virtual functions- Pure Virtual Functions. Managing console I/O operations:- C++ streams – C++ stream classes – unformatted I/O operations – formatted console I/O operations – Managing output with manipulators.

Unit V - File Management

Files - Classes for file stream operations – Opening and Closing a file – sequential input and output operations – updating a file random access – Command Line Arguments. Templates and Exceptions: - Templates – class templates – function templates – member function templates – exception handling.

Suggested Readings

1. Antonio Mallia, Francesco Zoffoli.(2019). C++ Fundamentals, Packt Publishing, Ltd.
2. Joel Murach, Mary Delamater. (2018). C++ Programming, Mike Murach & Associates Inc.
3. Stefan Bjornander. (2016). C++ Windows Programming, Packt Publishing Ltd.
4. Richard L. Stegman, (2016). Focus on Object-oriented Programming with C++, 6th Edition, CreateSpace Independent Publishing Platform.
5. Bjarne Stroustrup. (2014). Programming - Principles and Practice using C++, 2nd Edition, Addison-Wesley
6. Harry, H. Chaudhary. (2014). Head First C++ Programming: The Definitive Beginner's Guide, First Create space Inc, O-D Publishing, LLC USA.
7. Debasish Jana. (2014). C++ And Object-Oriented Programming Paradigm, PHI Learning Pvt. Ltd

Websites

1. www.programmingsimplified.com
2. [www.programiz.com / cpp-programming](http://www.programiz.com/cpp-programming)
3. www.cplusplus.com
4. www.learncpp.com
5. www.udemy.com
6. <https://nptel.ac.in/courses/106101208/>

LMS

<http://172.16.13.33/course/view.php?id=599>

21ADU102**Web Designing****Semester – I
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice markup languages
- To understand the technologies used in Web Programming.
- To know the importance of object-oriented aspects of Scripting.
- To understand and practice embedded dynamic scripting on client-side Internet Programming
- To design an interactive website using HTML, CSS and JavaScript.

Course Outcomes (COs)

Upon Completion of the course, the students will be able to

1. Apply basic HTML tags to format text in a web page
2. Use forms and frames in HTML to design interactive web pages.
3. Create a basic website using HTML and Cascading Style Sheets.
4. Learn to use JavaScript inside HTML to create web pages.
5. Validate user input using JavaScript objects and Events.
6. Design and implement dynamic web pages using HTML, CSS and JavaScript.

Unit I - HTML

What is HTML -HTML Documents -Basic structure of an HTML document -Creating an HTML document - Mark up Tags -Heading-Paragraphs - Line Breaks - HTML Tags. Introduction to elements of HTML- Working with Text - Working with Lists, Tables -Working with Hyperlinks, Images and Multimedia.

Unit II – Frames

Introduction to Frame, <frameset> and <frame> Tag with its Attributes, Creating Frames, Linking Frames, <noframes> tag, Complex Framesets, Floating or Inline Frame. Forms: <Form> Tag and its Attributes, <Input> Tag and its Attributes, Form Controls: Text Controls, Password Fields, Radio Buttons, Checkboxes, Reset and Submit Buttons, Form Control Selection, Option Processing and Text Area, Hidden Fields. Embedding Multimedia: Introduction, Embedding Multimedia, Inserting Sound/Audio Formats, Inserting Video File Formats.

Unit III - CSS

Concept of CSS- Creating Style Sheet - CSS Properties -CSS Styling: Background-Text Format-Controlling Fonts - Working with block elements and objects - Working with Lists and Tables - CSS Id and Class - Box Model: Introduction- Border properties- Padding Properties- Margin properties - CSS Advanced:Grouping-Dimension-Display-Positioning-Floating-Align-Pseudo class-Navigation Bar-Image Sprites-Attribute selector.CSS Color -Creating page Layout and Site Designs.

Unit IV – JavaScript Programming

Introduction to JavaScript: Utility of JavaScript-Evolution of the JavaScript Language- JavaScript Versions and Browser Support- Differences Between Client-Side vs. Server-Side JavaScript-

Statements and Operators-Variable Declarations- Operators and Statements- Operator Precedence- Implementing Control Constructs: Conditional and Looping Constructs- Implementing Functions: Defining Functions-Calling Functions- Passing Arguments- Local vs. Global Variables- Using the Return Statement-Nested Functions.

Unit V - JavaScript Objects

The JavaScript Object Model and Hierarchy- JavaScript Object Properties-Object Methods- New Keyword- This Keyword- Creating New Object Instances Using Constructor - JavaScript Object Constructor - Functions- String- Date and Array Objects- Construction of Custom Objects with Individual Properties and Methods. Event Handling: Event-Driven Programming Model - Handling Link Events, Window Events, Image Events, Form Events- Setting Event Handlers- In-Line or Referencing.

Suggested Readings

1. Paul McFedries. (2018). Web Coding & Development All-in-One For Dummies, 1st Edition. John Wiley & Sons.
2. Randy Connolly, Ricardo Hoar. (2017). Fundamentals of Web Development, 2nd Edition. Pearson.
3. Joel sklar. (2015). Principles of web design, 6th Edition. Cengage.
4. Jon Duckett.(2014). HTML and CSS: Design and Build Websites. 2nd Edition. John Wiley & Sons.
5. Thomas A Powell, Fritz Schneider.(2013). JavaScript: The Complete Reference, 3rd Edition, Tata McGraw Hill.

Websites

1. [http://www. freeCodeCamp Guides.com/](http://www.freeCodeCamp Guides.com/)
2. <http://www. Codrops CSS Reference/>
3. <https://developer.mozilla.org/enUS/docs/Web/JavaScript/Guide>.
4. <http://www.w3schools.com>.
5. <https://nptel.ac.in/courses/106105084/>
6. <https://freevideolectures.com/blog/webdesign-online-courses-and-video-lectures/>

21ADU103**Numerical Methods****Semester – I
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

This course enables the students to

- To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems.
- To solve problems in the field of Applied Mathematics, Theoretical Physics and Engineering which requires computing of numerical results using certain raw data.
- To solve complex mathematical problems using only simple arithmetic operations.
- To formulate the mathematical models of physical situations that can be solved with arithmetic operations.
- To deal with various topics like finding roots of equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration & differentiation, solution of differential equation, boundary value problems, solution of matrix problems.
- To facilitate numerical computing.

Course Outcomes (COs)

On successful completion of the course, students will be able to

1. Apply Numerical analysis which has enormous application in the field of science and some fields of Engineering.
2. Familiar with finite precision computation.
3. Familiar with numerical solutions of nonlinear equations in a single variable.
4. Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations.
5. Familiar with calculation and interpretation of errors in numerical method.
6. Familiar with programming with numerical packages like MATLAB

Unit I

The Solutions of Numerical Algebraic and Transcendental equations: Bisection method -iteration method- False Position method - Newton's method.

Unit II

Solution of Simultaneous Linear algebraic Equation – Gauss elimination method- Gauss Jordan method- Gauss Jacobi method- Gauss Seidel methods.

Unit III

Interpolation: Gregory-Newton forward and backward interpolation Formula– equidistant terms with one or more missing values - Lagrange and Inverse Lagrange Interpolation formula.

Unit IV

Numerical Differentiations: Newton's forward Difference and Newton's Backward Difference formula. Numerical Integration: Trapezoidal Rule & Simpson's Rule.

Unit V

Numerical Solution of Ordinary Differential Equations: Taylor's series - Euler's method – Modified Euler's method - Runge-Kutta methods (fourth order Runge Kutta method only) .

Suggested Readings

1. P. Kandasamy, Dr. K. Thilagavathy, Dr. K. Gunavathi. (2013). Numerical Methods, S.Chand & Company Pvt. Ltd., New Delhi.
2. M.K. Jain, S.R.K. Iyengar and Jain R.K. (2012). Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi.
3. T. Veerarajan and T. Ramachandran. (2008). Numerical Methods with Programs in C, Tata McGraw-Hill Publishing company limited, New Delhi.
4. B. Bradie. (2007). A Friendly Introduction to Numerical Analysis, Pearson Education, India.

Websites

1. <https://youtu.be/tcqsLqlyjmk>
2. https://youtu.be/0XcOwBY_Ryw

21ADU111 Object Oriented Programming Using C++ - Practical**Semester – I
4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To understand how C++ improves C with object-oriented feature.
- To learn the syntax and semantics of classes in C++ programming language.
- To learn how to perform operator overloading and inheritance.
- To learn how to design C++ programs using pointers.
- To learn file handling in C++.
- To write programs in C++ using the concepts learned above.

Course Outcomes (COs)

After the completion of this course, a successful student will be able to:

1. Understand the difference between top-down and bottom-up approach.
2. Apply the concepts of object-oriented programming in constructor and destructor.
3. Understand how to apply the major object-oriented concepts to implement inheritance and polymorphism.
4. Apply pointer concepts in C++
5. Use the concepts of preprocessor directives and macros.
6. Write programs in C++ using the concepts learned above

List of Programs

1. Write a C++ program to print sum of digits.
2. Write a C++ program to check palindrome number.
3. Write a program to swap numbers using friend function.
4. Write a program to perform multiplication of two matrices using operator overloading.
5. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers.
6. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
7. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).
8. Write a C++ Program to store GPA of n number of students and display it where n is the number of students entered by user (Memory Management).
9. Write a program to demonstrate the try, catch block in C++
10. Write a C++ program that uses a single file for both reading and writing the data.

Suggested Readings

1. Antonio Mallia, Francesco Zoffoli.(2019). C++ Fundamentals, Packt Publishing, Ltd.
2. Joel Murach, Mary Delamater. (2018). C++ Programming, Mike Murach & Associates Inc.
3. Stefan Bjornander. (2016). C++ Windows Programming, Packt Publishing Ltd.

4. Richard L. Stegman, (2016), Focus on Object-oriented Programming with C++, 6th Edition, CreateSpace Independent Publishing Platform.
5. Bjarne Stroustrup. (2014). Programming - Principles and Practice using C++, 2nd Edition, Addison-Wesley
6. Harry, H. Chaudhary. (2014). Head First C++ Programming: The Definitive Beginner's Guide, First Create space Inc, O-D Publishing, LLC USA.
7. Debasish Jana. (2014). C++ And Object-Oriented Programming Paradigm, PHI Learning Pvt. Ltd

Websites

1. www.programmingsimplified.com
2. [www.programiz.com / cpp-programming](http://www.programiz.com/cpp-programming)
3. www.cplusplus.com
4. www.learncpp.com
5. www.udemy.com

21ADU112**Web Designing - Practical****Semester – I****3H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

Course Objectives

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice markup languages
- To understand the technologies used in Web Programming.
- To know the importance of object-oriented aspects of Scripting.
- To understand and practice embedded dynamic scripting on client-side Internet Programming
- To design an interactive website using HTML, CSS and JavaScript.

Course Outcomes (COs)

Upon Completion of the course, the students will be able to

1. Select and apply markup languages for processing, identifying, and presenting of information in web pages.
2. Create and manipulate web media objects using editing software.
3. Create a basic website using HTML and Cascading Style Sheets.
4. Design and implement dynamic web pages using HTML, CSS and JavaScript.
5. Gain the skills and project-based experience needed for entry into web design and development careers.
6. Develop awareness and appreciation of the many ways that people access the web, and will be able to create standards-based websites that can be accessed by the full spectrum of web access technologies

List of Programs

1. Create HTML document with following formatting – Bold, Italics, Underline, Colors, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking text as well as marquee text.
2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internal and External linking
3. Create HTML document with Table

4. Create Form with Input Type, Select and Text Area in HTML.
5. Create an HTML containing Roll No., student's name and Grades in a tabular form.
6. Create an HTML document (having two frames) which will appear as follows

<p>About</p> <p>Department 1</p> <p>Department 2</p> <p>Department 3</p>	<p>This frame would show the contents according to the link clicked by the user on the left frame.</p>
--	--

7. Create an HTML document containing horizontal frames as follows

Department Names (could be along with Logos)
Contents according to the Link clicked

8. Create a website of 6 – 7 pages with different effects as mentioned in above problems.

9. Create HTML documents (having multiple frames) in the following three formats

Frame1
Frame2

Frame1
Frame2
Frame3

10. Create a form using HTML which has the following types of controls:

V. Text Box

VI. Option/radio buttons

VII. Check boxes

VIII. Reset and Submit buttons

List of Programs using JavaScript: Create event driven program for following:

11. Print a table of numbers from 5 to 15 and their squares and cubes using alert.

12. Print the largest of three numbers. 81

13. Find the factorial of a number n.

14. Enter a list of positive numbers terminated by Zero. Find the sum and average of these numbers.

15. A person deposits Rs 1000 in a fixed account yielding 5% interest. Compute the amount in the account at the end of each year for n years.

16. Read n numbers. Count the number of negative numbers, positive numbers and zeros in the list.

Suggested Readings

1. Paul McFedries. (2018). Web Coding & Development All-in-One For Dummies, 1st Edition. John Wiley & Sons.
2. Randy Connolly, Ricardo Hoar. (2017). Fundamentals of Web Development, 2nd Edition. Pearson.
3. Joel sklar. (2015). Principles of web design, 6th Edition. Cengage.
4. Jon Duckett.(2014). HTML and CSS: Design and Build Websites. 2nd Edition. John Wiley & Sons.
5. Thomas A Powell, Fritz Schneider.(2013). JavaScript: The Complete Reference, 3rd Edition, Tata McGraw Hill.

Websites

1. [http://www. freeCodeCamp Guides.com/](http://www.freeCodeCamp Guides.com/)
2. <http://www. Codrops CSS Reference/>
3. <https://developer.mozilla.org/enUS/docs/Web/JavaScript/Guide>.
4. <http://www.w3schools.com>.

21ADU113**Numerical Methods - Practical****Semester – I
3H – 2C****Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal : 40 External : 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

This course enables the students

- To solve simultaneous linear algebraic using various methods.
- To evaluate definite integrals using numerical integration
- To know problem- solving through (computer language) programming.
- To solve complex mathematical problems using only simple arithmetic operations.
- To formulate the mathematical models of physical situations that can be solved with arithmetic operations.
- To deal with various topics like finding roots of equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration & differentiation, solution of differential equation, boundary value problems, solution of matrix problems.

Course Outcomes (COs)

On successful completion of the course, students will be able to

1. Familiarize with the programming environment for numerical methods.
2. Develop proficiency skills to solve the algebraic equations.
3. Evaluate the definite integrals using computer programming techniques.
4. Familiarize with calculation and interpretation of errors in numerical method.
5. Get acquainted with programming with numerical packages like SCILAB
6. Get familiar with finite precision computation.

List of Practical (Using any software)**(Any 10 Programs)**

1. Solution of simultaneous linear algebraic equations- Gauss Elimination Method
2. Solution of simultaneous linear algebraic equations- Gauss Jordan Method
3. Solution of simultaneous linear algebraic equations- Gauss Jacobi Method
4. Solution of simultaneous linear algebraic equations- Gauss Seidal Method
5. Computing Lagrange's interpolating polynomial
6. Computing Newton's interpolating polynomial
7. Numerical Integration – Simpson's one third rule
8. Numerical Integration – Simpson's three eight rule
9. Numerical Integration – Trapezoidal rule
10. Solution for ordinary differential equation-Euler method.
11. Solution for ordinary differential equation- Runge Kutta Second order.

Suggested Readings

5. P. Kandasamy, Dr. K. Thilagavathy, Dr. K. Gunavathi. (2013). Numerical Methods, S.Chand & Company Pvt. Ltd., New Delhi.
6. M.K. Jain, S.R.K. Iyengar and Jain R.K. (2012). Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi.
7. T. Veerarajan and T. Ramachandran. (2008). Numerical Methods with Programs in C, Tata McGraw-Hill Publishing company limited, New Delhi.

8. B. Bradie. (2007). A Friendly Introduction to Numerical Analysis, Pearson Education, India.

Websites

1. <https://youtu.be/tcqsLqlyjmk>
2. https://youtu.be/0XcOwBY_Ryw

21LSU201

Language II

Semester – II
4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனை மேம்படுத்துதல்.
- ஆய்வுநோக்கை மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப் பயன் விளைவு

1. இந்திய குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற, 'தமிழ்இலக்கியவரலாறு' குறித்தமுழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின் வளர்ச்சித்துறையாகிய, 'அறிவியல்தமிழ்'; இணையதமிழ்' குறித்த பன்னோக்கு அணுகுமுறையிலான ஆய்வுச்சிந்தனை மேம்பாடு.
4. வேலைவாய்ப்புக்குரிய சுயதிறன்மேம்பாட்டுடன், படைப்பாக்கத் திறன்மேம்பாடும் பெற்றிருத்தல் .
5. சமுதாயமற்றும்வாழ்வியல்மதிப்புகளைப்பேணுவதற்குக்கருவியாகஇலக் கியங்களைநாடுகின்றமனப்பான்மைவளர்ச்சி.
6. மொழிபெயப்புத்துறை சார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்

அலகு – I : தமிழ் இலக்கிய வரலாறு- II**(5மணிநேரம்)**

தமிழ் இலக்கிய வரிசையில் திருமுறைகளும் நாலாயிரத் திவ்யப்பிரபந்தமும்-பன்னிரு திருமுறைகள் அறிமுகம்- திருமுறை ஆசிரியர்களின் இலக்கியப் பங்களிப்பு-திருமுறைகளில் பக்திநெறியும் சமுதாய நோக்கும்-சமயக்குரவரின் அருள்நெறி- பன்னிரு ஆழ்வார்கள் வரலாறு- ஆழ்வார்களின் இலக்கியப் பங்களிப்பு-திவ்யப் பிரபந்தத்தில் பக்திநெறியும் இலக்கிய நயமும்-தமிழில் சிற்றிலக்கியக் காலமும் கருத்தும்- தொண்ணூற்றாறு

வகைச் சிற்றிலக்கிய வரிசை- தமிழ் மொழியின்கவிதை - சிறுகதை - உரைநடை -இலக்கியங்களின்தோற்றம் - வளர்ச்சி - உத்திகள்-நாட்டுப்புறஇலக்கியங்கள்-கொங்குநாட்டார் வாய்மொழி வழக்காறுகள்.

