

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

CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum and Syllabus

Regular (2022 – 2023)



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)

(Accredited with A+ Grade by NAAC in the Second Cycle)

Eachanari (Post), Coimbatore – 641 021.

Tamil Nadu, 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 COMMERCE AND MANAGEMENT UNDER – GRADUATE PROGRAMMES (REGULAR PROGRAMME)

REGULATIONS (2022)

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FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

UNDER-GRADUATE PROGRAMMES

REGULAR MODE

REGULATIONS - 2022

The following Regulations are effective from the academic year 2022-2023 and are applicable to candidates admitted to Under Graduate Degree (UG) programmes in the Faculty of Arts, Science, Commerce and Management, Karpagam Academy of Higher Education (KAHE) from the academic year 2022-2023 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 144 for UG Programme.

3.2. Credits

Credit means the weightage given to each course by the experts of the Board of Studies concerned. Total credits 144 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 is 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 21 Core Courses compulsorily. Students have to earn 63 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 24 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 20 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 16 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. Internship report will be evaluated by Continuous Internal Assessment mode and awarded in the III and V semester respectively. Students have to earn 2 credits each for the Internships and 100 marks each is awarded for each Internship.

4.2.8. Soft Skill Development - I

The course Soft Skill Development - I shall be offered during the third semester for which examinations shall be conducted at the end of the semester and 100 marks is awarded through Continuous Internal

Assessment. Students have to earn 1 credit for this course.

Soft Skill Development - II

The course Soft Skill Development - I shall be offered during the fourth semester for which examinations shall be conducted at the end of the semester and 100 marks is awarded through Continuous Internal Assessment. Students have to earn 1 credit for this course.

Open Elective Course

He / She may select one of the open elective courses from the list given below offered by the other Departments in the fifth semester. Students have to earn 2 credits for this course. (The student cannot select a course offered by the parent department).

S.No	Name of the Department	Course Code	Name of the Course
1	B Com	22CMUOE501	Business Accounting
2	B Com Financial Analytics	22FAUOE501	Business Accounting
3	B Com Commerce with Computer Applications	22CCUOE501	Enterprise Resource Planning
4	B Com Commerce with Professional Accounting	22PAUOE501	Basics of Accounting
5	B Com Commerce with Business Process Services	22BPUOE501	Basics of Accounting
6	B Com International Accounting and Finance	22AFUOE501	Enterprise Resource Planning
7	BBA	22BAUOE501	Principles of Management
8	B.Sc Computer Science	22CSUOE501	Data Visualization
9	BCA	22CAUOE501	Animation Techniques
10	B.Sc Information Technology	22ITUOE501	Multimedia and its Applications

11	B.Sc Computer Technology	22CTUOE501	Multimedia and its Applications
12	B.Sc Computer Science (Cognitive Systems)	22CGUOE501	Web Designing
13	B.Sc Computer Science (Artificial Intelligence and Data Science)	22ADUOE501	E-Commerce Technologies
14	B.Sc Mathematics	22MMUOE501	Combinatorics
15	B.Sc Physics	22PHUOE501	Atmosphere and Weather
16	B.Sc Chemistry	22CHUOE501	Dairy Chemistry
17	B.Sc Microbiology	22MBUOE501	Bio Nanotechnology
18	B.Sc Biochemistry	22BCUOE501	Hygiene and Health
19	B.Sc Biotechnology	22BTUOE501	Golden Manure Preparation

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

- Analyzing 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 (20*1=20)
Part - B	Short Answer Type (3*2 = 6)
Part - C	3 Eight mark questions ‘either – or’ choice (3*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 (½ Hr for Part – A Online & 2 ½ Hours for Part – B and C
Part - A	20 Questions of 1 mark each (20 * 1 = 20 Marks) Question No. 1 to 20 Online Multiple-Choice Questions
Part- B	5 Questions of 2 marks each (5 * 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 * 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
Viva-voce	: 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.

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

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

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

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

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

where,

C_i is the credit fixed for the course 'i' in any semester
 GP_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.

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, web designing, mobile computing and networking for efficient design of computer-based system of varying complexity.
- l) Implement Artificial Intelligence and data science techniques such as search algorithms, neural networks, machine learning and data analytics for solving a problem and designing novel algorithms for successful career and entrepreneurship.
- m) Understand, analyze and develop essential proficiency in the areas related to data science and artificial intelligence in terms of underlying statistical and computational principles and apply the knowledge to solve practical 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 provide the knowledge in artificial intelligence techniques and apply them to develop relevant models and real time products.
- PEO III: To provide knowledge in data science for modern computational data analysis and modeling methodologies.
- 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	g	h	i	j	k	l	m	n
PEO I	X	X	X				X	X	X		X			X
PEO II			X					X				X	X	X
PEO III			X				X	X		X		X	X	X
PEO IV			X	X	X	X			X		X			
PEO V					X					X		X		

DEPARTMENT OF COMPUTER SCIENCE
FACULTY OF ARTS, SCIENCE COMMERCE AND MANAGEMENT
UG PROGRAM (CBCS) – B.Sc. Computer Science (Artificial Intelligence and Data Science)
(2022–2023 Batch and onwards)

Course code	Name of the course	Objectives and out comes		Instruction hours / week			Credit(s)	Maximum Marks			Cate gory	Pag e No	
		PEOs	POs	L	T	P		CIA	ESE	Total			
													40
SEMESTER – I													
22LSU101	Language – I	IV	d,e	4	-	-	4	40	60	100	AEC	1	
22ENU101	English-I	I	d,e, f	4	-	-	4	40	60	100	AEC	5	
22ADU101	Problem Solving Techniques	I	a,b, c	4	-	-	4	40	60	100	Core	7	
22ADU102	Object Oriented Programming using C++	I	a,b, c	4	-	-	4	40	60	100	Core	9	
22ADU103	Numerical Methods	III	h,,j	4	-		4	40	60	100	Allie d	11	
22ADU111	Office Automation - Practical	III	a,g	-	-	3	2	40	60	100	Core	13	
22ADU112	Object Oriented Programming using C++ - Practical	I	a,b, c	-	-	4	2	40	60	100	Core	15	
22ADU113	Numerical Methods - Practical	III	h,,j	-	-	3	2	40	60	100	Allie d	17	
Semester Total				20	-	10	26	320	480	800			
SEMESTER – II													
22LSU201	Language – II	IV	d,e, f	4	-	-	4	40	60	100	AEC	19	
22ENU201	English –II	II	d,e, f	4	-	-	4	40	60	100	AEC	23	
22ADU201	Programming in JAVA	I	a,b, c	6	-	-	6	40	60	100	Core	25	
22ADU202	Probability and Statistics	IV	h,,j	5	-	-	5	40	60	100	Allie d	27	
22ADU211	Programming in JAVA - Practical	I	a,b, c	-	-	4	2	40	60	100	Core	29	
22ADU212	Probability and Statistics-Practical	IV	h,,j	-	-	4	2	40	60	100	Allie d	31	
22AEC201	Environmental Studies	III	e	3	-	-	3	40	60	100	AEC	33	
Semester Total				22	-	8	26	280	420	700			

SEMESTER – III												
22ADU301	Data Structures	I	a,b,h	4	-	-	4	40	60	100	Core	36
22ADU302	Relational Database Management Systems	II	a,b,c	4	-	-	4	40	60	100	Core	38
22ADU303	Digital Computer Fundamentals	II	a,b,c	4	-	-	3	40	60	100	Allied	40
22ADU304A	Programming in Python	I	a,b,c	3	-	-	3	40	60	100	SEC	42
22ADU304B	PHP Programming	I	a,b,c									45
22ADU311	Data Structures - Practical	I	a,b,h	-	-	4	2	40	60	100	Core	46
22ADU312	Relational Database Management Systems - Practical	II	a,b,c	-	-	3	2	40	60	100	Core	48
22ADU313	Web Designing- Practical	I	a,b,c,h	-	-	3	2	40	60	100	Core	53
22ADU314A	Programming in Python - Practical	I	a,b,c	-	-	3	1	40	60	100	SEC	56
22ADU314B	PHP Programming - Practical	I	a,b,c									58
22SSD301	Soft Skill Development - I	I	a,i,j	2	-	-	1	100	-	100	SEC	59
22ADU391	Internship*	I	a,b,c,j				2	100	-	100	SEC	61
Semester Total				17	-	13	24	520	480	1000		
SEMESTER – IV												
22ADU401	Operating Systems	V	b,c,g	4	-	-	4	40	60	100	Core	62
22ADU402	Fundamentals of Data Science	II	b,c,g	4	-	-	4	40	60	100	Core	64
22ADU403	Operations Research	I	h,j	4	-	-	4	40	60	100	Allied	66
22ADU404A	Data Communications and Networks	V	a,b,c	3	-	-	3	40	60	100	SEC	68
22ADU404B	TCP/IP	III	a,b,h,j,k									70
22ADU411	Operating Systems – Practical	V	b,c,g	-	-	3	2	40	60	100	Core	72
22ADU412	Fundamentals of Data Science - Practical	III	a,b,j,k	-	-	4	2	40	60	100	Core	74
22ADU413	Scikit – Practical	IV	c,d,e,l	-	-	3	1	40	60	100	Core	76

22ADU414A	Data Communications and Networks - Practical	V	a,b,c	-	-	3	1	40	60	100	SEC	77
22ADU414B	TCP/IP– Practical	III	a,b,h,j,k	-	-	-	-	-	-	-	-	79
22SSD401	Soft Skill Development – II	I	a,i,j	2	-	-	1	100	-	100	SEC	81
Semester Total				17	-	13	22	420	480	900		
SEMESTER –V												
22ADU501	Fundamentals of Artificial Intelligence	I	b,c,g	4	-	-	4	40	60	100	Core	83
22ADU502A	Data Visualization	III	a,b,h,j	4	-	-	4	40	60	100	DSE	85
22ADU502B	Natural Language Processing	IV	c,d,e,l	-	-	-	4	40	60	100	-	87
22ADU503A	Software Engineering	II	a,b,c,d	3	-	-	3	40	60	100	DSE	89
22ADU503B	Software Project Management	III	b,h,j,k	-	-	-	-	-	-	-	-	91
22ADU504A	Data Mining	I	a,b,c	4	-	-	4	40	60	100	DSE	93
22ADU504B	Machine Learning	I	a,b,c	-	-	-	-	-	-	-	-	95
22ADU511	Fundamentals of Artificial Intelligence - Practical	I	b,c,g	-	-	3	2	40	60	100	Core	97
22ADU512A	Data Visualization– Practical	III	a,b,h,j	-	-	3	1	40	60	100	DSE	99
22ADU512B	Natural Language Processing- Practical	III	a,b,h,j	-	-	-	-	-	-	-	-	101
22ADU513A	Software Engineering -Practical	II	a,b,c,d	-	-	-	-	-	-	-	DSE	102
21ADU513B	Software Project Management- Practical	III	a,b,h,j	-	-	3	1	40	60	100	-	104
22ADU514A	Data Mining - Practical	I	a,b,c	-	-	3	1	40	60	100	DSE	106
22ADU514B	Machine Learning – Practical	I	a,b,c	-	-	-	-	-	-	-	-	108
22ADUOE501	E-Commerce Technologies	I,V	a,b,c	3	-	-	2	40	60	100	SEC	110
22ADU591	Internship*	I	a,b,c,j	-	-	-	2	100	-	100	SEC	112
Semester Total				18		12	24	460	540	1000		