அலகு - II : பக்தி இலக்கியமும் சிற்றிலக்கியமும்: (12 மணிநேரம்)

அ). பக்தி இலக்கியம்

(6 மணிநேரம்)

1. சைவம்- பெரியபுராணம் - இளையான்குடிமாறநாயனார் புராணம் -(19 பாடல்கள்)

(அம்பொன் நீடிய, கொண்டு வந்து, ஆளு நாயகர், செல்வம் மேவிய, மாரிக் காலத்து, ஈர மேனியை, நமக்கு முன்பிங்கு, செல்லல் நீங்க, மற்றம் மாற்றம், உள்ளம் அன்பு, காலினால் தடவி, வந்தபின் மனைவியாரும், முறித்தவை அடுப்பின், வழிவரும் இளைப்பினோடும், மனைவியார் கொழுநர், கணவனார் தம்மை, அழுந்திய இடருள், மாலயற் கரிய, அன்பனே அன்பர் பூசை)

2. வைணவம் - ஆண்டாள் நாச்சியார் திருப்பாவை: (11 பாடல்கள்):மார்கழித்திங்கள், வையத்து வாழ்வீர்காள், ஓங்கி உலகளந்த, ஆழி மழைக்கண்ணா, மாயனை மன்னுவட மதுரை, சிற்றம் சிறுகாலே, ஒருத்தி மகனாய், மாலே மணிவண்ணா, கூடாரை வெல்லும், கறவைகள் பின்சென்று, வங்கக்கடல் கடைந்த.

ஆ). சிற்றிலக்கியம் (6 மணிநேரம்)

1. முக்கூடற் பள்ளு- 2 பாடல்கள் - சித்திரக் காலிவாலான் (நெல்வகைகள்) குற்றாலத் திரிகூட மால்வரை (மீன் வகைகள்)
2. நந்தி கலம்பகம்- 5 பாடல்கள்- என்னையே புகழ்ந்தேன், பதிதொறு புயல்பொழி, இந்தப்புவிடில், அடிவிளக்கும் துகில், வானுறுமதியை
3. மதுரைச் சொக்கநாதர் தமிழ்விடு தூது -தமிழின் சிறப்பு பாடியருள பத்துப்பாட்டும்-விளம்பக்கேள்.

அலகு - III: கவிதையும்சிறுகதையும் (16 மணிநேரம்)

அ). கவிதை இலக்கியம் (8 மணிநேரம்)

1. மகாகவி பாரதியார் -கண்ணன் - என்சீடன்
2. புரட்சிக்கவிஞன் பாரதிதாசன் -இளையார் ஆத்திசூடி- அழுபவன் கோழை
3. கவிமணி தேசிக விநாயகம் பிள்ளை-கோயில் வழிபாடு
4. கவிக்கோ. அப்துல்ரகுமான்-பாருக்குள்ளே நல்ல நாடு
5. சிற்பி பாலசுப்பிரமணியன் -மலையாளக் காற்று
6. கவிஞர் தாமரை -தொலைந்து போனேன்

7. கவிஞர் கரிகாலன்- விடுதலை

ஆ). சிறுகதை இலக்கியம்

(8 மணிநேரம்)

- | | |
|---------------------|-------------------|
| 1. சாபவிமோசனம் | - புதுமைப்பித்தன் |
| 2. நகரம் | -சுஜாதா |
| 3. அந்நியர்கள் | -ஆர். சூடாமணி |
| 4. இந்நாட்டு மன்னர் | -நாஞ்சில்நாடன் |

அலகு - IV :உரைநடை இலக்கியம்

(8 மணிநேரம்)

1. ஆளுமைத்திறன் அறிவோம் - தன்னம்பிக்கை மாத இதழிலிருந்து
2. திருக்குறளும் சமுதாயவியலும் - முனைவர் புரிசை நடராசன்
3. தமிழ் - உயர்தனிச் செம்மொழி - முனைவர் இரா. குணசீலன்
4. நொய்யல் - முனைவர் ப. தமிழரசி

அலகு- V :அடிப்படை இலக்கணமும் பயன்பாட்டுத்தமிழும்- II (7மணி நேரம்)

இலக்கணப் பயிற்சி: 1. அணி இலக்கணம்

உவமையணி-பிறிது மொழிதல் அணி-சிலேடை அணி-தீவக அணி-ஏகதேச உருவக அணி - வேற்றுமையணி-பின்வருநிலையணிக்கான விளக்கங்கள்.

2. துறை சார் கலைச்சொல் பயன்பாட்டாக்கம்

3. படைப்பிலக்கியப் பயிற்சிகள்

1. மரபுக்கவிதை, புதுக்கவிதை, சிறுகதை, கட்டுரைபடைப்பாக்க உத்திகள்- பயிற்சிகள்
2. எழுத்தாளருடனான நேர்காணல் மற்றும் கள ஆய்வுக்கான வினா நிரல் தயாரித்தல் நுட்பங்களும் பயிற்சிகளும்.

4. மொழிபெயர்ப்புப்பயிற்சிகள்

1. தமிழ்-ஆங்கில மொழிபெயர்ப்புப் பயிற்சிகள் -2.
2. ஆங்கிலம்-தமிழ் மொழிபெயர்ப்புப் பயிற்சிகள்-2.

பாடநூல்:கற்பகச்சோலை - தமிழ்ஏடு.

கற்பகம் உயர்கல்வி கலைக்கழகத்தமிழ்த்துறை வெளியீடு.

21ENU201**ENGLISH II****Semester – II
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal : 40 External : 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To give basic knowledge on grammar.
- To train communication in real life situation.
- To be familiar with the four basic skills of English.
- To train students to acquire proficiency in English by reading different genres of literature and learning grammar.
- To provide aesthetic pleasure through literature.
- To develop the moral values of students.

Course Outcomes (COs)

1. Retrieve fundamentals of English language to construct error free sentences.
2. Develop the knowledge of interpersonal skills.
3. Establish and maintain social relationships.
4. Develop communication skills in business environment.
5. Refine communication competency through LSRW skills.
6. Introduce literature to enhance the moral and aesthetic values.

Unit I – Grammar

Voice, Idioms and Phrases, Clauses and Reported Speech

Unit II –Business and Technical Reports

Business Correspondence –Memo, Notices, Agenda, Minutes- Resume Writing- Report Writing- Letter Writing- Personal and Social Letters- E-mail Writing

Unit III – Communication Practice

Verbal and Non-Verbal Communication- Group Discussion and Seminars- Note-Taking and Note-Making

Unit IV –LSRW Skills**Listening-** Listening Talks and Presentations**Speaking** - Public Speaking- Preparatory steps, Time Management, Handling Questions and Meeting unexpected situations**Reading** - Language of Newspapers, Magazines and Internet**Writing** -Writing Paragraphs and Essays- Content Writing**Unit V –Literature****Prose-** Morals in the Indian Context by Francis Nicholas Chelliah**Poetry-** Telephone Conversation by Wole Soyinka**Short Stories-**The Last Leaf by O' Henry

Suggested Readings

1. Thomas S Kane. (1988). Oxford Handbook of Writing.
2. Andrea A. Lunsford. (2015). The St. Martins Handbook of Writing, 8th Edition, Bedford/St. Martin's
3. Julian Treasure. (2012). Sound Business, 3rd Edition, Management Books 2000 Ltd.

21ADU201**Programming in JAVA****Semester – II
6H – 6C****Instruction Hours / week: L: 6 T: 0 P: 0 Marks: Internal : 40 External : 60 Total: 100
End Semester Exam : 3 Hours****Course Objectives**

- To understand the fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- To use the Java SDK environment to create, debug and run simple Java programs.
- To use Java in various technologies in different platforms.
- To understand the fundamental of Packages and access modifiers and interface in java.
- To understand the fundamental of Exception Handling and AWT component and AWT classes.

Course Outcomes (COs)

Upon completion of this course the student will be able to:

1. Obtain knowledge of the structure and model of the Java programming language.
2. Use the Java programming language for many programming technologies (understanding)
3. Develop software in the Java programming language (application)
4. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
5. Use the certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)
6. Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

Unit I - Introduction to Java

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting.

Unit II - Arrays, Strings and I/O

Object-Oriented Programming Overview Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection-Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Unit III – Inheritance

Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes.

Unit IV - Exception Handling and Database Connectivity

Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Accessing and manipulating databases using JDBC.

Unit V – Java GUI Programming using Swing

Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using Swing components of Java Foundation Classes such as labels, buttons, text fields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts.

Suggested Readings

1. Herbert Schildt, (2017). Java the Complete Reference, 8th Edition McGraw Hill Education.
2. James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley.(2014). The Java Language Specification, Java SE 8th Edition (Java Series), Addison Wesley.
3. Cay S. Horstmann, Gary Cornell. (2013). Core Java 2 Volume 2 - Advanced Features, 9th Edition, Printice Hall.
4. Cay S. Horstmann, Gary Cornell. (2012). Core Java 2 Volume 1 ,9th Edition, Printice Hall.
5. Paul Deitel, Harvey Deitel. (2011). Java: How to Program, 10th Edition, Prentice Hall.
6. E. Balaguruswamy. (2009). Programming with Java, 4th Edition, McGraw Hill.
7. David J. Eck. (2009). Introduction to Programming Using Java, CreateSpace Independent Publishing Platform.
8. Joshua Bloch. (2008). Effective Java, 2nd Edition, Addison-Wesley.
9. ISRD Group, (2006). Introduction to object-oriented programming through Java, Tata McGraw-Hill Education
10. Ken Arnold, James Gosling, David Homes, 2005, The Java Programming Language, 4th Edition.
11. John R. Hubbard. (2004). Programming with JAVA, Schaum's Series, 2nd Edition, McGraw-Hill Education.
12. Bruce Eckel. (2002). Thinking in Java, 3rd Edition, PHI

Websites

1. <https://docs.oracle.com/java>
2. <https://www.tutorialspoint.com/java/index.htm>
3. <https://www.w3schools.com/java/>
4. <https://www.javatpoint.com/java-tutorial>
5. <https://docs.oracle.com/javase/tutorial/java/index.html>
6. <https://www.geeksforgeeks.org/java-tutorials/>

NPTEL

1. <https://nptel.ac.in/courses/106105191/>

LMS

- 1.<http://172.16.25.76/course/view.php?id=1827>

21ADU202**Probability and Statistics****Semester-II
5H – 5C****Instruction Hours / week: L: 5 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

This course enables the students to learn

- To understand the basic concepts in probability theory and the nature of uncertainty.
- To realize the applications of probability and commonly used probability distributions (both discrete and continuous), Central Limit theorem and their applications in various disciplines.
- To know the various techniques of descriptive and inferential statistics, and how to apply them for examining data in the analytical decision making.
- To draw conclusions based on sample data by constructing statistical hypothesis and estimation with statistical tools and techniques.
- To explain the foundations of probabilistic and statistical analysis which are mostly applied in computer science.

Course Outcomes (COs)

On successful completion of the course, students will be able to

1. Compute problems based on probability and conditional probability in appropriate ways.
2. Describe the probability distributions such as Binomial, Poisson and Normal distribution.
3. Evaluate various measures of descriptive statistical measures for any given data.
4. Derive the relationship between data using Correlation, Rank Correlation and Regression for two variables.
5. Understand the basic concept of test of significance and make inferences from statistical tests.
6. Develop an ability to analyze, demonstrate to provide meaningful information in from the collected statistical data.

Unit I-Basics of Probability

Trial, event -Sample space - Mutually exclusive event - Exclusive and exhaustive events - Dependent and independent events - Simple and compound events - Mathematical properties - Counting Principle for equally likely outcomes; probability rule -; Law of Total Probability, Addition and multiplication theorem, Combinations and Permutations. Conditional Probability Bayes Rule.

Unit II -Discrete and Continuous Probability Distributions

Random variables (discrete and continuous) - Mathematical expectation - Binomial distribution - Poisson distribution and its properties. Central Limit theorem, Uniform distribution - Normal distribution -conditions and properties, Standard normal distribution - Exponential distribution.

Unit III- Basics of Statistics and Uni Variate Analysis

Meaning and definition of statistics - Frequency Distribution, Concepts of measurement, scales of measurement of data, Different types scales (ratio, interval, nominal and ordinal); Measures of central tendency: Arithmetic Mean, Median, Mode. Measures of dispersion – Range, Coefficient of range - Quartile deviation - Coefficient of Quartile deviation - Standard deviation and Coefficient of variation.

Unit IV- Bivariate Analysis

Correlation – Meaning and definition - Scatter diagram – Karl Pearson’s Correlation Coefficient. Rank Correlation. Regression: Regression in two variables – Properties of Regression, uses of Regression.

Unit V-Inferential Statistics

Population and Sample - Parameter and Statistic, Sampling and its methods, Introduction to hypothesis testing, Concepts of statistical tests - Level of Significance and degrees of freedom type-I and type-II errors, one tailed and two tailed tests, standard error, small and large sample tests/ Estimation - confidence interval, confidence limits. Popular Software for Data Analytics - EXCEL, SPSS, Python, R- Programming.

Suggested Readings

1. R. Evans James., (2017), Business Analytics, 2nd Edition, Pearson Education, New Delhi.
2. U Dinesh Kumar., (2017), Business Analytics: The Science of Data - Driven Decision Making, Wiley, New Delhi.
3. Srivastava T.N., and Shailaja Rego., (2012). 2e, Statistics for Management, McGraw Hill Education, New Delhi.
4. Sheldon Ross., (2007). Introduction to Probability Model, Ninth Edition, Academic Press, Indian Reprint.
5. Robert V. Hogg, Joseph W. McKean and Allen T. Craig., (2007). Introduction to Mathematical Statistics, Pearson Education, Asia.
6. Irwin Miller and Marylees Miller, John E. Freund, (2006). Mathematical Statistics with Application, Seventh Edition, Pearson Education, Asia.
7. Pillai R.S.N., and Bagavathi V., (2002). Statistics, S. Chand & Company Ltd, New Delhi.

Websites

1. <https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/>
2. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE
3. <https://nptel.ac.in/courses/110107114/>
4. <http://172.16.25.76/course/view.php?id=1642>

21ADU211**Programming in JAVA - Practical****Semester – II****4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal : 40 External : 60 Total: 100**
End Semester Exam : 3 Hours**Course Objectives**

- To understand the fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- To use the Java SDK environment to create, debug and run simple Java programs.
- To use Java in various technologies in different platforms.
- To understand the fundamental of Packages and access modifiers and interface in java.
- To understand the fundamental of Exception Handling and AWT component and AWT classes.

Course Outcomes (COs)

1. Student will obtain knowledge of the structure and model of the Java programming language.
2. How to use the Java programming language for various programming technologies (understanding)
3. Develop software in the Java programming language (application)
4. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
5. Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)
6. Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

List of Programs

1. To convert a decimal to binary number
2. Write a program to find the sum of series $1+x+x^2+x^3+\dots$
3. To find the sum of any number of integers entered as command line arguments
4. To learn use of single dimensional array by defining the array dynamically.
5. Write a program to find maximum and sum of an array
6. Write a Program to generate Fibonacci Series and Factorial for a number
7. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions (from lower to higher data type)
8. Write a program to an exception out of bounds, if mark is greater than 100 throw an exception
9. Write a program —DivideByZero that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.
10. Write a program to generate multiplication table by multithreading
11. Write a program to demonstrate priorities among multiple threads
12. Write a program to perform string operations

Suggested Readings

1. Herbert Schildt, (2017). Java the Complete Reference, 8th Edition McGraw Hill Education.
2. James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley.(2014). The Java Language Specification, Java SE 8th Edition (Java Series), Addison Wesley.
3. Cay S. Horstmann, Gary Cornell. (2013). Core Java 2 Volume 2 - Advanced Features, 9th Edition, Printice Hall.
4. Cay S. Horstmann, Gary Cornell. (2012). Core Java 2 Volume 1 ,9th Edition, Printice Hall.
5. Paul Deitel, Harvey Deitel. (2011). Java: How to Program, 10th Edition, Prentice Hall.
6. E. Balaguruswamy. (2009). Programming with Java, 4th Edition, McGraw Hill.
7. David J. Eck. (2009). Introduction to Programming Using Java, CreateSpace Independent Publishing Platform.
8. Joshua Bloch. (2008). Effective Java, 2nd Edition, Addison-Wesley.
9. ISRD Group, (2006). Introduction to object-oriented programming through Java, Tata McGraw-Hill Education
10. Ken Arnold, James Gosling, David Homes, 2005, The Java Programming Language, 4th Edition.
11. John R. Hubbard. (2004). Programming with JAVA, Schaum's Series, 2nd Edition, McGraw-Hill Education.
12. Bruce Eckel. (2002). Thinking in Java, 3rd Edition, PHI

Websites

1. www.java.sun.com
2. www.knking.com
3. www.webdeveloper.com
4. www.forums.sun.com
5. www.netbeans.com
6. java.sun.com/docs/books/tutorial/
7. www.java.net/

21ADU212**Probability and Statistics - Practical****Semester – II****4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

This course enables the students to learn

- To understand the basic concepts in probability theory and the nature of uncertainty.
- To realize the applications of probability and commonly used probability distributions (both discrete and continuous), Central Limit theorem and their applications in various disciplines.
- To know the various techniques of descriptive and inferential statistics, and how to apply them for examining data in the analytical decision making.
- To draw conclusions based on sample data by constructing statistical hypothesis and estimation with statistical tools and techniques.
- To explain the foundations of probabilistic and statistical analysis which are mostly applied in computer science.

Course Outcomes (COs)

On successful completion of the course, students will be able to

1. Compute problems based on probability and conditional probability in appropriate ways.
2. Describe the probability distributions such as Binomial, Poisson and Normal distribution.
3. Evaluate various measures of descriptive statistical measures for any given data.
4. Derive the relationship between data using Correlation, Rank Correlation and Regression for two variables.
5. Understand the basic concept of test of significance and make inferences from statistical tests.
6. Develop an ability to analyze, demonstrate to provide meaningful information in from the collected statistical data.

List of Programs

1. Various other Software Package available for Data Analytics
2. Calculation of Basic Statistical Measures using Excel.
3. Introduction to SPSS Software Package for Data Analytics
4. Drawing of graphs and diagrams using SPSS software
5. Calculation of Mean, Median and Mode
6. Calculation of Standard deviation
7. Calculation of Karl Pearson's Correlation
8. Calculation of Rank Correlation Coefficient
9. Fitting of Linear Regression
10. Hypothesis Testing for small sample test (t - test)
11. Hypothesis Testing for two sample t - test
12. Hypothesis Testing for Large sample (Z-test)
13. Testing Hypothesis using chi-square - test (for Goodness of fit)
14. Testing Hypothesis using chi-square - test (for Contingency Table)

Suggested Readings

1. Dawn M. McBride, J. Cooper Cutting. (2017). Lab Manual for Statistical Analysis, 2nd Edition, SAGE Publications.
2. U Dinesh Kumar. (2017). Business Analytics: The Science of Data - Driven Decision Making, 1st Edition, Wiley, New Delhi.

3. Daniel Y Chen. (2017). Pandas for everyone - Python data Analysis, 1st Edition, Pearson Education.
4. R. Evans James. (2017). Business Analytics, 2nd Edition, Pearson Education, New Delhi.

21AEC201**Environmental Studies****Semester – II****3H – 3C****Instruction Hours / week: L: 3 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

Enable the student

- To create the awareness about environmental problems among people.
- To develop an attitude of concern for the environment.
- To motivate public to participate in environment protection and improvement.
- To encourage to learn ecosystems and biodiversity.
- To learn environment pollution and control measures of pollution.
- To create system concepts and methodologies and analyze interactions.

Course Outcomes (COs)

Upon successful completion of the course, the student will be able to:

1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Unit I – Introduction - Environmental Studies & Ecosystems

Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit II - Natural Resources - Renewable and Non-Renewable Resources

Natural resources - Renewable and Non – Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources - Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources - Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit III - Biodiversity and its Conservation

Levels of biological diversity - genetic, species and ecosystem diversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-

spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Unit IV - Environmental Pollution

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution. Nuclear hazards and human health risks. Solid waste management and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Case studies.

Unit V - Social Issues and the Environment

Concept of sustainability and sustainable development. Water conservation - Rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act). International agreements (Montreal and Kyoto protocols). Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Human population growth: Impacts on environment, human health and welfare.

Suggested Readings

1. Rajagopalan, R. (2016). Environmental Studies: From Crisis to Cure, Oxford University Press.
2. Sing, J.S., Sing. S.P. and Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
3. Mishra, D.D. (2010). Fundamental Concepts in Environmental Studies. S.Chand & Company Pvt. Ltd., New Delhi.
4. Uberoi, N.K. (2005). Environmental Studies. Excel Books Publications, New Delhi.
5. Anonymous. (2004). A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
6. Anubha Kaushik., and Kaushik, C.P. (2004). Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
7. Arvind Kumar. (2004). A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
8. Singh, M.P., Singh, B.S., and Soma, S. Dey. (2004). Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
9. Tripathy. S.N., and Sunakar Panda. (2004). Fundamentals of Environmental Studies (2nd Edition.). Vrianda Publications Private Ltd, New Delhi.
10. Verma, P.S., and Agarwal V.K. (2001). Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, New Delhi.
11. Daniel, B. Botkin., and Edward, A. Keller. (1995). Environmental Science John Wiley and Sons, Inc., New York.
12. Odum, E.P., Odum, H.T. and Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.

21ADU301**Data Structures****Semester – III
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To understand the fundamental concepts of data structures
- To Learn linear data structures – lists, stacks, and queues
- To apply Tree and Graph structures
- To understand and apply sorting, searching algorithms
- To know about hashing algorithms
- To develop application using data structures

Course Outcomes (COs)

Upon completion of this course, the student will be able to:

1. Implement abstract data types for linear data structures.
2. Apply the different linear and non-linear data structures to problem solutions.
3. Analyze the applications of tree.
4. Implement graph theory over various data structures.
5. Critically analyze the various sorting algorithms.
6. Apply searching algorithms over various data structures.

Unit I- Abstract Data Types**Abstract Data Types– List** – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).**Unit II- Stack and Queue****Stack:** Introduction– Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – **Queue:** Introduction – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.**Unit III -Tree****Tree** – Introduction-Tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap.**Unit IV -Graphs**

Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

Unit V- Searching and Sorting**Searching-** Linear Search – Binary Search. **Sorting** – Bubble sort – Selection sort – Insertion sort – Shell sort – Radix Sort-Heap Sort-Quick Sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Suggested Readings

1. R. S. Salaria (2018). Data Structures and Algorithms using C, 5th Edition, Khanna Publishing.
2. Goodrich, M., & Tamassia, R. (2013). Data Structures and Algorithms Analysis in Java 4th Edition, Wiley.
3. Reema Thareja. (2011). Data Structures Using C++, 2nd Edition, Oxford University Press.
4. Mark Allen Weiss. (2011). Data Structures and Algorithms Analysis in Java, 3rd Edition, Pearson Education.
5. Sartaj Sahni. (2011). Data Structures, Algorithms and applications in C++ ,2nd Edition, Universities Press
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein. (2002). Introduction to Algorithms, 2nd Edition, Mcgraw Hill.

Websites

1. http://en.wikipedia.org/wiki/Data_structure
2. <http://www.cs.sunysb.edu/~skiena/214/lectures/>
3. www.amazon.com/Teach-Yourself-Structures-Algorithms

21ADU302**Fundamentals of Data Science****Semester – III
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

The goal of this course is for the students

- To study the basic concepts of Data Science and data life cycle.
- To understand the theoretical and mathematical aspects of Data Science models.
- To learn common random variables and their uses, and with the use of empirical distributions.
- To obtain the knowledge in data management tools.
- To explore the major techniques for data science.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Understand the key concepts in data science, including tools and approaches.
2. Understand the concepts in data collection, sampling and probabilistic models
3. Understand the various techniques in data science
4. Apply the mathematical formulation of machine learning and statistical models to visualize the data in various methods.
5. Apply a suitable data science technique to solve an information analytics problem.

Unit I- Introduction

The Big Picture: What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Pre- processing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

Unit II- Sampling

Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

Unit III- Data Normalization

Data Normalization (z-values, transforms) –Random processes –Data Management: Tools for Data Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

Unit IV- Major Techniques in Data Science

Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse– Machine Learning- Supervised Learning, Unsupervised Learning.

Unit V- Business Intelligence

Business Intelligence –Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics– Cloud computing-definition, Cloud services, types of clouds, some of commercial and non-commercial cloud service providers.

Suggested Readings

1. Saltz Jeffrey S. (2019). An Introduction to Data Science, 2nd Edition, Sage Publications.
2. Peter Bruce & Andrew Bruce. (2017). Practical Statistics for Data Scientists, 1st Edition, O'Reilly Publication.
3. Murtaza Haider. (2015). Getting Started with Data Science: Making Sense of Data with Analytics, 1st Edition, IBM Press.
4. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data. (2014). A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition, John Wiley & Son Publication.
5. Dawn Griffiths. (2008). Head First Statistics, 1st Edition, O'Reilly Publication.

Websites

1. <https://www.inferentialthinking.com/chapters/intro>
2. <https://www.openintro.org/stat/>
3. https://swayam.gov.in/ndl_noc20_cs36/preview
4. https://swayam.gov.in/ndl_noc19_cs60/preview
5. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/>

21ADU303**Operating Systems****Semester – III
4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

Course Objectives

- To Study the basic concepts and functions of operating systems.
- To understand the structure and functions of OS.
- To Learn about Processes, Threads and Scheduling algorithms.
- To Understand the principles of concurrency, Deadlocks and Memory Management
- To Learn about the Protection and Security Concepts.
- Understand basic resource management techniques.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Design various Scheduling algorithms.
2. Apply the principles of concurrency.
3. Design deadlock, prevention and avoidance algorithms.
4. Compare and contrast various memory management schemes.
5. Apply the Security Concepts based on Authentication.
6. Understand about various Malicious Software

Unit I - Introduction to Operating System

Basic OS Functions-Resource Abstraction-Types of Operating Systems–Multiprogramming Systems-Batch Systems-Time Sharing Systems- Operating Systems for Personal Computers & Workstations-Process Control & Real Time Systems.

Unit II - Operating System Organization

Processor and user modes-Kernels-System Calls and System Programs. Process Management: System view of the process and resources- Process Abstraction-Process Hierarchy-Threads-Threading Issues-Thread Libraries-Process Scheduling-Non Pre-emptive and Preemptive scheduling algorithms-Concurrent and processes-Critical Section-Semaphores-Methods for inter-process communication- Deadlocks.

Unit III - Memory Management

Physical and Virtual address space-Memory Allocation strategies –Fixed and Variable partitions-Paging-Segmentation-Virtual memory.

Unit IV - File and Disk Scheduling

File Management: File and File Systems – File Operations - File Structure – File Organization Types – File Allocation Methods. Directory Structure: Naming – Tree Structure Directory. Disk Scheduling: FIFO – SSTF – SCAN – C- SCAN.

Unit V- Protection and Security

Authentication: Password-Based Authentication – Token – Based Authentication – Biometric Authentication. Access Control: Discretionary Access Control – Role - Based Access Control. Malicious Software Overview: Backdoor – Logic Bomb – Trojan horse. Viruses.

Suggested Readings

1. Silberschatz, A., Galvin, P.B., & Gagne, G. (2018). Operating Systems Concepts, 10th Edition. New Delhi: John Wiley Publications.
2. Stallings, W. (2013). Operating Systems, Internals & Design Principles, 7th Edition, New Delhi: Prentice Hall of India.
3. Jose M Garrido, Richard Schlesinger Kenneth Hoganson. (2013). Principles of Modern Operating Systems, 2nd Edition, Library of Congress Cataloging-in-Publication Data.

Websites

1. www.cs.columbia.edu/~nieh/teaching/e6118_s00/
2. www.clarkson.edu/~jnm/cs644
3. pages.cs.wisc.edu/~remzi/Classes/736/Fall2002/
4. [www.nptel.ac.in/operating systems.](http://www.nptel.ac.in/operating%20systems)
5. <http://172.16.25.76/course/view.php?id=1906>

21ADU304A**Programming in Python****Semester – III****3H – 3C****Instruction Hours / week: L: 3 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

- To Learn Syntax and Semantics of Python
- To create Functions in Python.
- To Understand the basic logic statements in Python
- To Handle Strings in Python.
- To Understand Lists, Dictionaries in Python.
- To Build GUI applications

Course Outcomes (COs)

Upon completion of this the course students will be able to:

1. Develop algorithmic solutions to simple computational problems
2. Structure simple Python programs for solving problems.
3. Learn to use logical constructs in Python
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries.
6. Read and write data from/to files in Python Programs.

Unit I - Algorithmic Problem Solving

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

Unit II - Data, Expressions, Statements

Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Unit III -Control Flow, Functions

Conditionals-Boolean values and operators, conditional (if), alternative (if-else), chained-conditional (if-else if-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Unit IV -Lists, Tuples, Dictionaries

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods;

advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

Unit V - Files, Modules, Packages

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

Suggested Readings

1. Allen B. Downey, (2016). Think Python: How to Think Like a Computer Scientist, 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers.
2. Charles Dierbach, (2013). Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition.
3. John V Guttag. (2013). Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press
4. Guido van Rossum and Fred L. Drake Jr, (2011). An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.

Websites

1. <http://docs.python.org/3/tutorial/index.html>.
2. <http://interactivepython.org/courselib/static/pythonds>.
3. <http://www.ibiblio.org/g2swap/byteofpython/read/>.

21ADU304B**PHP Programming****Semester – III****3H – 3C**

Instruction Hours / week: L: 3 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours**Course Objectives**

- To write basic PHP syntax using various operators.
- To write PHP scripts to handle HTML forms.
- To analyze different tasks using PHP functions.
- To understand the regular expressions in PHP.
- To learn array data structure using PHP scripts.
- To work with open-source applications that deal with database and website development.

Course Outcomes (COs)

Upon completion of this course, students will be able to:

1. Write PHP scripts using operators to perform various functions
2. Design PHP scripts to handle HTML forms.
3. Implement different types of PHP functions.
4. Write regular expressions including modifiers, operators, and metacharacters.
5. Create PHP scripts using array.
6. Develop dynamic web pages.

Unit I -Introduction to PHP

PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.) -PHP with other technologies, scope of PHP -Basic Syntax, PHP variables and constants -Types of data in PHP, Expressions, scopes of a variable (local, global)- PHP Operators: Arithmetic, Assignment, Relational, Logical operators, Bitwise, ternary and MOD operator-PHP operator Precedence and associativity

Unit II -Handling HTML form with PHP

Capturing Form Data-GET and POST form methods-Dealing with multi value fields Redirecting a form after submission -**PHP conditional events and Loops:** PHP IF Else conditional statements (Nested IF and Else) -Switch case, while, For and Do While Loop -Goto, Break, Continue and exit

Unit III -PHP Functions

Function, Need of Function, declaration and calling of a function -PHP Function with arguments, Default Arguments in Function -Function argument with call by value, call by reference -Scope of Function Global and Local

Unit IV -String Manipulation and Regular Expression

Creating and accessing String, Searching & Replacing String -Formatting, joining and splitting String, String Related Library functions-Use and advantage of regular expression over inbuilt function -Use of preg_match(), preg_replace(), preg_split()-functions in regular expression

Unit V -Array

Anatomy of an Array, Creating index based and Associative array, Accessing array-Looping with Index based array, with associative array using each() and foreach()-Some useful Library function

Suggested Readings

1. David Sklar, Adam Trachtenberg. (2014). PHP Cookbook: Solutions & Examples for PHP.
2. Robin Nixon. (2014). Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition, O'reilly.
3. Luke Welling, Laura Thompson. (2008). PHP and MySQL Web Development, 4th Edition, Addition Paperback, Addison-Wesley Professional.
4. Timothy Boronczyk, Martin E. Psinas. (2008). PHP and MYSQL, Wiley India Private Limited.
5. Steven Holzner. (2007). PHP: The Complete Reference, McGraw Hill Education (India).

Websites

1. www.php.net/
2. en.wikipedia.org/wiki/PHP
3. www.w3schools.com/PHP/default.asp
4. http://www.nptelvideos.com/php/php_video_tutorials.php
5. <http://172.16.25.76/course/view.php?id=1839>

21ADU311**Data Structures - Practical****Semester – III
4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To understand the fundamental concepts of data structures
- To Learn linear data structures – lists, stacks, and queues
- To apply Tree and Graph structures
- To understand sorting, searching and hashing algorithms
- To develop application using data structures
- To choose appropriate data structures and algorithms for problem solving.

Course Outcomes (COs)

Upon completion of this course, the student will be able to:

1. Implement abstract data types for linear data structures.
2. Apply the different linear and non-linear data structures to problem solutions.
3. Analyze the applications of tree.
4. Implement graph theory over various data structures.
5. Critically analyze the various sorting algorithms.
6. Apply hashing technique for various applications.

List of Programs

1. Write a program to search an element from a list. Give user the option to perform Linear and Binary search.
2. Give user the option to perform sorting using Insertion sort, Bubble sort and Selection sort.
3. Implement singly Linked List Include functions for insertion, deletion and search of a number, reverse the list.
5. Perform Stack operations using Linked List implementation.
6. Perform Stack operations using Array implementation.
7. Perform Queues operations using Array implementation.
7. Perform Queues operations using Linked List.
8. WAP to scan a polynomial using linked list and add two polynomial.
9. WAP to create a Binary Search Tree and include following operations in tree:
 - (a) Insertion
 - (b) Deletion
 - (c) Search a no. in BST
10. Program to implement Graph Traversal Techniques.

Suggested Readings

1. R. S. Salaria (2018). Data Structures and Algorithms using C, 5th Edition, Khanna Publishing.
2. Goodrich, M., & Tamassia, R. (2013). Data Structures and Algorithms Analysis in Java 4th Edition, Wiley.
3. Reema Thareja. (2011). Data Structures Using C++, 2nd Edition, Oxford University Press.
4. Mark Allen Weiss. (2011). Data Structures and Algorithms Analysis in Java, 3rd Edition, Pearson Education.

5. Sartaj Sahni. (2011). Data Structures, Algorithms and applications in C++ ,2nd Edition, Universities Press
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein. (2002). Introduction to Algorithms, 2nd Edition, Mcgraw Hill

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1. http://en.wikipedia.org/wiki/Data_structure
2. <http://www.cs.sunysb.edu/~skiena/214/lectures/>
3. www.amazon.com/Teach-Yourself-Structures-Algorithms

21ADU312**Fundamentals of Data Science using R - Practical****Semester – III****4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

The goal of this course is for the students

- To study the basic concepts of Data Science and data life cycle.
- To understand the theoretical and mathematical aspects of Data Science models.
- To learn common random variables and their uses, and with the use of empirical distributions.
- To obtain the knowledge in data management tools.
- To explore the major techniques for data science.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Understand the key concepts in data science, including tools and approaches.
2. Understand the concepts in data collection, sampling and probabilistic models
3. Understand the various techniques in data science
4. Apply the mathematical formulation of machine learning and statistical models to visualize the data in various methods.
5. Apply a suitable data science technique to solve an information analytics problem.

List of Programs

1. Matrix manipulations.
2. Creating and manipulating a List and an Array.
3. Manipulation of vectors and matrix.
4. Operators on Factors in R
5. Working with looping statements.
6. Find subset of dataset by using subset (), aggregate () functions on iris dataset
7. Find the data distributions using box and scatter plot.
8. Find the correlation matrix and plot the correlation plot on dataset and visualize it

Suggested Readings

1. Saltz Jeffrey S. (2019). An Introduction to Data Science, 2nd Edition, Sage Publications.
2. Peter Bruce & Andrew Bruce. (2017). Practical Statistics for Data Scientists, 1st Edition, O'Reilly Publication.
3. Murtaza Haider. (2015). Getting Started with Data Science: Making Sense of Data with Analytics, 1st Edition, IBM Press.
4. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data. (2014). A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition, John Wiley & Son Publication.
5. Dawn Griffiths. (2008). Head First Statistics, 1st Edition, O'Reilly Publication

Websites

1. <https://www.inferentialthinking.com/chapters/intro>
2. <https://www.openintro.org/stat/>
3. https://swayam.gov.in/nd1_noc20_cs36/preview
4. https://swayam.gov.in/nd1_noc19_cs60/preview
5. [https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/60002 - introduction-to-computational-thinking-and-data-science-fall-2016/](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/60002-introduction-to-computational-thinking-and-data-science-fall-2016/)

21ADU313**Operating Systems -Practical****Semester – III
4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100****End Semester Exam: 3 Hours****Course Objectives**

- To understand the main components of an OS & their functions.
- To study the process management and scheduling.
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC. To understand the concepts and implementation Memory management policies and virtual memory.
- To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS
- To study the need for special purpose operating system with the advent of new emerging technologies
- To implement the scheduling and process management algorithms.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Perform the role of operating system in their management policies and algorithms.
2. Understand the process management policies and scheduling of processes by CPU
3. Evaluate the requirement for process synchronization and coordination handled by operating system
4. Describe and analyze the memory management and its allocation policies.
5. Identify use and evaluate the storage management policies with respect to different storage management technologies.
6. Identify the need to create the special purpose operating system.