SEMESTER –VI												
22ADU601	Soft Computing in Data Science	V	e,j,l	4	-	-	4	40	60	100	Core	113
22ADU602A	Artificial Intelligence for Cyber Security	I	a,d,g,m	4	-	-	4	40	60	100	DSE	115
22ADU602B	Cyber Forensics	I	a,d,g,									117
22ADU603A	Big Data Analytics	I	a,b,c	3	-	-	3	40	60	100	DSE	119
22ADU603B	Deep Learning	III	a,b,h,j,k									121
22ADU611	Soft Computing in Data Science - Practical	IV	c,d,e	-	-	4	2	40	60	100	Core	123
22ADU612A	Artificial Intelligence for Cyber Security	I	a,d,g,	-	-	4	2	40	60	100	DSE	125
22ADU612B	Cyber Forensics	I	a,c,g,									127
22ADU613A	Big Data Analytics – Practical	II	b,c,g,	-	-	3	1	40	60	100	DSE	129
22ADU613B	Deep Learning- Practical	III	a,b,h,j,k									131
22ADU691	Project	III	a,b,c,g	-	-	8	6	40	60	100	Core	133
ECA / NCC / NSS / Sports / General interest etc		Good										
Semester Total				11	-	19	22	280	420	700		
Grand Total				105	-	75	144	2280	2820	5100		

Ability Enhancement Courses (AEC)		
Semester	Course Code	Name of the Course
I	22LSU101	Language –I
	22ENU101	English– I
II	22LSU201	Language –II
	22ENU201	English-II
	22AEC201	Environmental Studies

Generic Elective Courses (GE) /Allied Courses		
Semester	Course Code	Name of the Course
I	22ADU103	Numerical Methods
	22ADU113	Numerical Methods - Practical
II	22ADU202	Probability and Statistics
	22ADU212	Probability and Statistics - Practical
III	22ADU303	Digital Computer Fundamentals
IV	22ADU403	Operations Research

Core Courses (CC)		
Semester	Course Code	Name of the Course
I	22ADU101	Problem Solving Techniques
	22ADU102	Object Oriented Programming using C++
	22ADU111	Office Automation - Practical
	22ADU112	Object Oriented Programming using C++ - Practical
II	22ADU201	Programming in JAVA
	22ADU211	Programming in JAVA - Practical
III	22ADU301	Data Structures
	22ADU302	Relational Database Management Systems
	22ADU311	Data Structures – Practical
	22ADU312	Relational Database Management Systems – Practical
	22ADU313	Web Designing – Practical
IV	22ADU401	Operating Systems
	22ADU402	Fundamentals of Data Science

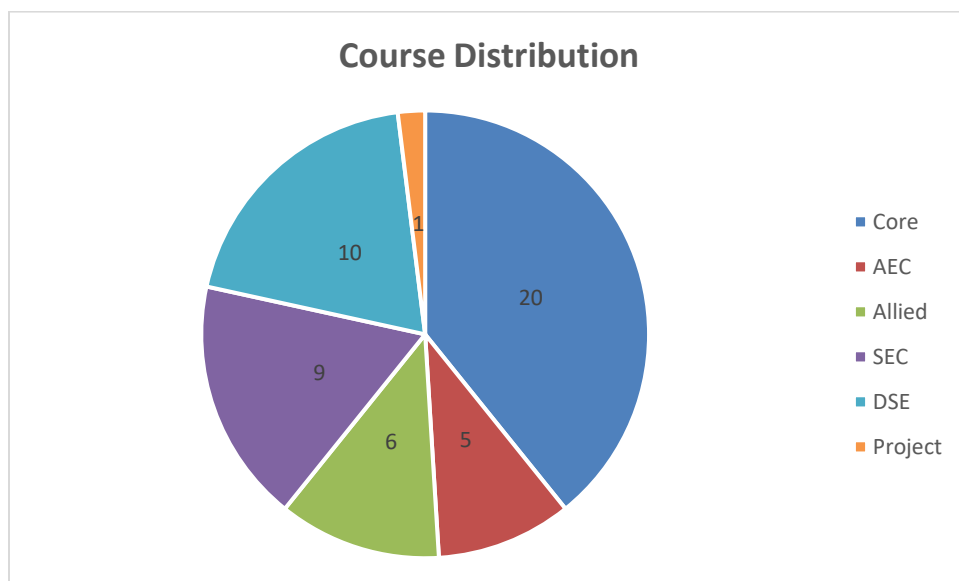
	22ADU411	Operating Systems- Practical
	22ADU412	Fundamentals of Data Science– Practical
	22ADU413	Scikit – Practical
V	22ADU501	Fundamentals of Artificial Intelligence
	22ADU511	Fundamentals of Artificial Intelligence – Practical
VI	22ADU601	Soft Computing in Data Science
	22ADU611	Soft Computing in Data Science – Practical
	22ADU691	Project

Skill Enhancement Courses(SEC)		
Semester	Course Code	Name of the Course
III	22ADU304A	Programming in Python
	22ADU304B	PHP Programming
	22ADU314A	Programming in Python – Practical
	22ADU314B	PHP Programming – Practical
	22SSD301	Soft Skill Development – I
	22ADU391	Internship*
IV	22ADU404A	Data Communications and Networks
	22ADU404B	TCP/IP
	22ADU414A	Data Communications and Networks – Practical
	22ADU414B	TCP/IP – Practical
	22SSD401	SoftSkill Development – II
V	22CGUOE501	E-Commerce Technologies
	22CGU591	Internship

Discipline Specific Elective Courses (DSE)		
Semester	Course Code	Name of the Course
V	21ADU502A	Data Visualization
	22ADU502B	Natural Language Processing
	22ADU503A	Software Engineering
	22ADU503B	Software Project Management
	22ADU504A	Data Mining
	22ADU504B	Machine Learning
	22ADU512A	Data Visualization - Practical
	22ADU512B	Natural Language Processing- Practical
	22ADU513A	Software Engineering -Practical
	22ADU513B	Software Project Management-Practical
	22ADU514A	Data Mining -Practical
	22ADU514B	Machine Learning – Practical
VI	22ADU602A	Artificial Intelligence for Cyber Security
	22ADU602B	Cyber Forensics
	22ADU603A	Big Data Analytics
	22ADU603B	Deep Learning
	22ADU612A	Artificial Intelligence for Cyber Security - Practical
	22ADU612B	Cyber Forensics - Practical
	22ADU613A	Big Data Analytics - Practical
	22ADU613B	Deep Learning - Practical

Course Distribution Table:

Category	No. of Courses		Total
	Theory	Practical	
Core	9	11	20
AEC	5	0	5
Allied	4	2	6
SEC	5	4	9
DSE	5	5	10
Project	0	1	1
Total	28	23	51



22LSU101

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

பாடத்திட்டப்பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும், மேம்படுத்துதல்.
- ஆய்வுநோக்கைமேம்படுத்துதல்.
- 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.

பாடத்திட்டப்பயன்விளைவு

- இந்தியகுடியுரிமைப்பணிமுதலானபோட்டித்தேர்வுகளில், விருப்பப்பாடமாகஇடம்பெறுகின்ற‘தமிழ்இலக்கியவரலாறு’ குறித்தமுழுமையானஅறிமுகம்பெற்றிருத்தல்.
- கல்வெட்டியல், ஓலைச்சுவடியியல்மற்றும்தொல்லியல்சார்ந்தஆவணத்தேடலுக்குரியஆய்வுமனப்பான்மையுடன், இலக்கியங்களைஅணுகுதல்.
- தமிழின்வளர்ச்சித்துறையாகிய, ‘அறிவியல்தமிழ்’ ; ‘இணையதமிழ்’ குறித்தபன்னோக்குஅணுகுமுறையிலானஆய்வுச்சிந்தனைமேம்பாடு.
- வேலைவாய்ப்புக்குரியசுயதிறன்மேம்பாட்டுடன், படைப்பாக்கத்திறன்மேம்பாடும்பெற்றிருத்தல் .
- சமுதாயமற்றும்வாழ்வியல்மதிப்புகளைப்பேணுவதற்குக்கருவியாகஇலக்கியங்களைநாடுகின்றமனப்பான்மைவளர்ச்சி.
- மொழிபெயப்புத்துறைசார்ந்தவேலைவாய்புத்திறன்பெற்றிருத்தல்

அலகு – I : தமிழ்இலக்கியவரலாறு – I

(8 மணிநேரம்)

முச்சங்கவரலாறு - சங்கஇலக்கியத்தொகுப்பு - பாட்டும்தொகையும் -
சங்கஇலக்கியச்சிறப்பியல்புகள் - சங்கம்மருவியகாலம்-
பதினெண்கீழ்க்கணக்குநூல்கள் - திருக்குறள் -நாலடியார் - நான்மணிக்கடிகை -
பழமொழிநானூறு - பிற்காலஅறஇலக்கியங்கள் - கொன்றைவேந்தன் - நீதிநூல் -
காப்பியங்கள் - தமிழில்காப்பியஇலக்கணம்-
தமிழில்பெருங்காப்பியங்களும்சிறுகாப்பியங்களும்-
இரட்டைக்காப்பியங்களாகச்சிலம்பும்மேகலையும்.

அலகு - II:சங்கஇலக்கியம்

(12 மணிநேரம்)

அ).எட்டுத்தொகை

நற்றிணை:கொண்டல்மாமழை - குறிஞ்சி - தலைவன்கூற்று - 140

குறுந்தொகை : வாரார்ஆயினும், வரினும் -முல்லை- தலைவிகூற்று - 110

ஐங்குறுநூறு :மருதம் -தோழிகூற்று-வேட்கைப்பத்து: வாழிஆதன்வாழிஅவினி - 6

பதிறுப்பத்து: சிதைந்ததுமன்ற- 27

பரிபாடல்: புறத்திரட்டு- மதுரைநகர்ச்சிறப்பு - உலகம்ஒரு நிறையாத்தான்-7, மாயோன்கொப்பூழ்-8, செய்யாட்கு இழைத்த-9, கார்த்திகை காதில்-10, ஈவாரைக் கொண்டாடி-11.