List of Programs

1. Write a program (using fork() and/or exec() commands) where parent and child execute:
 - a) same program, same code.
 - b) same program, different code.
 - c) before terminating, the parent waits for the child to finish its task.
2. Write a program to report behaviour of Linux kernel including kernel version, CPU type and model. (CPU information)
3. Write a program to report behaviour of Linux kernel including information on configured memory, amount of free and used memory. (memory information)
4. Write a program to print file details including owner access permissions, file access time, where file name is given as argument.
5. Write a program to copy files using system calls.
6. Write program to implement FCFS scheduling algorithm.
7. Write program to implement Round Robin scheduling algorithm.
8. Write program to implement SJF scheduling algorithm.
9. Write program to implement non-preemptive priority based scheduling algorithm.
10. Write program to implement preemptive priority based scheduling algorithm.
11. Write program to implement SRJF scheduling algorithm.

12. Write program to calculate sum of n numbers using thread library.
13. Write a program to implement first-fit, best-fit and worst-fit allocation strategies.

Suggested Readings

1. Silberschatz, A., Galvin, P.B., & Gagne, G. (2018). Operating Systems Concepts, 10th Edition. New Delhi: John Wiley Publications.
2. Stallings, W. (2013). Operating Systems, Internals & Design Principles, 7th Edition, New Delhi: Prentice Hall of India.
3. Jose M Garrido, Richard Schlesinger Kenneth Hoganson. (2013). Principles of Modern Operating Systems, 2nd Edition, Library of Congress Cataloging-in-Publication Data.

Web Sites

1. www.cs.columbia.edu/~nieh/teaching/e6118_s00/
2. www.clarkson.edu/~jnm/cs644
3. pages.cs.wisc.edu/~remzi/Classes/736/Fall2002/

21ADU314A**Programming in Python – Practical****Semester – III
3H – 1C****Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To Learn Syntax and Semantics of Python
- To create Functions in Python.
- To Understand the basic logic statements in Python
- To Handle Strings in Python.
- To Understand Lists, Dictionaries in Python.
- To Build GUI applications

Course Outcomes (COs)

Upon completion of this the course students will be able to:

1. Develop algorithmic solutions to simple computational problems
2. Structure simple Python programs for solving problems.
3. Learn to use logical constructs in Python
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries.
6. Read and write data from/to files in Python Programs.

List of programs

1. Find the maximum of a list of numbers
2. Linear search and Binary search
3. Selection sort, Insertion sort
4. Merge sort
5. First n prime numbers
6. Multiply matrices
7. Programs that take command line arguments (word count)
8. Find the most frequent words in a text read from a file
9. Simulate elliptical orbits in Pygame
10. Simulate bouncing ball using Pygame

Suggested Readings

1. Allen B. Downey, (2016). Think Python: How to Think Like a Computer Scientist, 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers.
2. Charles Dierbach, (2013). Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition.
3. John V Guttag. (2013). Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press
4. Guido van Rossum and Fred L. Drake Jr, (2011). An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.

Websites

1. <http://docs.python.org/3/tutorial/index.html>.
2. <http://interactivepython.org/courselib/static/pythonds>.
3. <http://www.ibiblio.org/g2swap/byteofpython/read/>.

21ADU314A**PHP Programming- Practical****Semester – III
3H – 1C****Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To write basic PHP syntax using various operators.
- To write PHP scripts to handle HTML forms.
- To analyze different tasks using PHP functions.
- To understand the regular expressions in PHP.
- To learn array data structure using PHP scripts.
- To work with open source applications that deal with database and website development.

Course Outcomes (COs)

Upon completion of this course, students will be able to:

1. Write PHP scripts using operators to perform various functions
2. Design PHP scripts to handle HTML forms.
3. Implement different types of PHP functions.
4. Write regular expressions including modifiers, operators, and metacharacters.
5. Create PHP scripts using array.
6. Develop dynamic web pages.

List of Programs

1. Write a PHP program that will use the concept of form.
2. Write a PHP program to read the employee detail using Form Component.
3. Write a PHP program to demonstrate the use of Array.
4. Write a PHP program to prepare the student mark sheet using Switch statement
5. Write a PHP program to generate the Multiplication of Matrix.

Suggested Readings

1. David Sklar, Adam Trachtenberg. (2014). PHP Cookbook: Solutions & Examples for PHP.
2. Robin Nixon. (2014). Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition, O'reilly.
3. Luke Welling, Laura Thompson. (2008). PHP and MySQL Web Development, 4th Edition, Addition Paperback, Addison-Wesley Professional.
4. Timothy Boronczyk, Martin E. Psinas. (2008). PHP and MYSQL, Wiley India Private Limited.
5. Steven Holzner. (2007). PHP: The Complete Reference, McGraw Hill Education (India).

21ADU401**Data Communication and Networks****Semester – IV
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal : 40 External : 60 Total: 100
End Semester Exam : 3 Hours****Course Objectives**

- To study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.
- To read the fundamentals and basics concepts of Physical layer with real time examples
- To study data link layer concepts, design issues, and protocols.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer and Application layer.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Understand the functions of each layer in OSI and TCP/IP model.
2. Explain the multiplexing, switching concept and types of transmission media with real time examples.
3. Understand the error detection and can implement the data link layer protocols
4. Learn different medium access method to avoid collision and to learn about routing table.
5. Learn basic functionalities of transport layer and application layer.
6. Understand the error correction methods and can implement the data link layer protocols

Unit I -Introduction to Data Communication

An Overview – Data Communication – Network – The Internet - Protocols and Standards. Network Models: Layered Task - The OSI Model and Layers – TCP/IP Protocol Suite – Addressing. **Physical Layer:** Analog and Digital Signals – Periodic and Non-Periodic Signals - Transmission Impairments - Performance.

Unit II - Physical Layer

Analog to Digital conversion - digital to analog conversion – Transmission Modes;; multiplexing techniques- Frequency Division Multiplexing –Wavelength Division Multiplexing – Time division Multiplexing. Transmission media: Guided Media – Unguided Media. **Switching:** Circuit-switched Networks – Datagram Network – Virtual-Circuit Networks.

Unit III -Data Link Layer

Error detection and error correction - data-link control- framing- flow and error control – protocols –Noisy channels: Simplest Protocol – Stop-and-Wait Protocol; and Noiseless Channels: Stop-and-Wait Protocol ARQ – Go-Back-N Automatic repeat request – Selective Repeat Automatic Repeat Request – Piggybacking.

Unit IV -Multiple Access Protocol

Random Access : Aloha – CSMA – CSMA/CD – CSMA/CA – Controlled Access: Reservation – Polling – Token Passing. **Networks Layer:** IPv6 Address -Delivery-Forwarding- **Unicast routing protocols:** Intra- and Inter domain Routing -Distance Vector Routing-Link state Routing- Path Vector Routing – Multicast Routing.

Unit V -Transport Layer

Process-to-Process Delivery: Connectionless versus Connection-oriented Service – Reliable versus unreliable – User datagram protocol –Transmission control Protocol. Congestion control and Quality of service: Data Traffic – Congestion Control – Techniques to improve QoS..

Application layer: Domain Name Space – E-Mail- FTP- WWW- HTTP.

Suggested Readings

1. Forouzan,B. A. (2017). Data Communications and Networking ,5thedition, .New Delhi: THM.
2. Alberto Leon-Garcia, Indra Widjaja (2017). Communication Network, 2nd Edition. Mc Graw Hill education.
3. Tanenbaum, A. S. (2012). Computer Networks, 5thedition, PHI.
4. Sathish Jain, Madhulika Jain, Vineeta Pillai, Kratika. (2010). A Level Data Communication & Network Technologies, BPB publication.
5. Wayne Tomasi. (2007). Introduction to Data Communications and Networking, 1st Edition, Pearson

Websites

1. http://docwiki.cisco.com/wiki/Introduction_to_WAN_Technologies
2. www.yale.edu/pclt/COMM/TCPIP.HTM
3. www.w3schools.com/tcpip/default.asp
4. <http://www.engppt.com/2009/12/networking-fourouzan-ppt-slides.html>
5. <http://citengg.blogspot.com/p/behrouz-forouzancomputer-networks4th.html>
6. http://www.crectirupati.com/sites/default/files/lecture_notes/DCN%20NOTES.pdf
7. <https://nptel.ac.in/courses/106105183/>
8. <http://172.16.25.76/course/view.php?id=1831>

21ADU402**Relational Database Management Systems****Semester – IV
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To understand the role and nature of relational database management systems (RDBMS) in today's IT environment.
- To understand need for normalization.
- To convert conceptual data models into relational database schemas using the SQL Data Definition Language (DDL).
- Query and manipulate databases using the SQL Data Manipulation Language (DML).
- To acquire Programming and Software Engineering skills and techniques using SQL and PL/SQL.
- To create PL/SQL applications.

Course Outcomes (COs)

1. Enhance the knowledge and understanding of Database analysis and design.
2. Enhance the knowledge of the processes of Database Development and Administration using SQL and PL/SQL.
3. Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.
4. Use the PL/SQL code constructs of IF-THEN-ELSE and LOOP types as well as syntax and command functions.
5. Solve Database problems using Oracle SQL and PL/SQL.
6. Effective use of Procedures, Functions, Packages, and Triggers.

Unit I- Database Concepts-A Relational Approach

Introduction to DBMS – Information-Data and Data Management-File-based data management – Database System - DBMS - Components of a DBMS. **Database Design:** Data Models-Introduction-Conceptual, Physical Models-Hierarchical Model - Network Model-Relational Model – E-R Model -Dependency - Normal forms - Dependency diagrams - Denormalization

Unit II -Structured Query Language (SQL)

Introduction – DDL - Naming rules and conventions - Data types-Constraints-Creating a table- Displaying table information - Altering an existing table – Dropping, renaming, and truncating table - Table types

Unit III -Working with Tables

DML - Adding a new Row/Record - Customized prompts - Updating and deleting an existing rows/record - Retrieving data from table - Arithmetic operations - Restricting data with WHERE clause - Sorting - Substitution variables - DEFINE command - CASE structure. **Functions and Grouping:** Built-in functions - Grouping data. **Joins and Views:** Join - join types-**Views:** Views - Creating a view - Removing a view - Altering a view

Unit IV- PL/SQL

Fundamentals - Block structure - comments - Data types – Other data types - Variable declaration - Assignment operation - Bind variables - Substitution variables - Printing. **Control Structures and Embedded SQL:** Control structures - Nested blocks - SQL in PL/SQL - Data manipulation - Transaction control statements

Unit V-PL/SQL Cursors and Exceptions

Cursors - Implicit & explicit cursors and attributes - cursor FOR loops - SELECT...FOR UPDATE - WHERE CURRENT OF Clause - cursor with parameters - Cursor variables - Exceptions - Types of exceptions - Records - Tables -Procedures -Functions-Triggers

Suggested Readings

1. Elmasri, R., & Navathe, S.B. (2016). Database Systems Models, Languages, Design and application Programming ,7th Edition, Pearson Education.
2. Steven Feuerstein., & Bill Pribyl. (2014). Oracle PL/SQL Programming 7th Edition O'Reilly Media
3. Silberschatz, A., Korth, H.F., & Sudarshan, S. (2013). Database System Concepts, 6th Edition, Tata McGraw-Hill
4. Nilesh Shah. (2004). Database Systems Using ORACLE, 2nd Edition, PHI.

Websites

1. <https://www.datanamic.com/support/lt-dez005-introduction-db-modeling.html>
2. https://docs.oracle.com/cd/B12037_01/server.101/b10759/statements_1001.htm
3. <https://www.geeksforgeeks.org/sql-ddl-dml-dcl-tcl-commands/>
4. <https://www.javatpoint.com/oracle-create-table>
5. <https://www.tutorialspoint.com/plsql/>

21ADU403**Fundamentals of Artificial Intelligence****Semester – IV
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To gain a historical perspective of AI and its foundations.
- To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- To investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- To experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
- To experiment with a machine learning model for simulation and analysis.
- To explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcomes (COs)

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
5. Demonstrate proficiency in applying scientific method to models of machine learning.
6. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Unit I -Introduction to AI

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

Unit II - Advanced Search

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

Unit III- Advanced Knowledge Representation and Reasoning

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Nonmonotonic Reasoning, Other Knowledge Representation Schemes Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

Unit IV- Learning

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

Unit V- Expert Systems

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

Suggested Readings

1. Kevin Night and Elaine Rich, Nair B. (2017). Artificial Intelligence (SIE), Mc Graw Hill.
2. Deepak Khemani. (2013). Artificial Intelligence, Tata Mc Graw Hill Education.
3. Russell, S. and Norvig, P. (2010). Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall.
4. Russell, S. and Norvig, P. (2010). Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall.
5. George F. Luger. (2009). Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th Edition, Pearson Education.
6. Dan W. Patterson. (2007). Introduction to AI and ES, Pearson Education.
7. Peter Jackson. (2007). Introduction to Expert Systems, 3rd Edition, Pearson Education

Websites

1. <https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-artificial-intelligence>
2. <https://news.microsoft.com/wp-content/uploads/prod/sites/93/2020/04/Student-Guide-Module-1-Fundamentals-of-AI.pdf>
3. <https://www.ics.uci.edu/~dechter/courses/ics-171/fall-06/lecture-notes/intro-class.ppt>
4. <https://nptel.ac.in/courses/112/103/112103280/>
5. <https://study.com/academy/topic/fundamentals-of-artificial-intelligence.html>

21ADU404A**Cloud Computing Techniques****Semester – IV
3H – 3C****Instruction Hours / week: L: 3 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

- To Provide a good understanding of the concepts, standards in Cloud computing
- To make the student understand about the cloud service providers and their usage.
- To learn how to secure the data in cloud depending.
- To understand the various service level agreements.
- To understand the cloud using various case studies.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Portray the recent trends in the field of cloud computing.
2. know the architecture of the cloud and the usage of clouds.
3. secure their data from the security issues.
4. make the students to work based on the various service level agreements.
5. work with the traditional cloud and Microsoft azure, etc.
6. Providing exposures to some open source and commercial clouds.

Unit I - Overview of Computing Paradigm

Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. **Introduction to Cloud Computing:** Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing.

Unit II - Cloud Computing Architecture

Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models- Infrastructure as a Service (IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), How Cloud Computing Works, Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, Case study of NIST architecture.

Unit III - Cloud Security

Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in cloud computing.

Unit IV - Service Management in Cloud Computing

Service Level Agreements, customer SLAs, Enterprise SLAs, and Organization SLAs, Billing & Accounting, Resource management billing, Resource hierarchy in cloud billing, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling, Deployment, security and scalability.

Unit V - Case Studies

Case study of Service model using Google App Engine, Case study of Service model using Microsoft Azure, worker role, web role, virtual machine role, Case study of Service model using Amazon EC2, Case study of Service model using Eucalyptus.

Suggested Readings

1. Barrie Sosinsky. (2019). Cloud Computing Bible. New Delhi: Wiley-India,
2. Thomas Erl, Zaigham Mahmood. (2019). Cloud computing concepts, Technology and Architecture, Prentice Hall
3. Gautam Shroff. (2019). Enterprise Cloud Computing Technology Architecture Applications, 3rd Edition, Cambridge University Press.
4. Nikos Antonopoulos., & Lee Gillam. (2018). Cloud Computing: Principles, Systems and Applications. Springer.
5. Toby Velte., Anthony Velte., & Robert Elsenpeter. (2018). Cloud Computing, A Practical Approach. McGraw Hills.
6. Dimitris, N. Chorafas. (2017). Cloud Computing Strategies. CRC Press.
7. Ronald, L. Krutz., & Russell Dean Vines. (2016). Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India.
8. Rajkumar Buyya., James Broberg., & Andrzej, M. Goscinski. (2011). Cloud Computing: Principles and Paradigms, 1st Edition, Wiley.

Websites

1. [wikipedia.org/wiki/Cloud_computing](https://www.wikipedia.org/wiki/Cloud_computing)
2. www.ibm.com/cloud-computing/in/en/
3. www.oracle.com/CloudComputing
4. www.microsoft.com/en-us/cloud/default.aspx
5. <https://nptel.ac.in/courses/106105167/>
6. <http://172.16.25.76/course/view.php?id=1785>

21ADU404B	Mobile and Pervasive Computing	Semester – IV
		3H – 3C
Instruction Hours / week: L: 3 T: 0 P: 0		Marks: Internal: 40 External: 60 Total: 100
		End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for the students:

- To provide guidelines, design principles and experience in developing wireless communication.
- To develop an appreciation of interaction modalities with small, mobile devices through the implementation of Wireless LAN.
- To introduce wireless communication and networking principles, that support mobile network, connectivity to cellular networks, wireless internet and sensor devices and application Layer.
- To understand the concept of pervasive computing basics.
- To enhance the knowledge of device technology.
- To explore and obtain awareness on the state-of-the art of research in pervasive computing

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Define, understand the basic concepts modulation types and overview of networks.
2. Apply computing services in Bluetooth and Ethernet.
3. Analyze routing techniques of mobile computing architecture
4. Understand the general issues in pervasive computing.
5. Understand the Web architectures
6. Explore and obtain awareness on the state-of-the art of research in pervasive computing.

Unit I- Introduction to Wireless transmission

Introduction – Wireless transmission – Multiplexing – Modulations – Types of modulation – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular wireless networks – Overview of GSM–GPRS –Satellite networks –Broadcast systems.

Unit II- Wireless LAN

Wireless LAN – IEEE 802.11 – Architecture – Services – MAC – Physical layer – IEEE 802.11a –802.11b standards – HIPERLAN – Bluetooth – Zigbee – PAN

Unit III- Mobile IP

Mobile IP – Dynamic host configuration protocol – Routing – DSDV – DSR – Multicast routing.

Unit IV- Transport and Application Layers

Mobile TCP– WAP – Architecture – WWW Programming Model– WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML – WML Scripts.

Unit V- Pervasive Computing

Pervasive computing infrastructure-applications- Device Technology - Hardware, Human-machine Interfaces, Biometrics, and Operating systems– Device Connectivity – Protocols, Security, and Device Management- Pervasive Web Application architecture- Access from PCs and PDAs - Access via WAP

Suggested Readings

1. Stephen A Rackley. (2011). Wireless Networking Technology: From Principles to Successful Implementation, 1st Edition, Newnes.
2. Jochen Schiller. (2009). Mobile Communications, 2nd Edition, Pearson Education.
3. Jochen Burkhardt, Horst Henn, Klaus Rintdorff and Thomas Schaeck. (2009). Pervasive Computing: Technology and Architecture of internet Applications, 6th Edition, Pearson Education.
4. William Stallings. (2009). Wireless Communications and Networks, 2nd Edition, Pearson Education.
5. Adelstein F, Sandeep K S. Gupta and Loren Schwiebert. (2008). Fundamentals of Mobile and Pervasive Computing, 4th Edition, Tata McGraw-Hill.
6. Krzysztof Wesolowski, (2007). Mobile Communications System, 2nd Edition, John Wiley.