கலித்தொகை:பாலைக்கலி-செவிலி - எறித்தரு கதிர்தாங்கி-9

அகநானூறு:அன்னைஅறியினும்அறிக - தோழி - நெய்தல் - 110

புறநானூறு :யாதும்ஊரேயாவருங்கேளிர் -பொதுவியல்- 192

ஆ).பத்துப்பாட்டு: நெடுநல்வாடை-கார்காலச்சிறப்பு : வையகம்பனிப்ப -1-70

அலகு - III: அறஇலக்கியம்

(10 மணிநேரம்)

- 1.திருவள்ளுவர்- திருக்குறள்- அதிகாரம் 67 - வினைத்திட்டம், அதிகாரம் 100 - பண்புடைமை
- 2.முன்றுறையரையனார் - பழமொழிநானூறு5 பாடல்கள் :உணற்குஇனிய 5, பரந்த திறலாரை 32, நெடியதுகாண்கிலாய் 46, இனியாரும் 153, உரைசான்ற 195.
3. ஓளவையார் - கொன்றைவேந்தன் (1- 50 பாடல்கள்)
அன்னையும்பிதாவும் - புலையும்கொலையும்களவும்தவிர்
4. வேதநாயகம்பிள்ளை- நீதிநூல் - (அதிகாரம்-7-தாய் தந்தையரைப்போற்றுதல்- தேர்ந்தெடுக்கப்பட்ட5பாடல்கள்)
சின்னவோர்பொருள், கடவுளைவருந்தி, எப்புவிளையும், வைத்தவர், ஈன்றவர்
5. குமரகுருபரர்-நீதிநெறிவிளக்கம் - 1.உறுதி - உறுதிபயப்ப(254), 2.முயற்சி -முயலாது வைத்து(255),3.உலையாமுயற்சி(256), 4.காலம் - காலம்அறிந்தாங்கு(257), 5.மெய்வருத்தம் -மெய்வருத்தம்பாரார்(258).

அலகு - IV :காப்பிய இலக்கியம்

(10 மணிநேரம்)

(அ). சிலப்பதிகாரம்(5மணிநேரம்)

மங்கலவாழ்த்துப்பாடல்: (21-29) - நாகநீள்நகரொடு-கண்ணகிஎன்பாண்மன்னோ.

வழக்குரைகாதை, (48-56) - நீர்வார்கண்ணை-புகாரென்பதியே .

வஞ்சினமாலை: (5-34) - வன்னிமரமும் - பிறந்தபதிப்பிறந்தேன்.

நடுகற்காதை: (207-234) - அருத்திறலரசர் - மன்னவரேறென்

வாழ்த்துக்காதை: (9) - என்னையிஃதென்னே - மீவிசும்பிறோன்றுமால்.

(ஆ). மணிமேகலை(5 மணிநேரம்)

பசியின்கொடுமை: பாத்திரம்பெற்றகாதை:‘போதிநீழல்’ - ‘பெருகியதன்றோ’ , ‘ஆற்றுநர்க்களிப்போர்’ - ‘நல்லறம்கண்டனை’ (73-98).

சிறைக்கோட்டம்அறக்கோட்டமாக்கியகாதை:மாவண்கிள்ளிக்குகாவலன்உரைத்த

வை:‘பைஞ்சேறுமெழுகாப்பசும்பொன்மண்டபத்து

அறவோர்க்காக்கினன்அரசாள்வேந்தன்’ (116-163).

இ). குளாமணி-அரசியல்சருக்கம்-

1.நாவியேகமமும்(1131),

- 2.கண்மிசைகனிந்த (1132),
- 3.விரைசெலலிவுளித்(1133),
- 4.அரைசர்கள்வருக(1134),
5. அருளுமாறடிகள் (1135),
- 6.விஞ்சையகுலக (1136),
- 7.சொரிகதிர் (1137),
- 8.கரியவன்வளைந்த(1138),
- 9.மடித்தவாயெயிறு (1139),
10. விஞ்சயரதனைக் (1140).

துறவுச்சுருக்கம் – பயாபதிமன்னனின்துறவுநெறி–

- 1.மன்னியபுகழி(1840),
2. திருமகி ழலங்கன் (1841),
3. ஆங்கவ ரணைந்த (1842),
4. அலகுடன் விளங்கு(1843),
5. தன்னையோர் அரசனாக்கி (1844),
- 6.சென்றநாள் (1845),
7. எரிபுரை (1846.),
8. பிறந்தனர் (1847),
9. பிறந்தநாம் (1848),
- 10.தொகைமலர் (1849)
- 11.ஓமுகிய(1850).

அலகு- V :அடிப்படை இலக்கணமும்பயன்பாட்டுத்தமிழும் - 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. வேலை வேண்டி விண்ணப்பம்
- 2.பல்கலைக்கழகப்பன்னாட்டுக்கருத்தரங்கச்செய்தியைநாளிதழில்வெளியிடவேண்டி நாளிதழின்பதிப்பாசிரியருக்குக்கடிதம்
3. கருத்தரங்கப் பங்கேற்புக்கு அனுமதிக்கடிதம்
- 4.பல்கலைக்கழக விழாவுக்குத் தலைமையேற்கவேண்டி, மாவட்ட ஆட்சியருக்கு விண்ணப்பம்
5. கல்விகடன் வேண்டி வங்கி மேலாளருக்கு விண்ணப்பம்
6. வசிப்பிடத்திற்கு அடிப்படை வசதி வேண்டி வட்டாட்சியருக்கு விண்ணப்பம்
7. தேசியவிருது பெற்ற நண்பனுக்குப் பாராட்டுக் கடிதம்
8. புத்தகங்கள் அனுப்பி உதவவேண்டி, பதிப்பகத்தாருக்குக் கடிதம்

இ). கட்டுரையை ஒரு பக்க அளவில் பத்திகளாகச் சுருக்கி எழுதுதல்

முச்சங்க வரலாறு-சங்க இலக்கியத் தொகுப்பு-பாட்டும் தொகையும் - சங்கஇலக்கியச்சிறப்பியல்புகள்-சங்கம்மருவியகாலம்-

பதினெண்கீழ்க்கணக்குநூல்கள் - திருக்குறள் -நாலடியார் - நான்மணிக்கடிகை- பழமொழி நானூறு - பிற்கால அற இலக்கியங்கள் -தமிழில் சிற்றிலக்கியக்காலமும் கருத்தும்-தொண்ணூற்றாறு வகைச் சிற்றிலக்கியவரிசை- காப்பியங்கள்-தமிழில் காப்பிய இலக்கணம் - தமிழில் பெருங்காப்பியங்களும் சிறுகாப்பியங்களும்-சிலம்பும் மேகலையும் என்ற தலைப்பிலான கட்டுரையில் ஏதேனும் ஒன்றை ஒரு பக்க அளவில் சுருக்கி எழுதுதல்.

- வினாத்தாளில் இதற்கென தனியே கட்டுரை வழங்கப் பெறவேண்டிய தேவை இல்லை.
- குறிப்பிட்டதலைப்பிலானகட்டுரையினைச்சுருக்கிஎழுதுகஎன்றுமட்டும்வினாஅமையவேண்டும்.
- விடையானது, தலைப்பு(Title), பத்திக்காக வரிசைப்படுத்தப்பட்ட குறிப்புகள் (Hints), பத்தியின் திருத்தாபடி (Rough Draft), பத்தியின் திருத்தியபடி (Fair Draft) என்ற வகையில் அமையவேண்டும்.

பாடநூல்:கற்பகச்சோலை - தமிழ்ஏடு.

கற்பகம்உயர்கல்விக்கழகத்தமிழ்த்துறை வெளியீடு.

22ENU101**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**LISTENING:** Listening –Types of Listening**SPEAKING:** Basics of Speaking**READING:** Reading –Types of Reading – Purpose of Reading**WRITING:** Writing – Types of Writing – Components of Writing**LITERATURE: Poem-** Ode on a Grecian Urn by John Keats**GRAMMAR:** Parts of Speech**Unit II****LISTENING:** Principles of Listening Skills – Tips for effective listening**SPEAKING:** Telephone Skills**READING:** Reading Techniques – Reading Newspaper, Magazine, Books and Articles**WRITING:** Paragraph Writing**LITERATURE: Prose-** Of Friendship by Francis Bacon**GRAMMAR:** Articles**Unit III****LISTENING:** Barriers of Listening – Problems of Listening**SPEAKING:** Role Play (formal Context)**READING:** Developing Analytical Skills, Skimming and Scanning**WRITING:** Precise Writing**LITERATURE:** Short Story: The Umbrella man by Roald Dahl**GRAMMAR:** Tense**Unit IV****LISTENING:** Note Taking**SPEAKING:** Group Discussion**READING:** Reading Comprehension**WRITING:** Report Writing

LITERATURE: Poem: Tyger by William Blake

GRAMMAR: Subject and Predicate – Question Tags

Unit V

LISTENING: Academic Listening – Listening to Radio and Television

SPEAKING: Interview Skills

READING: Tips for MOC- Anchoring

WRITING: Writing a Book Review

LITERATURE: Short story: Rapunzel by the Brothers Grimm

GRAMMAR: Framing Questions

Suggested Readings:

1. Wren & Martin.(2008). High School English Grammar & Composition, S.Chand& Company Ltd.
2. Board of Editors.(2012). Vibrant English for Enhancement, Emerald Publishers, 2012
3. Krashen, Stephen D .(1982) Principles and practice in second language acquisition. New York: Pergamon Press.

22ADU101**Problem Solving Techniques****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 develop a basic understanding of many areas of information technology and how they are used.
- To understand the basic structure of a program including sequence, decisions and looping.
- To understand how to design a program to solve a simple program.
- To introduce the basics of several programming language and understand the commonality and differences in languages.
- To lay a basic foundation involving hardware, software, navigation, the Internet for future development.
- To understand what a database is and how to design a working model.

Course Outcomes (COs)

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

1. Demonstrate knowledge of high-level structured programming logic and algorithm development.
2. Demonstrate knowledge of structured program design and modularity.
3. Demonstrate knowledge of file-based input/output operations, file manipulation and maintenance, extract reporting, and report writing.
4. Demonstrate knowledge of records, data types and structures, storage classes, addressable memory locations.
5. Demonstrate knowledge of table utilization, arrays and subscripts.
6. Demonstrate knowledge of arithmetic expressions, control structures, iteration techniques.

Unit – I

Language Evolution Machine Language, Assembly Language, High Level Language. Translators: compiler, Interpreter and Assembler. The Compilation Process, Linker, Loader, Study of HLL, Characteristics of Good Language, Generation of Languages, Study of Programming Languages (Function Oriented, Object Oriented, Event-Based). Problem Solving and Algorithmic Thinking Overview – problem definition, logical reasoning;

Unit II

Programming Construction Tools Problem Analysis, Process Analysis, Conceptual Development of Solution. Development Tools: Algorithm – definition, practical examples, properties,

representation, algorithms vs programs. Algorithm: Types of Algorithms, Algorithm of Analysis, Advantage and Disadvantage of Algorithm, Complexity of Algorithm, Big-O Notation.

Unit III

Flowcharts: Types of Flowcharts, Advantage and Disadvantage of Flowchart. Pseudocode: Definition and Its Characteristics Control Statements Basics of C Programming Language: Usage of Character Set, Meaning of Keywords and Identifiers, Role of Data Types, Constants and Variables.

Unit – IV

Importance of Casting, Different Types of Operators and their Precedence, Expressions, Conditional Statements (One-Way, Two-Way and Multi-Way Conditional), Looping Statements (For, While, do-while), Usage of Exit, continue, Break and Goto Statement.

Unit – V

Arrays: Arrays, One dimensional array, Various operation on Array (Inserting of Elements, Deleting of Element, Rotating List, Sorting, Searching, Merging etc) and Two dimensional arrays (Matrix Addition, Transpose of Matrix, Matrix Multiplication), Modular programming and its features.

Suggested Readings:

1. Ferragina P, Luccio. (2018). Computational Thinking: First Algorithms, Then Code. Springer.
2. Beecher. (2017). Computational Thinking: A beginner's guide to Problem-solving and Programming, BCS Learning & Development Limited.
3. Curzon P, McOwan. (2017). The Power of Computational Thinking: Games, Magic and Puzzles to help you become a computational thinker. World Scientific Publishing Company.
4. Riley DD, Hunt KA. (2014). Computational Thinking for the Modern Problem Solver. CRC press.
5. Maureen Sprankle.(2009). Problem Solving Programming Concepts (7th ed.). Pearson Education.
6. Anil V.Chouduri.The Art of Programming through Flowchart and Algorithms. Laxmi Publication.
7. Behrouz Forouzan. Basic of Computer Science. Cengage Learning
8. Donald Knuth. The Art of Computer Programming Vol-I,II, III, Pearson.
9. Horowitz, Sahani. Fundamental of Computer Algorithm. Orient Longman.

Websites

1. <http://www.cs.cf.ac.uk/Dave/C/CE.html>
2. <http://www2.its.strath.ac.uk/courses/c/>
3. <http://www.iu.hio.no/~mark/CTutorial/CTutorial.html>

22ADU102**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

Principles of object-oriented programming: Basic concepts of object-oriented programming – Benefits of OOP – Applications of OOPs – Structure of C++ Program C++ Tokens – Control Statement – Decision Making Statements- Loop Statements - Inline Functions – Friend Function - Function Overloading.

Unit II - Control Structure, Functions and Constructors

Classes and Objects: Specifying a class – Creating Objects – Accessing Class Members – Defining Member Functions – Static Data Members – Static Member Functions - Array of Objects – 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, Published by 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, Published by 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/>
7. <http://172.16.13.33/course/view.php?id=599>

22ADU103**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, Published By 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

22ADU111**Office Automation - 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 acquire knowledge on word editor, spreadsheet and slide preparation.
- To apply text formatting in word processor
- To create tables and learn mail merge in MSWord.
- To apply formulas in spreadsheet and draw graphs in Excel
- To improve creative thinking in presentation software.
- To create organizational charts in powerpoint.

Course Outcomes(COs)

1. Remember the concept of word processing.
2. Understanding the tools in Microsoft word.
3. Understand and Apply Excel Features.
4. Evaluate the EXCEL functions.
5. Analyze the different designs of MS Presentations.
6. Create organizational charts in powerpoint

List of Programs:**I. MS-Word**

1. Text Manipulation: Write a paragraph about your institution and Change the font size and type, Spell check, Aligning and justification of Text.
2. Bio data: Prepare a Bio-data.
3. Find and Replace: Write a paragraph about yourself and do the following. Find and Replace - Use Numbering Bullets, Footer and Headers.
4. Tables and manipulation: Creation, Insertion, Deletion (Columns and Rows). Create a mark sheet.
5. Mail Merge: Prepare an invitation to invite your friends to your birthday party. Prepare at least five letters.

II. MS-Excel

1. Data sorting-Ascending and Descending (both numbers and alphabets).
2. Mark list preparation for a student.
3. Individual Pay Bill preparation.

4. Invoice Report preparation.
5. Drawing Graphs. Take your own table.

III. MS-Powerpoint

1. Create a slide show presentation for a seminar.
2. Preparation of Organization Charts.
3. Create a slide show presentation to display percentage of marks in each semester for all students
 - (1) Use bar chart (X-axis: Semester, Y-axis: % marks).
 - (2) Use different presentation template different transition effect for each slide.

Suggested Readings

1. Sanjay Saxena. (2019). A First Course in Computers (Based on Windows 8 And MS Office 2013) Vikas Publishing.
2. R. Gabriel Gurley.(2018). A Conceptual Guide to OpenOffice.org 3, CreateSpace Independent Publishing Platform.
3. Alexis Leon, Mathews Leon, and Leena Leon, VijayNicole (2018). Introduction to Information Technology - Imprints Pvt. Ltd.
4. R. Gabriel Gurley. (2017). A Conceptual Guide to OpenOffice.Org 2 for Windows and Linux
5. John Walkenbach, HerbTyson, FaitheWempen, CaryN.Prague, Michael R, Groh, Peter G.Aitken, and Lisa A.Bucki, (2017). Microsoft Office 2017 Bible - Wiley India Pvt.ltd.
6. P. K. Sinha .(2017). Computer Fundamentals 2017, BPB Publications

Websites

1. https://www.tutorialspoint.com/word/word_tutorial.pdf
2. <https://it.fit.edu>
3. https://www.tutorialspoint.com/excel/excel_pdf_version.htm
4. https://web.itu.edu.tr/~tasking/Gulsen_Taskins_homepage/bil101e_files/powerpoint_how_to.pdf
5. <https://www.srsd.net/tech/docs/powerpointbeginnerstutorial.pdf>

22ADU112**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, Published by 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, Published by 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

22ADU113**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 MATLAB
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

1. P. Kandasamy, Dr. K. Thilagavathy, Dr. K. Gunavathi (2013), Numerical Methods,

Published By 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

22LSU201

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 திறனையும்,
- ஆய்வு நோக்கையும் மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனிதமனத்தினைப்பக்குவப்படுத்துதலில் இலக்கியம்தரும்பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்த மாக்குதல்.

பாடத்திட்டப் பயன்விளைவு

- இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப்பாடமாக இடம் பெறுகின்ற 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
- கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
- தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல்தமிழ்' 'இணையதமிழ்' குறித்தபன் நோக்கு அணுகு முறையிலான ஆய்வுச் சிந்தனை வளர்ச்சி.
- வேலைவாய்ப்புக் குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல்.
- சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.

அலகு – I :தமிழ்இலக்கியவரலாறு- II (7மணிநேரம்)

தமிழ் இலக்கிய வரிசையில் திருமுறைகளும் நாலாயிரத் திவ்யப் பிரபந்தமும் – பன்னிருதிருமுறைகள் அறிமுகம் – திருமுறை ஆசிரியர்களின் இலக்கியப் பங்களிப்பு – திருமுறைகளில் பக்திநெறியும் சமுதாய நோக்கும் – சமயக்குரவரின் அருள்நெறி – பன்னிரு ஆழ்வார்கள் வரலாறு – ஆழ்வார்களின் இலக்கியப் பங்களிப்பு – திவ்யப்பிரபந்தத்தில் பக்திநெறியும் இலக்கியநயமும் – தமிழில் சிற்றிலக்கியக் காலமும் கருத்தும் – தொண்ணூற்றாறு வகைச் சிற்றிலக்கியவரிசை – தமிழ்மொழியின் நாவல், சிறுகதை -கட்டுரை – கவிதை – திறனாய்வுநூல்களின் தோற்றம் – வளர்ச்சி – உத்திகள் – நாட்டுப்புற இலக்கியங்கள் – கொங்கு நாட்டார்வாய் மொழி வழக்காறுகள்.

அலகு – II:பக்தி இலக்கியமும் சிற்றிலக்கியமும்: பக்தி இலக்கியம் (12 மணிநேரம்)

சைவ, வைணவ இலக்கியங்கள் - தோற்றம் ,வளர்ச்சி, வரலாறு.

1. சைவம்- (19 பாடல்கள்) பெரியபுராணம் - இளையான் குடிமாறநாயனார் புராணம்.

2. வைணவம் -ஆண்டாள்நாச்சியார் திருப்பாவை :

(11 பாடல்கள்): மார்கழித்திங்கள், வையத்துவாழ்வீர்கள், ஓங்கிலகளந்த, ஆழிமழைக்கண்ணா, மாயனைமன்னுவடமதுரை, சிற்றம்சிறுகாலே, ஒருத்திமகனாய், மாலைமணிவண்ணா, கூடாரைவெல்லும், கறவைகள்பின்சென்று, வங்கக்கடல்கடைந்த.

சிற்றிலக்கியம்

1. முக்கூடற்பள்ளு- 2 பாடல்கள் - சித்திரக்காலிவாலான் (நெல்வகைகள்) குற்றாலத்திரிகூடமால்வரை (மீன்வகைகள்)

2. நந்திகலம்பகம்- 5 பாடல்கள் - என்னையேபுகழ்ந்தேன், பதிதொறுபுயல்பொழி, இந்தப்புவிபில், அடிவிளக்கும்துகில், வானுறுமதியை

3. மதுரைச்சொக்கநாதர் தமிழ்விடுதூது- தமிழின் சிறப்பு பாடியருளபத்துப்பாட்டும்-விளம்பக்கேள்.

4. தமிழலங்காரம் -வண்ணச்சரபம் தண்டபாணி சுவாமிகள் - 10 பாடல்கள்

1. கடல்நீரில்கல்மிதக்கும், 2. வண்டமிழ்ஆற்றுதி, 3. கோளத்தைமுட்டி
4. எக்காலம்என்று, 5. கடலூர்மயானத்தொர், 6. தேவாதிதேவன், 7. விண்மாரி,8. தேவர்முனிவர், 9. அழுதேங்கிநஞ்சிட்ட, 10. அத்தனைபொத்து.