Websites:

1. www.disco.ethz.ch/lectures/ss04/mobicomp/lecture/1/Chapter1Introduction4Slides.pdf
2. www.icta.ufl.edu/books.htm
3. www.cise.ufl.edu/class/cen5531fa06/notes/intro-mobilecomputing.pdf
4. www.bnrg.eecs.berkeley.edu/~randy/Courses/CS294.S96/CS
5. www.tutorialspoint.com/mobile_computing/mobile_computing_quick_guide.html

21ADU411**Data Communication and Networks - Practical****Semester – IV
4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal : 40 External : 60 Total: 100
End Semester Exam : 3 Hours****Course Objectives**

- To design and implement error detection algorithm
- Understand the basic concepts of cyclic codes, and explain how cyclic redundancy check works.
- Understand the concept of Routing algorithm to find shortest path using Distance vector algorithm
- To learn data link layer concepts, design issues, and protocols.
- To learn the functions of network layer and the various routing protocols.
- To effectively simulate the protocols using programming languages.

Course Outcomes (COs)

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

1. Build a program to implement error detection algorithm.
2. Develop a program to implement stop and wait protocol, go back N protocol and selective repeat sliding window protocol.
3. Simulate and build a program to implement routing protocol.
4. Understand the error detection and correction methods and can implement the data link layer protocols
5. Learn different medium access method to avoid collision and to learn about routing table.
6. Simulate the protocols using programming languages

List of Programs

1. Simulate Cyclic Redundancy Check (CRC) error detection algorithm for noisy channel.
2. Simulate and implement stop and wait protocol for noisy channel.
3. Simulate and implement go back n sliding window protocol.
4. Simulate and implement selective repeat sliding window protocol.
5. Simulate and implement distance vector routing algorithm
6. Simulate and implement Dijkstra algorithm for shortest path routing.

Suggested Readings

1. Forouzan, B. A. (2017). Data Communications and Networking ,5thedition, .New Delhi: THM.
2. Alberto Leon-Garcia, Indra Widjaja (2017). Communication Network, 2nd Edition. Mc Graw Hill education.
3. Tanenbaum, A. S. (2012). Computer Networks, 5thedition, PHI.
4. Sathish Jain, Madhulika Jain, Vineeta Pillai, Kratika. (2010). A Level Data Communication & Network Technologies, BPB publication.
5. Wayne Tomasi. (2007). Introduction to Data Communications and Networking, 1st Edition, Pearson

Web Sites

1. <https://forgetcode.com/c/1203-crc-generation-in-computer-networks>
2. <https://gist.github.com/ankurdinge/1202643>

3. <https://www.geeksforgeeks.org/>
4. <https://www.thelearningpoint.net/computer-science/c-program>
5. www.w3schools.com/tcpip/default.asp
6. <http://172.16.25.76/course/view.php?id=1835>

21ADU412**Relational Database Management Systems - Practical****Semester – IV****4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

- To understand the role and nature of relational database management systems (RDBMS) in today's IT environment.
- To understand need for normalization.
- To convert conceptual data models into relational database schemas using the SQL Data Definition Language (DDL).
- Query and manipulate databases using the SQL Data Manipulation Language (DML).
- To acquire Programming and Software Engineering skills and techniques using SQL and PL/SQL.
- To create PL/SQL applications.

Course Outcomes(COs)

1. Enhance the knowledge and understanding of Database analysis and design.
2. Enhance the knowledge of the processes of Database Development and Administration using SQL and PL/SQL.
3. Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.
4. Use the PL/SQL code constructs of IF-THEN-ELSE and LOOP types as well as syntax and command functions.
5. Solve Database problems using Oracle SQL and PL/SQL.
6. Effective use of Procedures, Functions, Packages, and Triggers.

List of programs**[SQL COMMANDS]**

- 1) SQL* formatting commands
- 2) To create a table, alter and drop table.
- 3) To perform select, update, insert and delete operation in a table.
- 4) To make use of different clauses viz where, group by, having, order by, union and intersection,
- 5) To study different constraints.

[SQL FUNCTION]

- 6) To use oracle function viz aggregate, numeric, conversion, string function.
- 7) To understand use and working with joins.
- 8) To make use of transaction control statement viz rollback, commit and save point.
- 9) To make views of a table.
- 10) To make indexes of a table.

[PL/SQL]

- 11) To understand working with PL/SQL
- 12) To implement Cursor on a table.
- 13) To implement trigger on a table

Suggested Readings

1. Elmasri, R., & Navathe, S.B. (2016). Database Systems Models, Languages, Design and application Programming ,7th Edition, Pearson Education.
2. Steven Feuerstein., & Bill Pribyl. (2014). Oracle PL/SQL Programming 7th Edition O'Reilly Media
3. Silberschatz, A., Korth, H.F., & Sudarshan, S. (2013). Database System Concepts, 6th Edition, Tata McGraw-Hill
4. Nilesch Shah. (2004). Database Systems Using ORACLE, 2nd Edition, PHI.

Websites

1. <https://www.datanamic.com/support/lt-dez005-introduction-db-modeling.html>
2. https://docs.oracle.com/cd/B12037_01/server.101/b10759/statements_1001.htm
3. <https://www.geeksforgeeks.org/sql-ddl-dml-dcl-tcl-commands/>
4. <https://www.javatpoint.com/oracle-create-table>
5. <https://www.tutorialspoint.com/plsql/>

21ADU413**Fundamentals of Artificial Intelligence - Practical****Semester – IV
4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To gain a historical perspective of AI and its foundations.
- To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- To investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- To experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
- To experiment with a machine learning model for simulation and analysis.
- To explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcomes (COs)

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
5. Demonstrate proficiency in applying scientific method to models of machine learning.
6. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

List of Programs

Write the following programs using PROLOG

1. Program to read address of a person using compound variable.
2. Program of fun to show concept of cut operator.
3. Program to count number of elements in a list.
4. Program to find member of a set.
5. Program to concatenate two sets.
6. Program to find permutation of a set.
7. Program to demonstrate family relationship.
8. Write a program to solve NQueens problem
9. Solve any problem using depth first search.
10. Solve any problem using best first search.
11. Solve traveling salesman problem.

Suggested Readings

1. Kevin Night and Elaine Rich, Nair B. (2017). Artificial Intelligence (SIE), Mc Graw Hill.
2. Deepak Khemani. (2013). Artificial Intelligence, Tata Mc Graw Hill Education.
3. Ivan Brako, (2011). PROLOG: Programming for Artificial Intelligence, 3rd Edition Pearson.

4. Russell, S. and Norvig, P. (2010). Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall.
5. George F. Luger. (2009). Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th Edition, Pearson Education.
6. Dan W. Patterson. (2007). Introduction to AI and ES, Pearson Education.
7. Peter Jackson. (2007). Introduction to Expert Systems, 3rd Edition, Pearson Education.

Web Sites

1. <https://nptel.ac.in/courses/106/105/106105077/>
2. <https://www.swi-prolog.org/>
3. <https://www.geeksforgeeks.org/prolog-an-introduction/>
4. https://www.tutorialspoint.com/prolog/prolog_introduction.htm
5. <https://www.javatpoint.com/prolog>
6. <https://www.tutorialride.com/artificial-intelligence/prolog-in-ai.htm>

21ADU414A**Cloud Computing Techniques-Practical****Semester – IV
3H – 1C****Instruction Hours / week: L: T: 0 P: 3 Marks: Internal : 40 External : 60 Total: 100
End Semester Exam : 3 Hours****Course Objectives**

- To Provide a good understanding of the concepts, standards and protocols in Cloud computing
- To make them understand to work on virtual machines on different platform.
- To enable them to work on different tools used in cloud.
- To make them understand the concept on sharing the data and their storage in cloud.
- To make them explore the different types of cloud my making them work in it.
- To familiarize various cloud computing platforms like Amazon, Google and Microsoft.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Portray the recent trends in the field of cloud computing
2. Provide exposures to some open source and commercial clouds.
3. Enable the students to work on different platforms and to access them.
4. Work on the virtual machines will know the usage of the clouds.
5. Secure the data and give the finest band width of their service to the customer.
6. Explore various cloud computing platforms like Amazon, Google and Microsoft.

List of Programs

1. Install Virtualbox/VMware Workstation with different flavours of Linux or windows OS on top of windows8 or 10.
2. Install a C compiler in the virtual machine created using virtual box and execute SimplePrograms
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using try stack (Online Open stack Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

Suggested Readings

1. Barrie Sosinsky. (2019). Cloud Computing Bible. New Delhi: Wiley-India,
2. Thomas Erl, Zaigham Mahmood (2019). Cloud computing concepts, Technology and Architecture, Prentice Hall
3. Rajkumar Buyya., James Broberg., & Andrzej, M. Goscinski Wile. Cloud Computing: Principles and Paradigms.
4. Nikos Antonopoulos., & Lee Gillam. (2018). Cloud Computing: Principles, Systems and Applications. Springer.
5. Ronald, L. Krutz., & Russell Dean Vines. (2016). Cloud Security: A Comprehensive Guide to Secure Cloud Computing. New Delhi: Wiley-India.

6. Gautam Shroff. (2019).Enterprise Cloud Computing Technology Architecture Applications. Adobe Reader ebooks available from eBooks.com.
7. Toby Velte., Anthony Velte., & Robert Elsenpeter.(2018).Cloud Computing, A Practical Approach. McGraw Hills.
8. Dimitris, N. Chorafas.(2017).Cloud Computing Strategies. CRC Press.

Websites

1. [wikipedia.org/wiki/Cloud_computing](https://www.wikipedia.org/wiki/Cloud_computing)
2. www.ibm.com/cloud-computing/in/en/
3. www.oracle.com/CloudComputing
4. www.microsoft.com/en-us/cloud/default.aspx
5. <https://nptel.ac.in/courses/106105167/>
6. <http://172.16.25.76/course/view.php?id=1785>

21ADU414B	Mobile and Pervasive Computing-Practical	Semester – IV
		3H – 1C
Instruction Hours / week: L: 0 T: 0 P: 3		Marks: Internal: 40 External: 60 Total: 100
		End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for the students:

- To provide guidelines, design principles and experience in developing wireless communication.
- To develop an appreciation of interaction modalities with small, mobile devices through the implementation of Wireless LAN.
- To introduce wireless communication and networking principles, that support mobile network, connectivity to cellular networks, wireless internet and sensor devices and application Layer.
- To understand the concept of pervasive computing basics.
- To enhance the knowledge of device technology.
- To explore and obtain awareness on the state-of-the art of research in pervasive computing

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Define, understand the basic concepts modulation types and overview of networks.
2. Apply computing services in Bluetooth and Ethernet.
3. Analyze routing techniques of mobile computing architecture
4. Understand the general issues in pervasive computing.
5. Understand the Web architectures
6. Explore and obtain awareness on the state-of-the art of research in pervasive computing.

List of Programs:

1. To create WLAN of at least five wireless devices using any simulation tool (e.g. packettracer).
2. To setup a WLAN using access point.
3. To transfer data between two wireless devices (e.g. PC-PC, PC-Smart phone)
4. Write a program that identifies the bluetooth devices in the wireless range.
5. Write a program that prints the signal strength of WiFi connection of the given computer.
6. Write a program to find hamming distance. For example Hamming distance $d(v_1, v_2) = 3$ if $v_1 = 011011, v_2 = 110001$.
7. Write a program to perform Bluetooth file transfer.
8. Develop an android app which displays “Hello, welcome to Android Lab” message
9. Using Android, Create a login Activity. It asks “username” and “password” from user. If username and password are valid, it displays Welcome message using new activity.
10. Develop calculator Android Application.

Suggested Readings:

1. Meier, R., Lake, I. (2018). Professional Android. United States: Wiley.
2. Stephen A Rackley. (2011). Wireless Networking Technology: From Principles to Successful Implementation, 1st Edition, Newnes.
3. Jochen Schiller. (2009). Mobile Communications, 2nd Edition, Pearson Education.
4. Jochen Burkhardt, Horst Henn, Klaus Rintdorffand Thomas Schaeck. (2009). Pervasive Computing: Technology and Architecture of internet Applications, 6th Edition, Pearson Education.

5. William Stallings. (2009). Wireless Communications and Networks, 2nd Edition, Pearson Education.
6. Adelstein F, Sandeep K S. Gupta and Loren Schwiebert. (2008). Fundamentals of Mobile and Pervasive Computing, 4th Edition, Tata McGraw-Hill.
7. Krzysztof Wesolowski, (2007). Mobile Communications System, 2nd Edition, John Wiley.

Websites:

1. www.disco.ethz.ch/lectures/ss04/mobicomp/lecture/1/Chapter1Introduction4Slides.pdf
2. www.icta.ufl.edu/books.htm
3. www.cise.ufl.edu/class/cen5531fa06/notes/intro-mobilecomputing.pdf
4. www.bnrg.eecs.berkeley.edu/~randy/Courses/CS294.S96/CS
5. www.tutorialspoint.com/mobile_computing/mobile_computing_quick_guide.html
6. <https://developer.android.com/training/basics/firstapp>
7. <http://tutorials.ptnetacad.net/tutorials70.htm>

21ADU501	Advanced Data Science	Semester V
		4H-4C
Instruction Hours/week: L:4 T:0 P:0		Marks: Internal:40 External:60 Total:100
		End Semester Exam:3 Hours

Course Objectives

The goal of this course is for the students:

- To learn the fundamentals of data science and big data.
- To gain in-depth knowledge on descriptive data analytical techniques.
- To gain knowledge to implement simple to complex analytical algorithms in big data frameworks.
- To learn the use of big data processing methods in data science
- To understand and perform data visualization, web scraping and machine learning using various Data Science tools.
- To build data science products that can be used by a broad audience

Course Outcomes (COs)

Upon Completion of this course the students will be able to:

1. Understand the describe the fundamentals of advanced data science
2. Understand about Hadoop file system
3. Apply suitable statistical testing by converting any real-world decision-making problem to hypothesis
4. Analyze various open-source frameworks for modelling and storing data and data analytics methods to choose best approaches.
5. Develop simple applications involving analytics using Hadoop and MapReduce.
6. Build data science products that can be used by a broad audience

Unit I-Data Science Fundamentals

Data Science – Fundamentals and Components – Data Scientist – Terminologies Used in Big Data Environments – Types of Digital Data – Classification of Digital Data – Introduction to Big Data – Characteristics of Data – Evolution of Big Data – Big Data Analytics – Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools. Linear Regression – Polynomial Regression – Multivariate Regression

Unit II- Introduction to Hadoop

Introducing Hadoop –Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce

Unit III -Introduction to NoSQL

Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL).

Unit IV- Introduction to Essential Data Science Packages

Introduction to Essential Data Science Packages: Numpy, Scipy, Jupyter, Statsmodels and Pandas Package – Data Munging: Introduction to Data Munging, Data Pipeline and Machine Learning in Python

Unit V- Data Visualization Using Matplotlib

Data Visualization Using Matplotlib – Interactive Visualization with Advanced Data Learning Representation in Python.

Suggested Readings:

1. Frank Pane. (2017). Hands on Data Science and Python Machine Learning, 1st Edition Packt Publishers.
2. Yuxi (Hayden) Liu. (2017). Python Machine Learning by Example, 2nd Edition, Packt Publication.
3. Alberto Boschetti and Luca Massaron, (2016). Python Data Science Essentials, 2nd Edition, Packt Publishers.
4. Seema Acharya and Subhashini Chellapan. (2015). Big Data and Analytics, 2nd Edition, Wiley Publishers.
5. DT Editorial Services. (2015). Big Data, Black Book, 1st Edition Dream Tech Press.

Websites:

1. www.nptel.ac.in/courses/106/106/106106179/
2. www.nptel.ac.in/courses/106/106/106106212/
3. www.nptel.ac.in/noc/courses/noc17/SEM2/no17-mg24/
4. www.nptel.ac.in/courses/106/104/106104189/
5. www.coursera.org/specializations/advanced-data-science-ibm

21ADU502A**Data Visualization****Semester – V**
4H – 4C**Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

- To know the importance of data Visualization in the world of Data Analytics and Prediction
- To know the important libraries in Tableau
- To get equipped with Tableau Tool
- To create charts using Tableau Tool
- To aggregate data using Tableau Tool
- To visualize data as maps and forecast future data using Tableau Tool

Course Outcomes (COs)

Upon completion of this course students will be able to:

1. Visualize data through seven stages of data analysis process
2. Explore hybrid types of data visualization
3. Understand various stages of visualizing data
4. Create charts using Tableau Tool
5. Aggregate data using Tableau Tool
6. Visualize data as maps and forecast future data using Tableau Tool

Unit I- Creating Visual Analytics with tableau

Creating Visual Analytics with tableau desktop, connecting to your data-How to Connect to your data, What are generated Values? Knowing when to use a direct connection, Joining tables with tableau, blending different data sources in a single worksheet.

Unit II- Building your first Visualization

Building your first Visualization- How Me works- Chart types, Text Tables, Maps, bar chart, Line charts, Area Fill charts and Pie charts, scatter plot, Bullet graph, Gantt charts, Sorting data in tableau, Enhancing Views with filters, sets groups and hierarchies.

Unit III- Creating calculations

Creating calculations to enhance your data- What is aggregation, what are calculated values and table calculations, Using the calculation dialog box to create, Building formulas using table calculations, Using table calculation functions

Unit IV- Using maps to improve insights

Using maps to improve insights-Create a Standard Map View, Plotting your own locations on a map, Replace Tableau's standard maps, Shaping data to enable Point-to-Point mapping.

Unit V- Developing an Adhoc analysis

Developing an Adhoc analysis environment- generating new data with forecasts, providing self-evidence adhoc analysis with parameters, Editing views in tableau Server.

Suggested Readings:

1. Joshua N. Millign. (2019). Learning Tableau ,3rd Edition, Packt publications
2. Daniel G. Murray and the Inter works BI team. (2016). Tableau your data, Wiley Publications.