5. அருள்தரும் பூங்கோதையன்னை பிள்ளைத்தமிழ் - 1.காப்புப்பருவம்- கோத்தமிழ்குமரகுரு, 2.சப்பாணிப்பருவம் - பட்டிமுனிகோமுனி, 3.ஊசல்பருவம் - நாவரசர்நற்றமிழால்

அலகு – III:கவிதையும், சிறுகதையும்(14மணிநேரம்)

அ). கவிதைஇலக்கியம்

1. மகாகவி பாரதியார் - பகைவனுக்கு அருள்வாய்

2. புரட்சிக்கவிஞர் பாரதிதாசன்	-	இளையார் ஆத்திச்சூடி -
அழுபவன்கோழை		
3. கவிமணிதேசிகவிநாயகம்பிள்ளை	-	கோயில்வழிபாடு
4. கவிக்கோ. அப்துல்ரகுமான்	-	பாருக்குள்ளேநல்லநாடு
5. சிற்பிபாலசுப்பிரமணியன்	-	மலையாளக்காற்று
6. கவிஞர்சுகந்திசுப்பிரமணியம்	-	-புதையுண்டவாழ்க்கை
7. கவிஞர்கரிகாலன்	-	விடுதலை
8. கவிஞர்அறிவுமதி	-	நட்புக்காலம்
9. கவிஞர்தாமரை	-	தொலைந்துபோனேன்

ஆ). சிறுகதைஇலக்கியம்

1. சாபவிமோசனம்	-	புதுமைப்பித்தன்
2. நகரம்	-	சுஜாதா
3. அந்நியர்கள்	-	ஆர். சூடாமணி
4. இந்நாட்டுமன்னர்	-	நாஞ்சில்நாடன்
5. வல்லூறுகள்	-	அம்பை

அலகு- IV :உரைநடைஇலக்கியம் (8 மணிநேரம்)

1. ஆளுமைத்திறன் அறிவோம் -தன்னம்பிக்கைமாத இதழ்
2. திருக்குறளும் சமுதாயவியலும் -முனைவர் புரிசைநடராசன்
3. உயர்தனிச் செம்மாழி - முனைவர் இரா. குணசீலன்
4. நொய்யல் - முனைவர் ப.தமிழரசி
5. கீழடி - வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் - தமிழ்நாடு அரசு தொல்லியல் துறையின் அறிக்கையிலிருந்து தொகுக்கப்பட்டது.

அலகு- V :அடிப்படைஇலக்கணமும்பயன்பாட்டுத்தமிழும்- II

(7மணிநேரம்)

அ). இலக்கணப்பயிற்சி :அணிஇலக்கணம்

உவமையணி -பிறிதுமொழிதல் அணி - சிலேடை அணி - தீவகஅணி -
ஏகதேசஉருவகஅணி - வேற்றுமையணி
பின்வருநிலையணிவிளக்கங்கள்.

ஆ). துறைசார்கலைச் சொல்பயன்பாட்டாக்கம்

இ). படைப்பிலக்கியப்பயிற்சிகள்

மரபுக்கவிதை, புதுக்கவிதை, சிறுகதை, கட்டுரைபடைப்பாக்கஉத்திகள்
- பயிற்சிகள் - நேர்காணல்வினாநிரல்தயாரித்தல்நுட்பங்கள்

ஈ). மொழிபெயர்ப்புப்பயிற்சிகள்

தமிழ் - ஆங்கிலமொழிபெயர்ப்புப்பயிற்சிகள் - 2.

ஆங்கிலம் - தமிழ்மொழிபெயர்ப்புப்பயிற்சிகள் - 2.

உ).கட்டுரையை ஒரு பக்க அளவில் பத்திகளாகச் சுருக்கி எழுதுதல்

தமிழ் இலக்கிய வரிசையில் திருமுறைகளும் நாலாயிரத்திவ்யப்பிரபந்தமும்-
பன்னிருதிருமுறைகள் அறிமுகம்- திருமுறை ஆசிரியர்களின்
இலக்கியப்பங்களிப்பு- திருமுறைகளில் பக்திநெறியும் சமுதாயநோக்கும் -
சமயக்குரவரின் அருள்நெறி - பன்னிரு ஆழ்வார்கள் வரலாறு - ஆழ்வார்களின்
இலக்கியப்பங்களிப்பு - திவ்யப்பிரபந்தத்தில் பக்தி நெறியும் இலக்கியநயமும்-
தமிழ்மொழியின் கவிதை, சிறுகதை, உரைநடை இலக்கியங்களின் தோற்றம் -
வளர்ச்சி - வரலாறு - நாட்டுப்புற இலக்கியங்கள் என்ற தலைப்பிலான
கட்டுரையில் ஏதேனும் ஒன்றை ஒரு பக்க அளவில் சுருக்கி எழுதுதல்.

- வினாத்தாளில் இதற்கென தனியே கட்டுரை வழங்கப் பெறவேண்டிய தேவை இல்லை.
- குறிப்பிட்ட தலைப்பிலான கட்டுரையினைச் சுருக்கி எழுதுக என்று மட்டும் வினா அமைய வேண்டும்.
- விடையானது, தலைப்பு (Title), பத்திக்காக வரிசைப் படுத்தப்பட்ட குறிப்புகள் (Hints), பத்தியின் திருத்தாபடி (Rough Draft), பத்தியின் திருத்தியபடி (Fair Draft) என்ற வகையில் அமைய வேண்டும்.

பாடநூல்:கற்பகச்சோலை - தமிழ்ஏடு.

கற்பகம் உயர்கல்விக்கழகத் தமிழ்த்துறை வெளியீடு.

22ENU201**ENGLISH - II****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 refresh the grammar knowledge of the students to improvise their language.
- To make the students to speak and write error free English.
- To make the students understand different kinds of communication.
- To develop knowledge on the business environment communication.
- To help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

Course Outcomes (COs)

- Strengthen the foundation of the language to elevate the command of standard grammar.
- Inculcate the proper communication strategy.
- Formulate and communicate persuasive arguments for specific business outcome.
- Apply fundamentals of language for reading, writing and effective communication.
- Standardize and demonstrate understanding of LSRW skills.
- Introduce literature to enhance the moral and aesthetic values.

Unit-I

Listening	: Goals of listening
Speaking	: Developing speaking skills
Reading	: Reading strategies
Writing	: Importance of professional writing-Developing a story with pictures
Grammar	: Voice
Literature	: Refuge Mother and Child by Chinua Achebe

Unit - II

Listening	: Dictation
Speaking	: Public speaking and secrets of good delivery
Reading	: Reading Passages-Reading Comprehension-Vocabulary skills
Writing	: Essay writing
Grammar	: Subject, verb, agreement
Literature	: Prose: Diamond of Creativity by A.P.J. Abdul Kalam

Unit -III

Listening	: Electronic recordings and listening
Speaking	: Oral presentation
Reading	: Note Making-Fluency in reading
Writing	: Layout of Business Letters-Letter writing
Grammar	: Degrees of comparison
Literature	: River by A.K. Ramanujan

Unit - IV

Listening	: Listening to instructions and announcements
Speaking	: Video conferencing
Reading	: Silent reading and methods of reading
Writing	: Basic content writing
Grammar	: Phrases and clauses
Literature	: Two Gentlemen of Verona by A.J. Cronin

Unit -V

Listening	; Testing listening
Speaking	: Dialogues
Reading	: Developing reading activities
Writing	: Writing agendas, memos and minutes
Grammar	: Direct and indirect speech
Literature	: Banquet Speech by Nadine Gordimer (Noble Prize Acceptance Speech)

Suggested Readings

1. Oxford Handbook of Writing: St. Martins Handbook of Writing (2013) CU Press
2. Julian Treasure (2012). Sound Business.
3. Hornby, A.S.(1975) The Guide to patterns and usage in English: Oxford university Press.
4. Ellis, R.(1990) Instructed second language acquisition.Oxford: oxford university Press.

22ADU201**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 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. 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, Mc Graw Hill ,Oracle Press.
2. James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley. (2015). The Java Language Specification, Java SE 8th Edition (Java Series), Addison Wesley Publishers.
3. Cay S. Horstmann, Gary Cornell. (2018). Core Java 2 Volume 1 ,11th Edition, Prentice Hall.
4. Cay S. Horstmann, Gary Cornell. (2019). Core Java 2 Volume 2 - Advanced Features, 9th Edition, Pearson.
5. E. Balaguruswamy. (2019). Programming with Java, 6th Edition, McGraw Hill.
6. Paul Deitel, Harvey Deitel. (2018). Java: How to Program (Early Objects), 11th Edition, Prentice Hall.
7. David J. Eck, 2015, Introduction to Programming Using Java 8th Edition, Published by CreateSpace Independent Publishing Platform.
8. Ben Evans and David Flanagan, 2019, Java in a Nutshell, Seventh Edition. O'Reilly Media, Inc.

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/>
7. <https://nptel.ac.in/courses/106105191/>
8. <http://172.16.25.76/course/view.php?id=1827>

22ADU202**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**

- 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.

Website Link:

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>

22ADU211**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, Mc Graw Hill , Oracle Press.
2. James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley. (2015). The Java Language Specification, Java SE 8th Edition (Java Series), Addison Wesley Publishers.
3. Cay S. Horstmann, Gary Cornell. (2018). Core Java 2 Volume 1 ,11th Edition, Prentice Hall.
4. Cay S. Horstmann, Gary Cornell. (2019). Core Java 2 Volume 2 - Advanced Features, 9th Edition, Pearson.
5. E. Balaguruswamy. (2019). Programming with Java, 6th Edition, McGraw Hill.
6. Paul Deitel, Harvey Deitel. (2018). Java: How to Program (Early Objects), 11th Edition, Prentice Hall.
7. David J. Eck. (2015). Introduction to Programming Using Java 8th Edition, Published by CreateSpace Independent Publishing Platform.
8. Ben Evans and David Flanagan. (2019). Java in a Nutshell, Seventh Edition. O'Reilly Media, Inc.

Web Sites

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/

22ADU212**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. SPSS Lab Manual
2. U Dinesh Kumar (2017), Business Analytics: The Science of Data - Driven Decision Making, Wiley, New Delhi.
3. Daniel Y Chen (2017), Pandas for everyone - Python data Analysis,
4. R. Evans James (2017), Business Analytics, 2nd edition, Pearson Education, New Delhi.

22AEC201**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. Biogeographical 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
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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 ed.). Vrianda Publications Private Ltd, New Delhi.

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12. Odum, E.P., Odum, H.T. and Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.

22ADU301**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 sorting, searching and hashing algorithms
- To develop application using data structures
- To design and implementation of various basic and advanced data structures.

Course Outcomes (COs)

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

1. Choose appropriate data structure as applied to specified problem definition.
2. Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Identify different parameters to analyze the performance of an algorithm.
4. Apply concepts learned in various domains like DBMS, compiler construction etc.
5. Use linear and non-linear data structures like stacks, queues, linked list etc.
6. Illustrate various technique to for searching, Sorting and hashing

Unit I

Introduction to Data Structures – Introduction- Basic terminologies of Data Organization- Concepts of Data Type- Data Structure Defined – Description of various Data Structures – Common operations on Data Structures. **Arrays & Matrices:** Introduction- Linear Arrays– Two dimensional Arrays – Matrices -Special and Sparse Matrices.

Unit II

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). **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–Introduction-Tree Terminologies –Tree traversals –Binary Tree–Expression trees– applications of trees– binary search tree ADT –Threaded Binary Trees- AVL Trees – 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- 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, Khanna Publishing, Fifth Edition.
2. Mark Allen Weiss. (2016). Data Structures and Algorithms Analysis in Java (3rd ed.). Pearson Education.
3. Sartaj Sahni. (2016). Data Structures, Algorithms and applications in C++(2nd ed.). Universities Press.
4. Reema Thareja, (2014). Data Structures Using C++, Second Edition , Oxford University Press.
5. Goodrich, M., &Tamassia, R. (2013). Data Structures and Algorithms Analysis in Java(4th ed.). Wiley.
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, (2012).Introduction to Algorithms”, Second 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

22ADU302**Relational Database Management 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 describe a good introduction to the discipline of database management systems.
- To give a good formal foundation on the data models and E-R model.
- To demonstrate the principles database constraints behind systematic database design by covering normalization concept.
- To introduce the concepts of basic SQL as a universal Database language.
- To have an introductory knowledge about the PL/SQL concept
- To provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques.

Course Outcomes (COs)

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

1. Demonstrate an understanding of the elementary features of RDBMS
2. Design conceptual models of a database using ER modeling for real life applications
3. Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database
4. Able to develop structured query language (SQL) queries to create, read, update, and delete relational database
5. Retrieve any type of information from a data base by formulating complex queries in SQL.
6. Design efficient PL/SQL programs to access Oracle databases

Unit I – Introduction

Introduction to DBMS – Information-Data and Data Management-File-based data management – Database System - DBMS - Components of a DBMS- Database User-Database Architecture and Design- Data Abstraction - Physical and Logical Data Independence

Unit II - Data Models

Data Models-Introduction-Conceptual, Physical Models-Hierarchical Model - Network Model-Relational Model – E-R Model- Entity – Relationship (E-R) Modeling: Introduction – E-R Model - Components of an E-R Model-Relationships- Relationships, E-R conventions- Composite Entities - Entity List-E-R diagrams, E-R Modeling Symbols

Unit III - Relational Database Design

Data Integrity, Constraints and Normalization: Introduction-Integrity Constrains - Normalization-Keys-Relationships-Normalization - Keys-Relationships-First Normal Form(1NF)-Second Normal form(2NF) -Third Normal Form(3NF)- Boyce-Codd Normal Form (BCNF)

Unit IV - SQL Concepts

Introduction to SQL, DDL, DML, and DCL statements, Creating Tables, Adding Constraints, Altering Tables, Update, Insert, Delete & various Form of SELECT- Simple, Using Special Operators for Data Access. Aggregate functions, Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins)

Unit V - PL/SQL Concepts

Introduction to PL/SQL-Variable-Constants-Conditional Statements-Cursor-Implicit Cursors-PL/SQL Explicit Cursors - PL/SQL Procedures - PL/SQL Functions - PL/SQL Exception Handling PL/SQL Triggers

Suggested Readings

1. ElmasriRamez and Navathe Shaman. (2019). Fundamentals of Database System', Pearson Education , Sixth Edition.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan. (2018). Database System Concepts', Tata Mc Graw Hill,Sixth Edition.
3. Ivan Bayross. (2018). SQL, PL/SQL the Programming Language of Oracle Paperback. BPB Publication, Fifth Edition.
4. ParteekBhatia. (2016). PL/SQL for Beginners: A Simplified Approach, Kindle Edition.
5. C.J.Date, A.Kannan and S.Swamynathan. (2015). An Introduction to Database Systems. Pearson Education ,Eighth Edition.

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1. <http://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm>
2. <https://www.javatpoint.com/dbms-tutorial>
3. <https://www.javatpoint.com/dbms-sql-introduction>
4. www.databasedir.com
5. <http://plsqli-tutorial.com/>

22ADU303**Digital Computer Fundamentals****Semester – III
4H – 3C****Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objective**

- To know Structure and functions of Computer architecture and organizations.
- To observe the characteristics of various computer memory concepts.
- To understand the computer arithmetic and machine instructions.
- To know the concepts of logic circuits.
- To understand the parallel processing concepts.
- To understand the memory concepts.

Course Outcomes(COs)

Upon completion of this course, students will be able to

1. Bridge the fundamental concepts of computers with the present level of knowledge of the students.
2. Perform number conversions from one system to another system.
3. Understand how logic circuits and Boolean algebra forms as the basics of digital computer.
4. Understanding the Mapping Expression as the basics of digital computer.
5. Demonstrate the building up of Sequential and combinational logic from basic gates.
6. Analyse the memory and I/O organizations.

UNIT – I

Introduction: Application of Computer - Different types of Computer systems - Basic components of Digital Computer System - Programming Languages; Number Systems.

UNIT – II

Boolean Algebra and Gate Networks: Fundamentals concepts of Boolean Algebra – Logical Multiplication AND Gates, OR Gates, and Inverters – Evaluation of logical Expressions – Basic Law of Boolean Algebra – Simplification of expressions – De Morgan's theorems – Basic Duality of Boolean Algebra - Derivation of a Boolean Expression.

UNIT - III

Interconnecting Gates: Sum of products (SOP) and Products of sums (POS) – Derivation of products of sums expressions – Derivation of three Input variable expression – NAND gates and NOR gates - The Map method for simplifying expressions – Sub cube and covering – product of sums expressions – Don't cares.

UNIT –IV

Combination of Logic Circuits: Half Adder- Full adder- Half Subtractor – Full Subtractor- Encoder-Decoder Multiplexer-Demultiplexer- -Sequential Circuits-Flipflops: Basic of Flipflops- SR Flipflops-JK Flipflops-D Flipflops-T Flipflops- Edge triggered Flipflops – Master-slave Flipflops.

UNIT –V

Register, Counter and Memory Unit: Register: Introduction- Types of Register- Counter: Introduction-Asynchronous or ripple counters-Asynchronous or ripple countersMemory: Introduction - Magnetic Memory - Optical Memory - Memory Addressing - ROMs, PROMs, EPROMs and EEPROM.

Suggested Books:

- 1.M.Morris Mano. (2018). Digital Logic and Computer Design., 7th Edition Pearson India EducationServices Pvt. Ltd Publisher.
2. William Stallings. (2016). Computer Organization and Architecture 10th Edition, Pearson Education, Inc., Hoboken, NJ. Al.
3. FloydMalvino, Paul Albert & Leach, Donald P.(2000), Digital Principles and Applciations, 4th edition, TMH.
4. Thomas C.Bartee. (1991). Digital Computer Fundamentals., 6thEdition T.M.H Publisher, New Delhi.

22ADU304A**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 understand the problem-solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.
- To Implement Object Oriented Programming concepts in Python

Course Outcomes (COs)

Upon completion of the course, students will be able to

1. Develop algorithmic solutions to simple computational problems
2. Develop and execute simple Python programs.
3. Implement programs in Python using conditionals and loops for solving problems.
4. Deploy functions to decompose a Python program.
5. Process compound data using Python data structures.
6. Utilize Python packages in developing software applications.

Unit I -Python Overview, Data Types, Expressions

Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.Types, Operators, and Expressions: Types – Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations

Unit II - Control Statements

Control Flow- if, if-elif-else, for, while break, continue, pass. Data Structures Lists – Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.Data Structures Lists – Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

Unit III - Algorithm and Data Structure, Strings

Stack, Queue, Tree, ordered list, Introduction to Recursion, Divide and Conquer Strategy, Greedy Strategy, Graph Algorithms. Regular Expression. Strings: String slices, immutability, string functions and methods, string module; Lists as arrays.

Unit IV -Functions and Modules

Functions – Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables. Modules: Creating modules, import statements, from. The import statement, namespacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

Unit V - OOPS in Python

Object-Oriented Programming OOP in Python: Classes, ‘ self-variable’, Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions. Files and exception: text files, reading and writing files, format operator; command line arguments

Suggested Readings

1. Kenneth A. Lambert, Martin Osborne. (2018). Fundamentals of Python: First Programs, Cengage Learning, 2nd edition..
2. Karl Beecher. (2017). Computational Thinking: A Beginner’s Guide to Problem Solving and Programming, 1st Edition, BCS Learning & Development Limited.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero. (2016). Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd..
4. Allen B. Downey. (2016). Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers.
5. Timothy A. Budd. (2015). Exploring Python, Mc-Graw Hill Education (India) Private Ltd.
6. John V Guttag. (2013). Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press.

Websites

1. <https://www.learnpython.org/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://docs.python.org/3/tutorial/>
4. <https://runestone.academy/runestone/books/published/thinkcspy/index.html>
5. <http://www.w3schools.com>
6. <http://docs.python.org>
7. <http://www.tutorialspoint.com>
8. <http://www.learnpython.org>
9. <https://nptel.ac.in/courses/106106182/>
10. <http://172.16.25.76/course/view.php?id=1225>

22ADU304B**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, (2019). PHP Cookbook: Solutions & Examples for PHP.
2. Robin Nixon. (2018). Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition Paperback, O'reilly.
3. Luke Welling, Laura Thompson. (2017). PHP and MySQL Web Development, 4th Edition. Addition Paperback, Addison-Wesley Professional.
4. Timothy Boronczyk, Martin E. Psinas. (2016). PHP and MYSQL (Create-Modify-Reuse), Wiley India Private Limited.
5. Steven Holzner. (2016). PHP: The Complete Reference Paperback, 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>

22ADU311**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, Khanna Publishing, Fifth Edition.
2. Mark Allen Weiss. (2016). Data Structures and Algorithms Analysis in Java (3rd ed.). Pearson Education.
3. Sartaj Sahni. (2016). Data Structures, Algorithms and applications in C++(2nd ed.).