3. Alexandru C. Telea. (2014). Data Visualization principles and practice, 2nd Edition, CRC Publications
4. Nussbaumer Knaflie (2014). Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole
5. Ashutosh Nandeshwar. (2013). Tableau Data Visualization Cookbook, PACKT publishing.
6. Noah Iliinsky, Julie Steele. (2011). Designing Data Visualizations: Representing Informational Relationships, O'Reilly Media.
7. Hadley Wickham. (2009). ggplot2: Elegant Graphics for Data Analysis, 1st Edition, Springer

Websites

1. <https://www.tableau.com/>
2. <https://www.tutorialspoint.com/tableau/index.htm>
3. <https://www.coursera.org/specializations/data-visualization>
4. <https://towardsdatascience.com/tableau-visualizations>

21ADU502B**Data Mining****Semester – V
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal : 40 External : 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To introduce students to the basic concepts and techniques of Data Mining.
- To understand data mining fundamentals and characterize the kinds of patterns that can be discovered by association rule mining
- To compare and evaluate different data mining techniques like classification, prediction, etc.
- To cluster the high dimensional data for better organization of the data
- To describe complex data types with respect to spatial and web mining
- To design data warehouse with dimensional modelling and apply OLAP operations.

Course Outcomes (COs)

Upon completion of this course students will be able to:

1. Understand the basic concepts and techniques of Data Mining
2. Extract knowledge using data mining techniques and Implement Preprocess the data for mining applications and apply the association rules for mining the data
3. Design and deploy appropriate classification techniques
4. Understand the concept of clustering and its real time applications
5. Explore recent trends in data mining such as web mining, spatial-temporal mining
6. Analyze the basic concepts of data warehouse and OLAP operations

Unit I- Introduction

Data mining application - data mining techniques - the future of data mining - data mining software - Association rules mining: basics- task and a naïve algorithm- Apriori algorithm - improve the efficient of the Apriori algorithm - mining frequent pattern without candidate generation (FP-growth) - performance evaluation of algorithms.

Unit II - Classification

Introduction - decision tree - over fitting and pruning - DT rules- Naive bayes method- estimation predictive accuracy of classification methods - other evaluation criteria for classification method - classification software.

Unit III - Cluster analysis

cluster analysis - types of data - computing distances-types of cluster analysis methods - partitioned methods - hierarchical methods - density based methods - dealing with large databases - quality and validity of cluster analysis methods - cluster analysis software.

Unit IV- Web data mining

Introduction- web terminology and characteristics- locality and hierarchy in the web- web content mining-web usage mining- web structure mining - web mining software - Search engines: Search engines functionality- search engines architecture - ranking of web pages.

Unit V -Data warehousing

Introduction - Operational data sources- data warehousing - Data warehousing design - Guidelines for data warehousing implementation - Data warehousing metadata - Online analytical processing (OLAP): Introduction - OLAP characteristics of OLAP system - Multidimensional view and data cube - Data cube implementation - Data cube operations OLAP implementation guidelines.

Suggested Readings

1. Steinbach Tan, Kumar. (2016). Introduction to Data Mining, 1st Edition, Pearson Education.
2. Mohammed J. Zaki, Wagner Meira, Jr. (2014). Data Mining and Analysis Fundamental Concepts and Algorithms, Cambridge University Press.
3. Han, Kamber & Pei. (2013). Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher.
4. G.K. Gupta. (2011). Introduction to Data mining with case studies, 2nd Edition, PHI Private limited, New Delhi.
5. Arun K Pujari. (2008). Data Mining Techniques. 10th Edition, University Press.

Websites

1. www.geeksforgeeks.org
2. www.tutorialride.com
3. www.javatpoint.com
4. <https://nptel.ac.in/courses/106105174/>
5. <http://172.16.25.76/course/view.php?id=100>

21ADU503A**Machine Learning****Semester – V
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To define the types and theory of machine learning.
- To describe the classification models of machine learning
- To learn the techniques of distance-based models of machine learning
- To examine the various tree based and rule-based models of machine learning
- To demonstrate the concept of reinforcement learning for game playing
- To effectively use machine learning toolboxes to design and develop machine learning applications.

Course Outcomes (Cos)

Upon successful completion of the course the student will be able to:

1. Analyze theory of machine learning components and models
2. Characterize the algorithms of machine learning to learn linear and non-linear models
3. Implement data clustering algorithms for machine learning process
4. Construct machine learning algorithms to learn tree and rule-based models
5. Apply reinforcement machine learning techniques for robotics
6. Design and develop machine learning applications.

Unit I - Foundations of Learning

Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – bias and variance – learning curve

Unit II - Linear Models

Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures – support vector machines – soft margin SVM – generalization and over fitting – regularization – validation

Unit III - Distance-Based Models

Nearest neighbour models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k- d trees – locality sensitive hashing – non - parametric regression – ensemble learning – bagging and random forests – boosting – meta silhouettes – hierarchical clustering – k- d trees – locality sensitive hashing – non - parametric regression – ensemble learning – bagging and random forests – boosting – meta learning

Unit IV - Tree and Rule Models

Decision trees – learning decision trees – ranking and probability estimation trees – Regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first -order rule learning

Unit V - Reinforcement Learning

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal - difference learning – active reinforcement learning – genetic algorithm for Reinforcement Learning- exploration – learning an action utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control

Suggested Readings

1. Tom.M.Mitchell (2017). Machine Learning, Tata McGraw Hill Publications
2. Y. S. Abu - Mostafa, M. Magdon-Ismael, and H.-T. Lin. (2012). Learning from Data, AMLBook Publishers.
3. P. Flach. (2012). Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press.
4. K. P. Murphy. (2012). Machine Learning: A probabilistic perspective, MIT Press,
5. D. Barber. (2012). Bayesian Reasoning and Machine Learning, Cambridge University Press.

Web Sites

1. <https://machinelearningmastery.com/linear-regression-for-machine-learning/>
2. <https://www.cambridge.org/core/books/machine-learning/distancebased-models/>
3. <https://dzone.com/articles/machine-learning-with-decision-trees>
4. <http://reinforcementlearning.ai-depot.com/>
5. <https://nptel.ac.in/courses/106106139/>
6. https://swayam.gov.in/nd1_noc19_cs81/preview

21ADU503B**Natural Language Processing****Semester – V
4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To introduce the fundamental concepts and techniques of natural language processing (NLP)
- To understanding of the models and algorithms in the field of NLP.
- To demonstrate the computational properties of natural languages and
- To develop the commonly used algorithms for processing linguistic information.
- To understanding Lexical and syntactic levels of languages for processing
- To understanding semantics and pragmatics of languages for processing

Course Outcomes (COs)

Upon completion of this course the student will be able to:

1. Understand the fundamental concepts and techniques of natural language processing (NLP)
2. Understanding of the models and algorithms in the field of NLP.
3. Demonstrate the computational properties of natural languages and
4. Develop the commonly used algorithms for processing linguistic information.
5. Understanding Lexical and syntactic levels of languages for processing
6. Understanding semantics and pragmatics of languages for processing

Unit I -Introduction to NLP

Introduction – Models -and Algorithms - The Turing Test - Regular Expressions Basic Regular Expression Patterns -Finite State Automata - Regular Languages and FSAs – Morphology - Inflectional Morphology - Derivational Morphology – Finite – State Morphological Parsing - Combining an FST Lexicon and Rules -Porter Stemmer

Unit II -N-grams Models

N-grams Models of Syntax - Counting Words - Unsmoothed N-grams – Smoothing- Backoff - Deleted Interpolation – Entropy - English Word Classes - Tagsets for English - Part of Speech Tagging - Rule-Based Part of Speech Tagging - Stochastic Part of Speech Tagging – Transformation - Based Tagging

Unit III- Context Free Grammars

Context Free Grammars for English Syntax- Context - Free Rules and Trees – Sentence - Level Constructions – Agreement – Sub Categorization – Parsing – Top-down – Earley Parsing - Feature Structures - Probabilistic Context-Free Grammars

Unit IV- Representing Meaning

Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus - Representing Linguistically Relevant Concepts -Syntax-Driven Semantic Analysis - Semantic Attachments - Syntax-Driven Analyzer - Robust Analysis - Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval

Unit V- Discourse

Discourse -Reference Resolution - Text Coherence -Discourse Structure - Dialog and Conversational Agents - Dialog Acts – Interpretation – Coherence -Conversational Agents - Language Generation – Architecture -Surface Realizations – Discourse Planning – Machine Translation -Transfer Metaphor – Interlingua – Statistical Approaches.

Suggested Readings

1. Yue Zhang, Zhiyang Teng. (2021). Natural Language Processing-A Machine Learning Perspective, 1st Edition, Cambridge University Press.
2. Brojo Kishore Mishra, Raghvendra Kumar. (2021). Natural Language Processing in Artificial Intelligence, 1st Edition, Apple Academic Press.
3. Lan H Written and Elbef, Mark A. Hall. (2017). Data mining: practical machine learning tools and techniques . 4th Edition, Morgon Kaufmann
4. D. Juraf sky and J. Martin. (2014). Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education.

Websites

1. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
2. https://onlinecourses.swayam2.ac.in/arp19_ap79/preview
3. https://www.tutorialspoint.com/natural_language_processing/index.htm

21ADU504A	Software Engineering and Testing	Semester – V 3H – 3C
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Instruction Hours / week: L: 3 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

Course Objectives

- To introduce the fundamental concepts of software engineering.
- To Analyze, specify and document software requirements for a software system.
- To Design, select and apply the most appropriate software engineering process for a given project, plan for a software project, identify its scope and risks,
- To estimate cost and time for a software engineering process.
- To expose the criteria for test cases.
- Be familiar with test management and test automation techniques

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Identify suitable life cycle models to be used and translate a requirement specification to a design using an appropriate software engineering methodology.
2. Apply systematic procedure for software design and deployment.
3. Analyze a problem and identify and define the computing requirements to the problem.
4. Formulate appropriate testing strategy for the given software system.
5. Create appropriate test cases for software engineering process.
6. Develop software projects based on current technology, and test the software using testing tools.

Unit I – Introduction

The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).

Unit II - Requirement Analysis

Initiating Requirement Engineering Process- Requirement Analysis and Modeling Techniques- Flow Oriented Modeling- Need for SRS- Characteristics and Components of SRS- Software Project Management: Estimation in Project Planning Process, Project Scheduling.

Unit III - Risk Management & Design Engineering

Software Risks, Risk Identification Risk Projection and Risk Refinement, RMMM plan, Metrics for Process and Projects- Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.

Unit IV - Testing Strategies & Tactics

Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System testing Black-Box Testing, White-Box Testing- Performance Testing-Stress Testing – Scalability Testing – Soak Testing-Spike Testing. Agile Testing Functional testing concepts, Equivalence class partitioning, Boundary value analysis, Decision tables, Random testing, Error guessing.

Unit V - Automation Testing Basics

Introduction of selenium- Selenium components- Overview of the Testing framework- Selenium Architecture- Selenium Features- Selenium IDE- IDE-Features- IDE Commands - IDE-First Test Case-Selenium Web Driver- Web Driver-Architecture- Web Driver-Features- WebDriver Commands- Locating Strategies

Suggested Readings

1. Paul C. Jorgensen. (2018). Software Testing: A Craftsman's Approach, 4th Edition, CRC Press.
2. Pressman, R.S. (2014). Software Engineering: A Practitioner's Approach. 7th Edition, McGraw-Hill.
3. Aditya P. Mathur. (2013). Foundations of Software Testing, 2nd Edition, Pearson Education.
4. Jalote, P. (2012). An Integrated Approach to Software Engineering. 2nd Edition. New Delhi: New Age International Publishers.
5. Aggarwal, K.K., & Singh, Y. (2012). Software Engineering. 2nd Edition. New Delhi: New Age International Publishers.
6. Lisa Crispin and Janet Gregory. (2010). Agile Testing: A Practical Guide for Testers and Agile Teams, 1st Edition, Pearson Education.
7. Sommerville, I. (2006). Software Engineering. 8th Edition, Addison Wesley.
8. William E Perry. (2006). Effective Methods for Software Testing. 3rd Edition, Wiley Publishing.

Websites

1. http://en.wikipedia.org/wiki/Software_engineering
2. <http://www.onesmartclick.com/engineering/software-engineering.html>
3. http://www.CSU.gatech.edu/classes/AY2000/cs3802_fall/
4. <https://www.javatpoint.com/selenium-tutorial>
5. <https://nptel.ac.in/courses/106105087/>

Semester - V**20ADU504B****Software Project Management****3H - 3C****Instruction Hours / week: L: 4 T: 0 P: 0****Marks: Internal: 40 External: 60 Total: 100****End Semester Exam: 3 Hours****Course Objectives**

- To design, select and apply the most appropriate software engineering process for developing any software project
- To implement planning for a software project and identify the risks in software planning.
- To analyze the software requirements for developing any software.
- To understand the importance of negotiation, effective work habits, leadership in the software development process.
- To identify the risks involved in software project management
- To know the organization structure to develop the software project

Course Outcomes (Cos)

Upon Completion of this course, the student Will be able to

1. Implement the concept of software effort estimation in developing software project.
2. Develop a responsible attitude towards the use of computer as well as the technology.
3. Evaluate the risks during the development of software projects
4. Understand the organization behavior in software project management.
5. Implement team management process in developing quality software
6. Monitor the software project management in various ways such as cost control, performance control, etc.,

Unit I - Introduction

Software Project Management -Project evaluation and programme Management- An overview of Project planning- Stepwise Planning-Selection of an appropriate project Approach.

Unit II - Software Effort Estimation

Problems with over- and underestimates-Software effort estimation Techniques - Estimating by analogy -Albrecht function point analysis -Function points Mark II –COSMIC full function points - COCOMO 13: a parametric productivity model. Activity planning: The objectives of activity Planning-Project schedules - Projects and activities - Sequencing and scheduling activities - Network planning models - Formulating a network model - Adding the time dimension - The forward pass - The backward pass - Identifying the critical path.

Unit III - Risk management

Introduction to Risk - Categories of risk - A framework for dealing with risk -Risk identification- Risk assessment - Risk planning - Risk management - Evaluating risks to the schedule - Applying the PERT technique - Monte Carlo simulation - Critical chain concepts. Resource allocation: Introduction -The nature of resources - Identifying resource requirements - Scheduling resources -Creating critical paths -Counting the cost - Being specific -Publishing the resource schedule - Cost schedules -The scheduling sequence.

Unit IV - Monitoring and control

Creating the framework-Collecting the data- Visualizing progress- Cost monitoring -Earned value analysis-Prioritizing monitoring - Getting the project back to target - Change control.

Managing people in software environments: Understanding behavior -Organization behavior: a background - Selecting the right person for the job - Instruction in the best methods – Motivation - Stress -Health and safety -Some ethical and professional concern

Unit V - Working in Teams

Becoming a team - Decision making - Organizational structures - Coordination dependencies - Dispersed and virtual teams - Communication genres -Communication plans - Leadership. Software quality: Introduction -The place of software quality in project planning - The importance of software quality - Defining software quality - ISO 9126 -Product versus process quality management -Quality management systems -Process capability models -Techniques to help enhance software quality -Testing -Quality plans and software testing tools.

Suggested Readings

1. Kelkar. (2012). Software Project Management, 3rd Edition, Prentice Hall India.
2. Bob Hughes and Mike Cotterell. (2011). Software Project Management, 5th Edition, Tata McGraw Hill.
3. Royce. (2000). Software Project Management, 1st Edition, AddisonWesley.

Websites

1. http://en.wikipedia.org/wiki/Software_project_management
2. <http://www.onesmartclick.com/engineering/software-engineering.html>
3. http://www.cc.gatech.edu/classes/AY2000/cs3802_fall/
4. <https://www.classcentral.com/course/swayam-software-project-management-14294>
5. <https://nptel.ac.in/courses/106105218/>
6. https://swayam.gov.in/nd1_noc19_cs70/preview

		Semester V
21ADU511	Advanced Data Science – Practical	4H - 2C
Instruction Hours/week: L:0 T:0 P:4 Marks: Internal:40 External:60 Total:100		
End Semester Exam:3 Hours		

Course Objectives

The goal of this course is for the students:

- To learn the fundamentals of data science and big data.
- To gain in-depth knowledge on descriptive data analytical techniques.
- To gain knowledge to implement simple to complex analytical algorithms in big data frameworks.
- To learn the use of big data processing methods in data science
- To understand and perform data visualization, web scraping and machine learning using various Data Science tools.
- To build data science products that can be used by a broad audience

Course Outcomes (COs)

Upon Completion of this course the students will be able to:

1. Understand the describe the fundamentals of advanced data science
2. Understand about Hadoop file system
3. Apply suitable statistical testing by converting any real-world decision-making problem to hypothesis
4. Analyze various open-source frameworks for modelling and storing data and data analytics methods to choose best approaches.
5. Develop simple applications involving analytics using Hadoop and MapReduce.
6. Build data science products that can be used by a broad audience

List of programs

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages. Reading data from text file, Excel and the web.
2. Exploring various commands for doing descriptive analytics on state-of-the-art data set.
3. Perform Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
4. Perform bivariate and multivariate analysis: Linear and logistic regression modeling
5. Apply and explore various plotting functions on data sets.
6. Install and configure Hadoop in its two operating modes
7. Implement the following file management tasks in Hadoop: Adding files and directories, retrieving files and deleting files.
8. Create a retail data base with the following tables: Product, Customer, Manufacturer, Shipping and Time using MongoDB and perform data replication using sharding techniques.
9. Install HIVE and implement the above retail schema definition and perform CRUD operations.
10. Perform data visualization using python.

Suggested Readings:

1. Frank Pane. (2017). Hands on Data Science and Python Machine Learning, 1st Edition Packt Publishers.
2. Yuxi (Hayden) Liu. (2017). Python Machine Learning by Example, 2nd Edition, Packt Publication.
3. Alberto Boschetti and Luca Massaron, (2016). Python Data Science Essentials, 2nd Edition, Packt Publishers.
4. Seema Acharya and Subhashini Chellapan. (2015). Big Data and Analytics, 2nd Edition, Wiley Publishers.
5. DT Editorial Services. (2015). Big Data, Black Book, 1st Edition Dream Tech Press.