- Universities Press.
4. Reema Thareja, (2014). Data Structures Using C++, Second Edition , Oxford University Press.
 5. Goodrich, M., & Tamassia, R. (2013). Data Structures and Algorithms Analysis in Java(4th ed.). Wiley.
 6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, (2012). Introduction to Algorithms”, Second 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

22ADU312**Relational Database Management Systems - Practical****Semester – III
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 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

1. To implement Data Definition language
2. To implement Data Manipulation language
3. To implementation on DCL and TCL
4. To implement the following Constraints
 - (a) Primary key
 - (b) Foreign Key
 - (c) Check
 - (d) Unique
 - (e) Null
 - (f) Not null

5. Create a table with following fields:
Employee table:

Field name	Constraint	Type	Size
Employee_no	Primary key	Character	6
Employee_name		Character	30

Address		Character	25
Designation		Character	15
Dob		Date	
Gender	Check	Character	1
Doj		Date	
Salary		Number	10,2

Queries:

- Display name of the employees whose salary is greater than “10,000”.
- Display the details of employees in ascending order according to Employee Code
- Display the details of employees earning the highest salary
- Display the names of employees who earn more than “Ravi”.

6. Create table named Student with following fields and insert the values:

Field name	field type	field size
Student Name	Character	15
Gender	Character	6
Roll No.	Character	10
Department Name	Character	15
Address	Character	25
Percentage of marks	Number	4,2

Queries:

- Calculate the average mark percentage of the students
- Display the names of the students whose percentage marks are greater than 80%
- Display the details of the students who got the highest percentage of marks
- Display the details of the students whose mark percentage between 50 and 70
- Display the details of the students whose mark percentage is greater the mark percentage of Roll No=12CA01

7. Create a table with following fields:

Staff table:

Field name	Constraint	Type	Size
Staff_no	Primary key	Character	6
Staff_name		Character	30
Dob		Date	
Dept_code	Foreign key	Character	4
Designation		Character	15
Basic		Number	7,2

Department table:

Field name	constraint	Type	Size
Dept_code	Primary key	Character	4
Dept_name		Character	30

Execute the following queries:

1. To list the staff who joined 2 years back.
2. To list the staff in computer science dept.
3. To list the staff_name and the dept_name in which he/she works.
4. To list the maximum and minimum salary in each dept.
5. To list the dept along with the total amount spent on salary
6. To list the name of the employees who draw the salary more than the average salary.

8. Create a table with the following fields:

Book table:

Field name	Constraint	Type	Size
Access_no	Primary key	Character	6
Title		Character	30
Author		Character	30
Publisher		Character	30
Subject		Character	10
Price		Number	6,2

Execute the following queries:

1. The title of C and C++ books.
2. The books written by a particular author.
3. The books which costs between Rs.300/- and Rs.500/-
4. The number of books available in each subject.
5. The books in the decreasing order of the cost.

9. Create a table with the following fields:

Account table:

Field name	Constraint	Type	Size
Acc_no	Primary key	Number	4
Cust_name		Varchar2	30
Branch_name		Varchar2	30
Cust_city		Varchar2	30

Borrower table:

Field name	Constraint	Type	Size
Acc_no	Foreign key	Number	30
Branch_name		Varchar2	30
Amount		Number	8,2

Write queries to perform different types of Join.

10. Write a PL/SQL block to create and handle User Defined Exception
clientmaster

Field name	Constraint	Type	Size
Client_id		Number	6
Client_name		Varchar2	30
Address		Varchar2	50
Phone		Number	10
Balance		Number	10,2

11. Create table with following fields:

Product table:

Field name	Constraint	Type	Size
Product_code	Primary key	Varchar2	7
Product_name		Varchar2	30
Price		Number	6,2
Quantity		Number	4

Vendor table:

Field name	Constraint	Type	Size
Vendor_name		Varchar2	30
Vendor address		Varchar2	30
Product_code	Foreign Key	Varchar2	7

Create a Trigger to fire when the Record is deleted and inserted.

12. Write a PL/SQL trigger to update the records while deleting the one record in another table.

Voters_master:

Field name	Constraint	Type	Size
Voterid	Primary key	Number	5
Name		Varchar2	30
Ward_no	Primary Key	Number	4
Dob		Date	
Address		Varchar2	150

New_list

Field name	Constraint	Type	Size
Voterid		Number	5
Ward_no		Number	4
Name		Varchar2	30
Description		Character	50

13. Create a table to store the salary details of the employees in a company. Declare the Cursor id to contain empno, employee name and net salary. Use cursor to update the employee details.

Salary:

Field name	Constraint	Type	Size
Emp_no	Primary key	Number	4
Emp_name		Varchar2	30
Designation		Varchar2	25
Dept		Varchar2	30
Basic		Number	5

14. Create a table stock contains the itemcode varchar2(10), itemname varchar2(50), current_stocknumber(5), date_of_last_purchase date. Write a stored procedure to seek for an item using itemcode and delete it, if the date of last purchase is before 1 year from the current date. If not, update the curent stock.

15. Create a Package in PL/SQL

Suggested Readings

1. ElmasriRamez and Navathe Shaman. (2019). Fundamentals of Database System', Pearson Education , Sixth Edition.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan. (2018). Database System Concepts', Tata Mc Graw Hill,Sixth Edition.
3. Ivan Bayross. (2018). SQL, PL/SQL the Programming Language of Oracle Paperback. BPB Publication, Fifth Edition.
4. ParteekBhatia. (2016). PL/SQL for Beginners: A Simplified Approach, Kindle Edition.
5. C.J.Date, A.Kannan and S.Swamynathan. (2015). An Introduction to Database Systems. Pearson Education ,Eighth Edition.

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1. <http://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm>
2. <https://www.javatpoint.com/dbms-tutorial>
3. <https://www.javatpoint.com/dbms-sql-introduction>
4. www.databasedir.com
5. <http://plsqli-tutorial.com/>

22ADU313**Web Designing - Practical****Semester – III
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

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

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. PaulMcFedries. (2018). Web Coding & Development All-in-One For Dummies,
2. Randy Connolly, Ricardo Hoar. (2017). Fundamentals of Web Development,

3. Joelsklar. (2015). Principles of web design.,,6th Edition.
4. Jon Duckett. (2014). HTML and CSS: Design and Build Websites.
5. Thomas A Powell, Fritz Schneider. (2013). JavaScript: The Complete Reference, Third Edition, Tata McGraw Hill.

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

22ADU314A**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. Write a python program using Control statements
2. Write a python program using Functions and String Operations
3. Write a python program using List, Tuples and List comprehensions
4. Write a python program using Inheritance
5. Write a python program using Synchronization
6. Write a python program using Text Files
7. Write a python program using Graphical user Interfaces
8. Write a python program using Exceptional Handling
9. Write a python program using Classes and Objects
10. Write a python program using Chat Applications

Suggested Readings

1. Kenneth A. Lambert, Martin Osborne. (2018). Fundamentals of Python: First Programs, Cengage Learning, 2nd edition..
2. Karl Beecher. (2017). Computational Thinking: A Beginner's Guide to Problem Solving and Programming, 1st Edition, BCS Learning & Development Limited.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero. (2016). Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd..
4. Allen B. Downey. (2016). Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers.
5. Timothy A. Budd. (2015). Exploring Python, Mc-Graw Hill Education (India) Private Ltd.

6. John V Guttag. (2013). Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press.

Websites

1. <https://www.learnpython.org/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://docs.python.org/3/tutorial/>
4. <https://runestone.academy/runestone/books/published/thinkcspy/index.html>
5. <http://www.w3schools.com>
6. <http://docs.python.org>
7. <http://www.tutorialspoint.com>
8. <http://www.learnpython.org>
9. <https://nptel.ac.in/courses/106106182/>
10. <http://172.16.25.76/course/view.php?id=1225>

22ADU314B**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, (2019). PHP Cookbook: Solutions & Examples for PHP.
2. Robin Nixon. (2018). Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition Paperback, O'reilly.
3. Luke Welling, Laura Thompson. (2017). PHP and MySQL Web Development, 4th Edition. Addition Paperback, Addison-Wesley Professional.
4. Timothy Boronczyk, Martin E. Psinas. (2016). PHP and MYSQL (Create-Modify-Reuse), Wiley India Private Limited.
5. Steven Holzner. (2016). PHP: The Complete Reference Paperback, 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>

22SSD301**Soft Skill Development- I****Semester – III
2H – 1C****Instruction Hours / week: L: 2 T: 0 P: 0 Marks: Internal: 40 External: 60 Total: 100**
End Semester Exam: 3 Hours**Course Objectives**

- To understand the main concepts of Employability and Skill Development
- To escalate the knowledge in Analytical and Mathematical Skills
- To develop and nurture the soft skills for the students through individual and group activities
- To stimulate the all-round development of the students by emphasizing on Soft skills and Aptitude
- To embellish self-esteemed individuals by mastering inter-personal skills, team management skills and leadership skills
- To steer and bestow right module of training that meets the industry needs and ameliorate their employability skills.

Course Outcomes (COs)

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

1. Understand the basic concepts of Quantitative Aptitude and Logical reasoning.
2. Solve the real-time problems to accomplish job functions easily.
3. Understand the basic grammar and utilize it for their language enhancement.
4. Communicate in genuine circumstances acquiring basic grammatical structure and vocabulary.
5. Articulate efficiently with others as well within a group or a team catalyzing in building a rapport with the team members.
6. Intensify their professionalism at work by acquiring knowledge on job roles and responsibilities.

Unit I- BASIC APPROACHES TO NUMBERS

- Number system
- Problems on numbers
- Number series
- Simplifications

Unit II- PROBLEMS RELATED TO TIME

- Time and work
- Pipes and cisterns
- Time, speed, distance and problems on trains
- Boats and streams
- Clocks
- Calendar

Unit III- PROBLEMS ON PARTITIONS

- Ratio and Proportion
- Average
- Inequalities
- Allegation and Mixture
- Elementary Statistics

Unit IV- INTRODUCTION TO GRAMMAR AND PREREQUISITES FOR INTERVIEW

- Parts of Speech
- Tense
- Subject Verb Agreement
- Articles and Prepositions
- Resume Building
- Self-Introduction

Unit V- EMPHASIZING THE FUNCTIONS OF GRAMMAR AND LIFE SKILLS

- Active and Passive Voice
- Direct and Indirect Speech
- Idioms and Phrases
- Degrees of Comparison and Conditional clause
- Prefix, suffix and Question tags
- Group discussion
- Extempore Speech

Suggested Readings

1. S.Chand, Dr. R.S. Aggarwal .(2018). Quantitative aptitude for competitive exams, Chand Publishing.
2. S.Chand, Dr. R.S. Aggarwal. (2018). A modern Approach to Logical Reasoning.
3. S. Chand, Dr. R.S. Aggarwal (2018). Verbal Aptitude for competitive exams by
4. Edgar Thorpe, Showick Thorpe. (2013). Objective English for Competitive Examinations.Pearson Education.
5. E. Suresh Kumar, P.Sreehari, J Savithri.(2010). Communication skills and soft skills an integrated approach.Pearson Education.