Websites:

1. www.nptel.ac.in/courses/106/106/106106179/
2. www.nptel.ac.in/courses/106/106/106106212/
3. www.nptel.ac.in/noc/courses/noc17/SEM2/no17-mg24/
4. www.nptel.ac.in/courses/106/104/106104189/
5. www.coursera.org/specializations/advanced-data-science-ibm

		Semester - V
20ADU512A	Data Visualization Using Tableau – Practical	4H – 2C

Instruction Hours / week: L: T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

Course Objectives

- To know the importance of data Visualization in the world of Data Analytics and Prediction
- To know the important libraries in Tableau
- To get equipped with Tableau Tool
- To create charts using Tableau Tool
- To aggregate data using Tableau Tool
- To visualize data as maps and forecast future data using Tableau Tool

Course Outcomes (COs)

Upon completion of this course students will be able to:

1. Visualize data through seven stages of data analysis process
2. Explore hybrid types of data visualization
3. Understand various stages of visualizing data
4. Create charts using Tableau Tool
5. Aggregate data using Tableau Tool
6. Visualize data as maps and forecast future data using Tableau Tool

List of Programs

1. Connect to data Sources
2. Create Univariate Charts
3. Create Bivariate and Multivariate charts
4. Create Maps
5. Calculate user-defined fields
6. Create a workbook data extract
7. Save a workbook on a Tableau server and web
8. Export images, data.

Suggested Readings:

1. Joshua N. Millign. (2019). Learning Tableau ,3rd Edition, Packt publications
2. Daniel G. Murray and the Inter works BI team. (2016). Tableau your data, Wiley Publications.
3. Alexandru C. Telea. (2014). Data Visualization principles and practice, 2nd Edition, CRC Publications
4. Nussbaumer Knaflic (2014). Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole
5. Ashutosh Nandeshwar. (2013). Tableau Data Visualizaton Cookbook, PACKT publishing.
6. Noah Iliinsky, Julie Steele. (2011). Designing Data Visualizations: Representing Informational Relationships, Oreilly Media.
7. Hadley Wickham. (2009). ggplot2: Elegant Graphics for Data Analysis, 1st Edition, Springer

Websites

1. <https://www.tableau.com/>
2. <https://www.tutorialspoint.com/tableau/index.htm>
3. <https://www.coursera.org/specializations/data-visualization>
4. <https://towardsdatascience.com/tableau-visualizations>

21ADU512B**Data Mining - Practical****Semester – V
4H – 2C****Instruction Hours / week: L: T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To Understand Data Mining fundamentals and Characterize the kinds of patterns that can be discovered by association rule mining
- To Compare and evaluate different data mining techniques like classification, prediction,
- To Cluster the high dimensional data for better organization of the data
- To describe complex data types with respect to spatial and web mining
- To Design data warehouse with dimensional modelling and apply OLAP operations.
- To use Weka tool to implement various data mining algorithms.

Course Outcomes (COs)

Upon completion of this course students will be able to:

1. Extract knowledge using data mining techniques and Implement Preprocess the data for mining applications and apply the association rules for mining the data
2. Design and deploy appropriate classification techniques
3. Understand the concept of clustering and its real time applications
4. Explore recent trends in data mining such as web mining, spatial-temporal mining
5. Able to know the basic concepts of data warehouse and OLAP operations
6. Use Weka tool to implement various data mining algorithms

List of Programs

1. Use the following learning schemes, with the default settings to analyze the weather data (in weather.arff). for test options, first choose “Use training set”, then choose “Percentage split” using default 66% percentage split. Report model percent error rate.
2. Use iris dataset preprocess and classify it with j4.8 and Naive Bayes classifier. Examine the tree in the classifier output panel.
3. Using the dataset ReutersCorn – Train and Reuters Grain – Train. Classify articles using binary attributes and word count attributes.
4. Apply any two association rule based algorithm for the supermarket analysis.
5. Using weka experimenter perform comparison analysis of j4.8, oneR and ID3 for vote dataset.
6. Using weka experimenter perform comparison analysis of Naive Bayes with different datasets.
7. Apply ZeroR, OneR and j4.8, to classify the iris data in an experiment using 10 train and test runs, with 66% of the data used for 34% used for testing.
8. Using Weka Knowledge flow set up a flow to load an ARFF file (batch mode) and perform a cross-validation using j4.8 (WEKS’s C4.5implementation).
9. Draw multiple ROC curves in the same plot window, using j4.8 and Random Forest as classifiers.
10. Use any three clustering algorithm on Vehicle data set and find best among them.

Suggested Readings

1. Steinbach Tan, Kumar. (2016). Introduction to Data Mining, 1st Edition, Pearson Education.
2. Mohammed J. Zaki, Wagner Meira, Jr. (2014). Data Mining and Analysis Fundamental Concepts and Algorithms, Cambridge University Press.
3. Han, Kamber & Pei. (2013). Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher.
4. G.K. Gupta. (2011). Introduction to Data mining with case studies, 2nd Edition, PHI Private limited, New Delhi.
5. Arun K Pujari. (2008). Data Mining Techniques. 10th Edition, University Press.

Websites

1. www.geeksforgeeks.org
2. www.tutorialride.com
3. www.javatpoint.com

21ADU513A**Machine Learning - Practical****Semester – III
4H – 2C****Instruction Hours / week: L: 3 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

- To define the types and theory of machine learning.
- To describe the classification models of machine learning
- To learn the techniques of distance-based models of machine learning
- To examine the various tree based and rule-based models of machine learning
- To demonstrate the concept of reinforcement learning for game playing
- To effectively use machine learning toolboxes to design and develop machine learning applications.

Course Outcomes (Cos)

Upon successful completion of the course the student will be able to:

1. Analyze theory of machine learning components and models
2. Characterize the algorithms of machine learning to learn linear and non-linear models
3. Implement data clustering algorithms for machine learning process
4. Construct machine learning algorithms to learn tree and rule-based models
5. Apply reinforcement machine learning techniques for robotics
6. Design and develop machine learning applications.

List of Programs:

1. Implement Decision Tree learning
2. Implement Logistic Regression
3. Implement classification using Multilayer perceptron
4. Implement classification using SVM
5. Implement Adaboost
6. Implement Bagging using Random Forests
7. Implement K-means, K-Modes Clustering to Find Natural Patterns in Data
8. Implement Hierarchical clustering

Suggested Readings

1. Tom.M.Mitchell (2017). Machine Learning, Tata McGraw Hill Publications
2. Y. S. Abu - Mostafa, M. Magdon-Ismael, and H.-T. Lin. (2012). Learning from Data, AMLBook Publishers.
3. P. Flach. (2012). Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press.
4. K. P. Murphy. (2012). Machine Learning: A probabilistic perspective, MIT Press,
5. D. Barber. (2012). Bayesian Reasoning and Machine Learning, Cambridge University Press.

Web Sites

1. <https://machinelearningmastery.com/linear-regression-for-machine-learning/>
2. <https://www.cambridge.org/core/books/machine-learning/distancebased-models/>
3. <https://dzone.com/articles/machine-learning-with-decision-trees>
4. <https://nptel.ac.in/courses/106106139/>
5. https://swayam.gov.in/nd1_noc19_cs81/preview

21ADU513B**Natural Language Processing- Practical****Semester – V
4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To introduce the fundamental concepts and techniques of natural language processing (NLP)
- To understanding of the models and algorithms in the field of NLP.
- To demonstrate the computational properties of natural languages and
- To develop the commonly used algorithms for processing linguistic information.
- To understanding Lexical and syntactic levels of languages for processing
- To understanding semantics and pragmatics of languages for processing

Course Outcomes (COs)

Upon completion of this course the student will be able to:

1. Understand the fundamental concepts and techniques of natural language processing (NLP)
2. Understanding of the models and algorithms in the field of NLP.
3. Demonstrate the computational properties of natural languages and
4. Develop the commonly used algorithms for processing linguistic information.
5. Understanding Lexical and syntactic levels of languages for processing
6. Understanding semantics and pragmatics of languages for processing

List Of Programs

1. Implementing word similarity
2. Implementing simple problems related to word disambiguation
3. Simple demonstration of part of speech tagging
4. Implement Lexical Analyzer
5. Implement Semantic Analyzer
6. Implement Sentiment Analysis

Suggested Readings

1. Yue Zhang, Zhiyang Teng. (2021). Natural Language Processing-A Machine Learning Perspective, 1st Edition, Cambridge University Press.
2. Brojo Kishore Mishra, Raghvendra Kumar. (2021). Natural Language Processing in Artificial Intelligence, 1st Edition, Apple Academic Press.
3. Lan H Written and Elbef, Mark A. Hall. (2017). Data mining: practical machine learning tools and techniques. 4th Edition, Morgon Kaufmann
4. D. Juraf sky and J. Martin. (2014). Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education.

Websites

1. Related Online Contents (MOOC, SWAYAM, NPTEL, Websites, etc.,)
2. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
3. https://onlinecourses.swayam2.ac.in/arp19_ap79/preview
4. https://www.tutorialspoint.com/natural_language_processing/index.htm

21ADU514A**Software Engineering and Testing - Practical****Semester – V
3H – 1C****Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal: 40 External: 60 Total: 100****End Semester Exam: 3 Hours****Course Objectives**

- To understand the nature of software development and software life cycle process models, agile software development, SCRUM and other agile practices.
- To explain methods of capturing, specifying, visualizing and analyzing software requirements.
- To understand concepts and principles of software design and user-centric approach and principles of effective user interfaces.
- To know basics of testing and understanding concept of Testing Tools.
- To learn the criteria and design for test cases for real-time applications.
- To formulate the use-cases and test cases for real time applications

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Work effectively as leader/member of a development team to deliver quality software artifacts.
2. Implement a given software design using sound development practices.
3. Verify, validate, assess and assure the quality of software artifacts.
4. Design test cases suitable for a software development for different domains.
5. Identify suitable tests to be carried out.
6. Formulate the use-cases and test cases for real time applications

List of Programs

S. No	Practical Title
1.	<ul style="list-style-type: none"> • Problem Statement • Process Model
2.	Requirement Analysis: <ul style="list-style-type: none"> • Creating a Data Flow • Data Dictionary, Use Cases
3.	Project Management: <ul style="list-style-type: none"> • Computing FP • Effort • Schedule, Risk Table, Timeline chart
4.	Design Engineering: <ul style="list-style-type: none"> • Architectural Design • Data Design, Component Level Design
5.	Testing: <ul style="list-style-type: none"> • Basis Path Testing

Sample Projects: [ANY 3]

1. **Criminal Record Management:** Implement a criminal record management system for jailers, police officers and CBI officers.

2. Patient Appointment and Prescription Management System.
3. Organized Retail Shopping Management Software.
4. Online Hotel Reservation Service System.
5. Examination and Result computation system
6. Automatic Internal Assessment System

Using Testing Tool: (Selenium) [ANY 5]

1. Using Selenium IDE, write a test suite containing minimum 4 test cases.
2. Conduct a test suite for any two websites.
3. Write and test a program to login a specific webpage
4. Write Selenium Web driver Script using java
5. Create Locators in Selenium using IDE
6. Find Element and Find Elements in Web using Selenium WebDriver
7. Program to Select Checkbox and Radio Button in Selenium WebDriver

Websites

1. www.testinggeek.com
2. www.softwaretestinghelp.com
3. www.softwaretestinginstitute.com
4. <https://www.javatpoint.com/selenium-tutorial>
5. <https://nptel.ac.in/courses/106105087/>

21ADU514B**Software Project Management – Practical****Semester-V
3H – 1C****Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To design, select and apply the most appropriate software engineering process for developing any software project
- To implement planning for a software project and identify the risks in software planning.
- To analyze the software requirements for developing any software.
- To understand the importance of negotiation, effective work habits, leadership in the software development process.
- To identify the risks involved in software project management
- To know the organization structure to develop the software project

Course Outcomes (COS)

Upon completion of the course, students will be able to

1. Implement the concept of software effort estimation in developing software project.
2. Develop a responsible attitude towards the use of computer as well as the technology.
3. Evaluate the risks during the development of software projects
4. Understand the organization behavior in software project management.
5. Implement team management process in developing quality software
6. Monitor the software project management in various ways such as cost control, performance control, etc.,

List of Programs

Prepare a more detailed, organized and easy-to-read documentation, for any application software, which should describe the following using Moodle tool:

1. User Requirement Documentation (USD)
2. Requirement Analysis Documentation. (RAD)
3. User Interfaces Specification. (UIS)
4. Object Oriented Design (OOD) or Low Level Design (LLD)
5. Code Documentation (CD)
6. Testing Documentation (TD)
7. User's Guide (UG)

Suggested Readings

1. Kelkar. (2012). Software Project Management, 3rd Edition, Prentice Hall India.
2. Bob Hughes and Mike Cotterell. (2011). Software Project Management, 5th Edition, Tata McGraw Hill.
3. Royce. (2000). Software Project Management, 1st Edition, Addison Wesley.

Web sites

1. http://en.wikipedia.org/wiki/Software_project_management
2. <http://www.onesmartclick.com/engineering/software-engineering.html>
3. http://www.cc.gatech.edu/classes/AY2000/cs3802_fall/
4. <https://www.classcentral.com/course/swayam-software-project-management-14294>

21ADU601**Deep Learning****Semester -VI
4H-4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100****End Semester Exam: 3 Hours****Course Objectives**

The goal of this course is for the students:

- To understand the basic ideas and principles of Neural Networks
- To design the feed forward neural networks for real world problems
- To apply the concept of CNN for image classification
- To apply RNN methods for image classification using the tools like TensorFlow and Keras
- To appreciate the use of Deep Learning models for real world Applications
- To understand and implement Deep Learning Architectures

Course Outcomes (COs)

After completion of this course the student will be able to

Upon Completion of this course the students will be able to:

1. Understand the basic ideas and principles of Neural Networks
2. Apply feed forward neural networks for real world problems.
3. Analyze different deep learning models in Image related projects.
4. Design and implement deep learning applications using RNN.
5. Understand the role of deep learning in machine learning applications and get familiar with the use of TensorFlow/Keras in deep learning applications.
6. Understand a wide variety of learning algorithms and apply to solve real world problems.

Unit I- Introduction to Neural Networks

Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

Unit II- Feed Forward Neural Networks

Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – ReLU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training.

Unit III -Convolution Neural Networks

Nestors Accelerated Gradient Descent – Regularization – Dropout. CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning

Unit IV- Recurrent Neural Networks

RNN, LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM- Image Segmentation – Object Detection – Automatic Image Captioning– Image generation with Generative Adversarial Networks – Video to Text with LSTM Models.

Unit V- Case Studies Using CNN & RNN

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.

Suggested Readings

1. Ragav Venkatesan, Baoxin Li. (2018). Convolutional Neural Networks in Visual Computing, 1st Edition, CRC Press.
2. Francois Chollet. (2018). Deep Learning with Python, 1st Edition, Manning Publications.
3. Navin Kumar Manaswi. (2018). Deep Learning with Applications Using Python, 1st Edition, A press.
4. Ian Good Fellow, Yoshua Bengio and Aaron Courville. (2017). Deep Learning, 1st Edition, MIT Press.
5. Phil Kim. (2017). Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence, 3rd Edition, A Press.
6. Joshua F. Wiley. (2016). R Deep Learning Essentials, 1st Edition, Packt Publications.

Websites

1. www.nptel.ac.in/courses/106/106/106106184/
2. www.nptel.ac.in/courses/106/106/106106201/
3. www.nptel.ac.in/courses/106/105/106105215/
4. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s191-introduction-to-deep-learning-january-iap-2020/
5. www.kaggle.com/learn/intro-to-deep-learning

21ADU602A**Artificial Intelligence for Cyber Security****Semester - VI
4H - 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To know about the various cybercrimes and cyber security issues.
- To apply the artificial intelligence algorithms for detecting email cybersecurity threats
- To detect malware threats by implementing machine learning algorithms.
- To implement network anomaly detection using artificial intelligence
- To protect the sensitive information like the user authentication details using artificial intelligence
- To understand and apply the various artificial intelligence algorithms for the common cyber security threats.

Course Outcomes (COs)

After completion of this course the student will be able to

1. Understand the various cybercrimes and cyber security issues.
2. Apply the artificial intelligence algorithms for detecting email cybersecurity threats
3. Deduce malware threats by implementing machine learning algorithms.
4. Implement network anomaly detection using artificial intelligence
5. Implement various algorithms to protect the sensitive information like the user authentication details using artificial intelligence
6. Understand and apply the various artificial intelligence algorithms for the common cyber security threats.

Unit I - Introduction to Cyber Security

Cyber Crime-Definition and Origin- Cyber Crime and Information Security-who are cybercriminals? - Classification of cybercrimes- types of hackers-planning a cybercrime-cyber stalking-botnets.

Unit II- Detecting Email Cybersecurity Threats With AI

Spam detection with SVM: SVM Optimization strategy-SVM Spam filter Example-Image Spam detection with SVMs. Phishing detection with logistic regression and decision trees: Regression models- Logistic regression- A phishing detector with logistic regression- Making decisions with trees- Phishing detection with decision trees- Spam detection with Naive Bayes

Unit III- Malware Threat Detection

Malware analysis- Artificial intelligence for malware detection-types of Malware- Malware detection strategies- Static malware analysis- Static analysis methodology- Dynamic malware analysis- Clustering malware with K-Means- Detecting malwares with decision trees- Random Forest Malware Classifier- Advanced malware detection with deep learning.

Unit IV- Network Anomaly Detection with AI

Network anomaly detection techniques- Intrusion Detection Systems- Types of IDS- Anomaly-driven IDS- Turning service logs into datasets- Advantages of integrating network data with service logs Most common network attacks- Anomaly detection strategies- Detecting botnet topology- Different ML algorithms for botnet detection.

Unit V- Protecting Sensitive Information and Assets

Securing User Authentication- Common authentication practices- Fake login management – reactive versus predictive- Predicting the unpredictable- Classifying suspicious user activity- User authentication with keystroke recognition- Anomaly detection with keystroke dynamics Biometric authentication with facial recognition- Eigenfaces facial recognition.

Suggested Readings:

1. Tony Thomas, Athira P. Vijayaraghavan, Sabu Emmanuel. (2020). Machine Learning Approaches in Cyber Security Analytics, Springer Nature Singapore Pte Ltd.
2. Alessandro Parisi. (2019). Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing.
3. Leslie F. Sikos. (2019). AI in Cybersecurity, Springer Nature Switzerland AG.
4. Jeetendra Pande. (2017). Introduction to Cyber Security, Uttarakhand Open University.
5. Nina Godbole & Sunit Belapure. (2013). Cyber Security, Wiley India Pvt. Ltd. New Delhi

Web Sites:

1. <https://www.ibm.com/topics/cybersecurity>
2. <https://www.xenonstack.com/blog/artificial-intelligence-cyber-security>
3. <https://www.altexsoft.com/blog/ai-cybersecurity/>
4. <https://www.computer.org/publications/tech-news/trends/the-use-of-artificial-intelligence-in-cybersecurity/>
5. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
6. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks>
7. <https://www.coursera.org/learn/ai-for-everyone>

21ADU602B**Cyber Forensics****Semester - VI****4H - 4C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

The goal of this course is for the students

- To understand about computer forensics and investigations.
- To know about digital evidence and crime.
- To analyze and validate forensics data.
- To know about e-mail investigation.
- To understand about Mobile device forensics.
- To understand the tools and tactics associated with Cyber Forensics.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Define, understand and explain various investigation procedures and summarize duplication of digital evidence.
2. Apply the knowledge of digital evidences.
3. Design and develop various forensics tools and analyze the network forensics.
4. Demonstrate the systematic study of high-tech forensics
5. Understand the importance of reports.
6. Understand the tools and tactics associated with Cyber Forensics.

Unit I- Computer forensics and investigations

Computer forensics and investigations as a profession – Preparing for computer investigations – Taking a systematic approach–Procedures for corporate high-tech investigations–Data recovery work stations and software– Conducting an investigation.

Unit II- Data acquisition

Data acquisition – Storage formats for digital evidence – Validating data acquisitions – Processing crime and incident scenes–Identifying digital evidence–Collecting evidence in private sector incident scenes – Preparing for search-seizing digital evidence at the scene-storing digital evidence –Reviewing a case.

Unit III - Computer Forensics Tools

Current computer forensics tools–Software tools–Hardware tools–The Macintosh file structure and boot process – Computer forensics analysis and validation – Addressing data –Hiding techniques.

Unit IV- Network forensics

Virtual machines – Network forensics – Developing standard procedures – Live acquisitions – email investigations – Investigating e-mail crimes and violations – Understanding e-mail servers – Cell phone and mobile device forensics.

Unit V- Mobile Device Forensics

Understanding mobile device forensics – Acquisition procedures –Report writing for high-tech investigations – Importance of reports – Guidelines for writing reports –Expert testimony in high-tech investigations.

Suggested Readings

1. Bill Nelson, Amelia Phillips and Christopher Steuart. (2016). Computer Forensics and Investigations, 5th Edition, Cengage Learning.
2. Eoghan Casey. (2010). Handbook of Digital Forensics and Investigation, 1st Edition, Academic Press.
3. John R Vacca. (2009). Computer Forensics, 3rd Edition, Laxmi Publications Pvt Limited.

Websites

1. www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf
2. www.forensicsguru.com/devicedataextractionsimcell.php
3. www.nptel.ac.in/courses/106101060
4. www.samsclass.info/121/ppt/ch11.ppt
5. www.garykessler.net/library/role_of_computer_forensics.html
6. www.ukessays.com/essays/information-technology/computer-forensics-and-crime-investigations-information-technology-essay.php

21ADU603A**Big Data Analytics****Semester - VI
3H - 3C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.
- To perform analytics on data streams
- To learn NoSQL databases and management.

Course Outcomes (COs)

Upon completion of the course, the students will be able to:

- Understand the fundamental concepts of big data and analytics
- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

Unit I- Introduction to Big Data

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics Validating – The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of High - Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

Unit II- Clustering and Classification

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions.

Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes Theorem - Naïve Bayes Classifier.

Unit III- Association and Recommendation System

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm – Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

Unit IV- Stream Memory

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –

Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform (RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

Unit V- NoSQL Data Management for Big Data and Visualization

NoSQL Databases: Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding -- Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

Suggested Readings

1. Kim H. Pries and Robert Dunnigan. (2015). Big Data Analytics: A Practical Guide for Managers, CRC Press.
2. EMC Education Services. (2015). Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley publishers.
3. Bart Baesens. (2015). Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publishers.
4. David Loshin. (2013). Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Morgan Kaufmann/Elsevier Publishers.
5. Anand Rajaraman and Jeffrey David Ullman. (2012). Mining of Massive Datasets, Cambridge University Press.
6. Dietmar Jannach and Markus Zanker. (2010). Recommender Systems: An Introduction, Cambridge University Press.
7. Jimmy Lin and Chris Dyer. (2010). Data-Intensive Text Processing with MapReduce, Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers.

Websites

1. www.oracle.com/bigdata
2. www.planet-data.eu/sites/default/files/Big_Data_Tutorial_part4.pdf
3. www.ibm.com/developerworks/data
4. www.solacesystems.com
5. en.wikipedia.org/wiki/Big_data
6. www.sap.com/solution/big-data.html
7. <https://nptel.ac.in/courses/110106072/>
8. <https://nptel.ac.in/courses/110106064/>

21ADU603B**Soft Computing in Data Science****Semester – VI
3H – 3C****Instruction Hours / week: L: 3 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

The goal of this course is for the students:

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing-based solutions for real-world problems.
- To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- To understand the fundamentals of nature inspired optimization algorithms
- To reveal different applications of soft computing techniques to solve engineering and other problems.
- To implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.

Course Outcomes (COs)

Upon Completion of this course the students will be able to:

1. Understand soft computing techniques and their roles in building intelligent systems
2. Apply swarm intelligence-based algorithms to different optimization problems and apply fuzzy logic and reasoning to handle uncertainty
3. Analyze various soft computing methods to solve various engineering problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem
5. Understand design of fuzzy logic system
6. Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.

Unit I- Introduction to soft computing

Introduction to soft computing – Importance of Soft Computing – Main Components of Soft Computing – Fuzzy Logic – Artificial Neural Networks – Support Vector machine – Evolutionary Algorithms – Introduction to Genetic Algorithms (GA) – Binary and real-coded GA

Unit II- Swarm Intelligence

Swarm Intelligence: Ant Colony Optimization Algorithm – Application of ACO to combinatorial problems – Particle Swarm Optimization Algorithm Working Principles – Introduction to Differential Evolution Algorithm.

Unit III- Optimization Algorithms

Bacterial Foraging Algorithms – Cuckoo Search Algorithm – Firefly Algorithm and Artificial Bee Colony Algorithm – Applications of nature inspired optimization algorithms in Data Science.

Unit IV- Fuzzy Logic Systems

Fuzzy Logic Systems: Introduction to Fuzzy logic – Classical sets vs fuzzy sets – Membership functions and its features – Properties and operations on Fuzzy sets – Classical relations vs Fuzzy relation – Operations of Fuzzy relation.

Unit V- Defuzzification

Defuzzification – Fuzzy rule base and approximate reasoning – Fuzzy Inference Systems – Design of fuzzy logic system: Mamdani & Sugeno Architecture – Applications of Fuzzy logic in Data Science

Suggested Readings

1. Driankov. D, Nervosa. (2020). An introduction to Fuzzy Control, 1st Edition, Wiley India Edition.
2. Sivanandam. S.N and Deepa. S.N. (2018). Principles of Soft computing, 3rd Edition. Wiley India Edition.
3. Ke-Lin Du and Madiseti NS Swamy. (2013). Neural networks in a soft computing framework, 1st Edition. Springer Science & Business Media.
4. Ross. J.T. (2009). Fuzzy Logic with Engineering Applications, 4th Edition , John Wiley & Sons.
5. Priddy. L.K and Keller. E.P. (2005). Artificial Neural Networks: An Introduction, 1st Edition, SPIE Press.
6. Rajasekaran. S and Vijayalakshmi Pai. (2003). Neural Networks, Fuzzy Logic and Genetic Algorithms, 1st Edition. PHI Learning.

Websites

1. www.nptel.ac.in/courses/106/105/106105173/
2. www.nptel.ac.in/courses/112/105/112105235/
3. www.ocw.mit.edu/courses/brain-and-cognitive-sciences/9-641j-introduction-to-neuralnetworks-spring-2005/
4. www.udemy.com/course/fuzzy-logic/
5. www.swarmintelligence.org/tutorials.php

21ADU611**Deep Learning - Practical****Semester - VI****4H - 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

The goal of this course is for the students:

- To understand the basic ideas and principles of Neural Networks
- To design the feed forward neural networks for real world problems
- To apply the concept of CNN for image classification
- To apply RNN methods for image classification using the tools like TensorFlow and Keras
- To appreciate the use of Deep Learning models for real world Applications
- To understand and implement Deep Learning Architectures

Course Outcomes (COs)

After completion of this course the student will be able to

Upon Completion of this course the students will be able to:

1. Understand the basic ideas and principles of Neural Networks
2. Apply feed forward neural networks for real world problems.
3. Analyze different deep learning models in Image related projects.
4. Design and implement deep learning applications using RNN.
5. Understand the role of deep learning in machine learning applications and get familiar with the use of TensorFlow/Keras in deep learning applications.
6. Understand a wide variety of learning algorithms and apply to solve real world problems.

List Of Programs

1. Implement Simple Programs like vector addition in TensorFlow.
2. Implement a simple problem like regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Implement a Transfer Learning concept in Image Classification.
7. Implement an Autoencoder in TensorFlow/Keras.
8. Implement a Simple LSTM using TensorFlow/Keras.
9. Implement an Opinion Mining in Recurrent Neural network.
10. Implement an Object Detection using CNN.

Suggested Readings

1. Ragav Venkatesan, Baoxin Li. (2018). Convolutional Neural Networks in Visual Computing, 1st Edition, CRC Press.
2. Francois Chollet. (2018). Deep Learning with Python, 1st Edition, Manning Publications.
3. Navin Kumar Manaswi. (2018). Deep Learning with Applications Using Python, 1st Edition, A press.
4. Ian Good Fellow, Yoshua Bengio and Aaron Courville. (2017). Deep Learning, 1st Edition, MIT Press.
5. Phil Kim. (2017). Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence, 3rd Edition, A Press, Third Edition.
6. Joshua F. Wiley. (2016). R Deep Learning Essentials, 1st Edition, Packt Publications.

Websites

1. www.nptel.ac.in/courses/106/106/106106184/
2. www.nptel.ac.in/courses/106/106/106106201/
3. www.nptel.ac.in/courses/106/105/106105215/
4. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s191-introduction-to-deep-learning-january-iap-2020/
5. www.kaggle.com/learn/intro-to-deep-learning

21ADU612A**Artificial Intelligence for Cyber Security-Practical****Semester -VI
4H - 2C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives:**

- To know about the various cybercrimes and cyber security issues.
- To apply the artificial intelligence algorithms for detecting email cybersecurity threats
- To detect malware threats by implementing machine learning algorithms.
- To implement network anomaly detection using artificial intelligence
- To protect the sensitive information like the user authentication details using artificial intelligence
- To understand and apply the various artificial intelligence algorithms for the common cyber security threats.

Course Outcomes (COs):

After completion of this course the student will be able to

1. Understand the various cybercrimes and cyber security issues.
2. Apply the artificial intelligence algorithms for detecting email cybersecurity threats
3. Deduce malware threats by implementing machine learning algorithms.
4. Implement network anomaly detection using artificial intelligence
5. Implement various algorithms to protect the sensitive information like the user authentication details using artificial intelligence
6. Understand and apply the various artificial intelligence algorithms for the common cyber security threats.

List of Programs

1. Implement linear regression to fit and predict in a dataset using Sci-Kit
2. Implement SMS Spam detection with SVM
3. Implement Email Phishing detection with logistic regression
4. Implement Phishing detection with decision trees
5. Cluster malware with K-Means
6. Detect malwares with decision trees
7. Classify Malware using Random Forest Algorithm
8. Detect Anomaly using the Gaussian distribution
9. Detect Key stroke for password authentication
10. Implement Biometric user authentication using Eigenfaces facial recognition

Suggested Readings

1. Tony Thomas, Athira P. Vijayaraghavan, Sabu Emmanuel. (2020). Machine Learning Approaches in Cyber Security Analytics, Springer Nature Singapore Pte Ltd.
2. Alessandro Parisi. (2019). Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing.
3. Leslie F. Sikos. (2019). AI in Cybersecurity, Springer Nature Switzerland AG.
4. Jeetendra Pande. (2017). Introduction to Cyber Security, Uttarakhand Open University.
5. Nina Godbole & SUNIT Belapure. (2013). Cyber Security. Wiley India Pvt. Ltd. New Delhi

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1. <https://www.ibm.com/topics/cybersecurity>
2. <https://www.xenonstack.com/blog/artificial-intelligence-cyber-security>
3. <https://www.altexsoft.com/blog/ai-cybersecurity/>
4. <https://www.computer.org/publications/tech-news/trends/the-use-of-artificial-intelligence-in-cybersecurity/>
5. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
6. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks>
7. <https://www.coursera.org/learn/ai-for-everyone>

21ADU612B**Cyber Forensics – Practical****Semester – VI
4H – 2C****Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

The goal of this course is for the students

- To understand about computer forensics and investigations.
- To know about digital evidence and crime.
- To analyze and validate forensics data.
- To know about e-mail investigation.
- To understand about Mobile device forensics.
- To understand the tools and tactics associated with Cyber Forensics.

Course Outcomes (COs)

Upon completion of this course the students will be able to:

1. Define, understand and explain various investigation procedures and summarize duplication of digital evidence.
2. Apply the knowledge of digital evidences.
3. Design and develop various forensics tools and analyze the network forensics.
4. Demonstrate the systematic study of high-tech forensics
5. Understand the importance of reports.
6. Understand the tools and tactics associated with Cyber Forensics.

List of Programs

1. Use a Web search engine, such as Google or Yahoo!, and search for companies specializing in computer forensics. Select three and write a two-to three-page paper comparing what each company does.
2. Search the Internet for articles on computer crime prosecutions. Find at least two. Write one to two pages summarizing the two articles and identify key features of the decisions you find in your search.
3. Use a Web search engine, search for various computer forensics tools.
4. Preparing and processing of investigations. Try to examine and identify the evidences from the drives.
5. Extracting of files that have been deleted.
6. Illustrate the analysis of forensic data.
7. Illustrate the validating of forensic data.

Suggested Readings

1. Bill Nelson, Amelia Phillips and Christopher Steuart. (2016). Computer Forensics and Investigations, 5th Edition, Cengage Learning.
2. Eoghan Casey. (2010). Handbook of Digital Forensics and Investigation, 1st Edition, Academic Press.
3. John R Vacca. (2009). Computer Forensics, 3rd Edition, Laxmi Publications Pvt Limited.

Websites

1. www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf
2. www.forensicsguru.com/devicedataextractionsimcell.php

3. www.nptel.ac.in/courses/106101060
4. www.samsclass.info/121/ppt/ch11.ppt
5. www.garykessler.net/library/role_of_computer_forensics.html
6. www.ukessays.com/essays/information-technology/computer-forensics-and-crime-investigations-information-technology-essay.php

21ADU613A**Big Data Analytics – Practical****Semester – VI****3H – 1C**

Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours

Course Objectives

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.
- To perform analytics on data streams
- To learn NoSQL databases and management.

Course Outcomes (COs)

Upon completion of the course, the students will be able to:

- Understand the fundamental concepts of big data and analytics
- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

List Of Programs

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2. MapReduce application for word counting on Hadoop cluster
3. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
4. K-means clustering using map reduce
5. Page Rank Computation
6. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
7. Application of Recommendation Systems using Hadoop/mahout libraries

Suggested Readings

1. Kim H. Pries and Robert Dunnigan. (2015). Big Data Analytics: A Practical Guide for Managers, CRC Press.
2. EMC Education Services. (2015). Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley publishers.
3. Bart Baesens. (2015). Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publishers.
4. David Loshin. (2013). Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Morgan Kaufmann/Elsevier Publishers.
5. Anand Rajaraman and Jeffrey David Ullman. (2012). Mining of Massive Datasets, Cambridge University Press.
6. Dietmar Jannach and Markus Zanker. (2010). Recommender Systems: An Introduction, Cambridge University Press.

7. Jimmy Lin and Chris Dyer. (2010). Data-Intensive Text Processing with MapReduce, Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers.

Websites

1. www.oracle.com/bigdata
2. www.planet-data.eu/sites/default/files/Big_Data_Tutorial_part4.pdf
3. www.ibm.com/developerworks/data
4. www.solacesystems.com
5. en.wikipedia.org/wiki/Big_data
6. www.sap.com/solution/big-data.html
7. <https://nptel.ac.in/courses/110106072/>
8. <https://nptel.ac.in/courses/110106064/>

21ADU613B**Soft Computing in Data Science - Practical****Semester – VI
3H – 1C****Instruction Hours / week: L: 0 T: 0 P: 3 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours****Course Objectives**

The goal of this course is for the students:

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing-based solutions for real-world problems.
- To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- To understand the fundamentals of nature inspired optimization algorithms
- To reveal different applications of soft computing techniques to solve engineering and other problems.
- To implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.

Course Outcomes (COs)

Upon Completion of this course the students will be able to:

1. Understand soft computing techniques and their roles in building intelligent systems
2. Apply swarm intelligence-based algorithms to different optimization problems and apply fuzzy logic and reasoning to handle uncertainty
3. Analyze various soft computing methods to solve various engineering problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem
5. Understand design of fuzzy logic system
6. Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.

List of Programs

1. Write a program of Perceptron Training Algorithm
2. Write a program for Back Propagation Algorithm
3. Implement Travelling sales person using genetic Algorithm
4. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
5. Implement linear regression and multi-regression for a set of data points
6. Implement crisp partitions for real-life iris dataset
7. Write a program to implement logic gates
8. Implement SVM classification by fuzzy concepts.

Suggested Readings

1. Driankov. D, Narosa. (2020). An introduction to Fuzzy Control, 1st Edition, Wiley India Edition.
2. Sivanandam. S.N and Deepa. S.N. (2018). Principles of Soft computing, 3rd Edition. Wiley India Edition.

3. Ke-Lin Du and Madiseti NS Swamy. (2013). Neural networks in a soft computing framework, 1st Edition. Springer Science & Business Media.
4. Ross. J.T. (2009). Fuzzy Logic with Engineering Applications, 4th Edition, John Wiley & Sons.
5. Priddy. L.K and Keller. E.P. (2005). Artificial Neural Networks: An Introduction, 1st Edition, SPIE Press.
6. Rajasekaran. S and Vijayalakshmi Pai. (2003). Neural Networks, Fuzzy Logic and Genetic Algorithms, 1st Edition. PHI Learning.

Websites

1. www.nptel.ac.in/courses/106/105/106105173/
2. www.nptel.ac.in/courses/112/105/112105235/
3. www.ocw.mit.edu/courses/brain-and-cognitive-sciences/9-641j-introduction-to-neuralnetworks-spring-2005/
4. www.udemy.com/course/fuzzy-logic/
5. www.swarmintelligence.org/tutorials.php

21ADU691**Project****Semester – VI****8H – 6C**

Instruction Hours / week: L: 0 T: 0 P:8 Marks: Internal: 40 External: 60 Total: 100
End Semester Exam: 3 Hours