22ADU391**Internship****Semester – III
H – 2C**

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

22ADU401**Operating 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 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 understand the structure and organization of the file system

Course Outcomes (COs)

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

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

Unit I- Introduction to Operating System

Introduction-Basic OS Functions-Types of OS: Multi programming Systems-Batch Systems-Time Sharing Systems- Real Time Systems. Computer System Structures: Computer System operation-I/O Structure-Storage Structure- Storage Hierarchy.

Unit II-Operating System Structures and Process Management:

System Components-Operating System Services-System Calls-System Programs-System Structures.Processes:Process Concept- Process Scheduling-Inter Process Communication. Threads: Multithreading Models- Thread issues.

Unit III- Process Management

CPU Scheduling: Basic concepts- Scheduling Algorithm-Multiple-preprocessor scheduling-real time scheduling. **Process Synchronization:** Critical section problem-

Synchronization hardware-semaphore. **Deadlocks:** System Model- Deadlock characterization– Dead lock Prevention-Deadlock Avoidance – Deadlock Recovery.

Unit IV- Storage Management

Memory Management: Swapping- Paging-Segmentation- Segmentation with Paging. **Virtual Memory:** Demand Paging-Process Creation-Page replacement Allocations of Frame-Thrashing.

File System Interface: File Concept- Accept Method-Directory Structure-File system monitoring-file sharing.

Unit V-Protection and Security

Protection: Goals of Protection-Domain of Protection-capability based systems-Language based protection

Security: Security Problem-User Authentication-Program Threats-System Threats-Security systems and facilities.

Suggested Readings

1. Silberschatz, A., Galvin, P.B. ,&Gagne,G.(2018). Operating Systems Concepts, 10thEdition ,New Delhi, John Wiley Publications.
2. Stallings, W.(2016). Operating Systems, Internals & Design Principles 7th Edition. New Delhi: Prentice Hall of India.
3. Jose M Garrido , Richard Schlesinger Kenneth Hoganson. (2015). Principles of Modern Operating Systems, 2ndEdition, 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.
5. <http://172.16.25.76/course/view.php?id=1906>

22ADU402**Fundamentals of Data Science****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**

The goal of this course is for the students

- To study the basic concepts of Data Science and data lifecycle.
- 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 datascience, including tools and approaches.
2. Understand the concepts in data collection, sampling and probabilistic models.
3. Understand the various techniques in datascience
4. Apply the mathematical formulation of machine learning and statistical models to visualize the data in various methods.
5. Apply a suitable datascience 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

Preprocessing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, StandardDeviation. 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. Glenn J. Myatt, Wayne P. Johnson. (2014). Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley&Son Publication, Second Edition.
2. SaltzJeffreyS. (2019). An Introduction to DataScience, SagePublicationsInc, Second Edition.
3. Murtaza Haider. (2015). Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition.
4. Peter Bruce & Andrew Bruce. (2017). Practical Statistics for Data Scientists, O'Reilly Publication, FirstEdition.
5. DawnGriffiths. (2008). HeadFirstStatistics,O'ReillyPublication,FirstEdition.

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/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/>

22ADU403**Operations Research****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

- Learn the basic concepts of linear programming.
- Learnt he applications of linear programming.
- Impart knowledge in concepts.
- Usage of tools of operations research.
- Know the constructive techniques.
- Learn to make effective business decisions.

Course Outcomes (COs)

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

1. Understand the basic concepts and application of operation research in various fields.
2. Understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
3. Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry.
4. Identify and develop operational research models from the verbal description of the real system.
5. Solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
6. Understand the Big M Method.

UNIT I

Linear Programming – Mathematical Model assumption of linear Programming – Graphical method-Principles of Simplex method-Big-M Method-Duality in LPP.

UNIT-II

Transportation Model: Introduction–Mathematical Formulation–Finding Initial Basic Feasible Solutions Optimum Solution for Nondegeneracy and Degeneracy Model-Unbalanced Transportation Problems and Maximization case in Transportation Problem.

UNIT-III

The Assignment problem: Mathematical Formulation of the Problem – Hungarian Method –Unbalanced Assignment Problem- Maximization Case in Assignment Problem-Travelling Salesman Problem. **Queuing Theory** :Introduction–

Characteristics of Queuing System. Problems in $M/M/1$ (FIFO) and $(M/M/1):(N/FIFO)$ models.

UNIT-IV

Inventory Control: Introduction – Costs involved in Inventory – Deterministic EOQ Models – Purchasing Model without and with Shortage, Manufacturing Model without and with Shortage -Price Break.

UNIT V

PERT AND CPM

Introduction - Network scheduling by PERT / CPM – Network and basic components – Rules of Network construction – Time calculation in Networks – CPM. PERT – PERT calculations – Cost Analysis – Crashing the Network – Problems.

Suggested Readings

1. Kandiswarup, P.K. Gupta and Man Mohan. (2011), Operations Research, 12th Revised Edition, S. Chand & Sons Education Publications, New Delhi.
2. S.D.Sharma. (2017). Operations Research Theory, Methods & Applications, Kedar Nath Ram Nath Publications, India.
3. Hamdy A.Taha. (2012). Operations Research-An Introduction, 9th Edition, published by Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.
4. Prem Kumar Gupta and D.S.Hira. (2014), Operations Research, S.Chand & Company Ltd, Ram Nagar, New Delhi.
5. G.Srinivasan. (2017), Operations Research: Principles and Applications, PHI, New Delhi

Websites

1. <https://youtu.be/vUMGvpsb8dc>
2. <https://youtu.be/ItOuvM2KmD4>

Semester – IV

22ADU404A DATA COMMUNICATION AND NETWORKS 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 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 –(Cont..)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: Simplex 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. (2019). Data Communications and Networking .6thEdition.New Delhi: THM.
2. Alberto Leon-Garcia, Indra Widjaja (2017). Communication Network .4thEdition.Mc Graw Hill Education.
3. Sathish Jain, Madhulika Jain, Vineeta Pillai, Kratika. (2016). A Level Data Communication & Network Technologies. BPB Publication.
4. Tanenbaum, A. S. (2016). Computer Networks.7thEdition.New Delhi: PHI.

Websites

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

22ADU404B**TCP/IP****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 understand about subnets using IP classes
- To understand the key features and functions of TCP
- To understand how basic routing works including the use of routing protocols.
- To understand about DNS and its applications
- To understand the concepts of Remote Login and VPN
- To compare and contrast IP routing protocols

Course Outcomes(COs)

At the completion of the course, students will:

1. Have the ability to analyze and differentiate networking protocols used in TCP/IP protocol suite.
2. Understand IP Addressing Fundamentals
3. Understand IPv4 forwarding and routing.
4. Learn about host name resolution and the Domain Name System (DNS).
5. Learn about services and operations of DHCP Servers and Domain Name Servers
6. Create major applications using the key TCP/IP protocols

Unit I – INTRODUCTION WAN technologies - Protocols and Standards - TCP/IP protocol suite - Internetworking Devices - Classful IP Addressing – Subnetting – Supernetting – Classless Addressing

Unit II - ARP & RARP -Proxy ARP – ARP over ATM – ARP and RARP Protocol Format. IP Datagram – Fragmentation – Options – IP Datagram Format – Routing IP Datagrams – Checksum. ICMP – Types of Messages - Message Format – Error Reporting – Query – Checksum

Unit III - ROUTING PROTOCOL Unicast Routing Protocol: Intra Domain and Inter Domain Routing – Distance Vector Routing – RIP – Link State Routing – OSPF – Path Vector Routing – BGP – Multicast Routing – Multicast Routing Protocols. Group Management – IGMP Message – IGMP Operation – Process to Process Communication – UDP Operation – TCP Services - Flow Control.

Unit IV – BOOTP, DHCP Address Discovery and Binding. DNS – Name Space – DNS in Internet – Resolution – Resource Records

Unit V - REMOTE LOGIN FTP – SMTP – SNMP. IP over ATM Wan – Cells – Routing the Cells – ATMARP – Logical IP Subnets. VPN

Suggested Readings

1. Jason Edelman, Scott Lowe .(2018), Network Programmability and Automation, O'Reilly

2. Jeff Doyle, Jennifer DeHaven Carroll. (2017), Routing TCP/IP, Volume 1. 2nd Edition, Cisco Press
3. Behrouz, A. Forouzan. (2016). TCP/IP Protocol Suite. 6th Edition. Tata McGraw Hill Publication. New Delhi:
4. Andrews, S. Tanenbaum. (2014). Computer Networks. 5th Edition.:Prentice Hall of India Private Ltd. New Delhi.
5. Buck Graham. (2013). TCP/IP Addressing. 2nd edition. Harcount India Private Limited. New Delhi
6. Douglas, E. Comer. (2010). Computer Networks and Internets. 5th Edition. Pearson Education. New Delhi.
7. William Stallings. (2010). Data and Communication Network. 8th edition. Tata McGraw Hill. New Delhi

Web Sites

1. en.wikipedia.org/wiki/Internet_protocol_suitehttp://docwiki.cisco.com/wiki/Introduction_to_WAN_Technologies
2. www.yale.edu/pclt/COMM/TCPIP.HTM
3. www.w3schools.com/tcpip/default.asp

22ADU411**Operating Systems -Practical****Semester – IV
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 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, 10thEdition ,New Delhi, John Wiley Publications.
2. Stallings, W.(2016). Operating Systems, Internals & Design Principles 7th Edition. New Delhi: Prentice Hall of India.
3. Jose M Garrido , Richard Schlesinger Kenneth Hoganson. (2015). Principles of Modern Operating Systems,2ndEdition, 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/Courses/736/Fall2002/
4. www.nptel.ac.in/operating systems.
5. <http://172.16.25.76/course/view.php?id=1906>

22ADU412**Fundamentals of Data Science – 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 lifecycle.
- 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 datascience, including tools and approaches.
2. Understand the concepts in data collection, sampling and probabilistic models.
3. Understand the various techniques in datascience
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. Glenn J. Myatt, Wayne P. Johnson. (2014). Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition.
2. Saltz JeffreyS. (2019). An Introduction to Data Science, Sage Publications Inc, Second Edition.
3. Murtaza Haider. (2015). Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition.
4. Peter Bruce & Andrew Bruce. (2017). Practical Statistics for Data Scientists, O'Reilly Publication, First Edition.
5. Dawn Griffiths. (2008). Head First Statistics, O'Reilly Publication, First Edition.

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/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/>

22ADU413

SciKit– 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 demonstrate understanding of the mathematical foundations needed for data science.
- To collect, explore, clean, munge and manipulate data.
- To implement models such as k-nearest Neighbors, Naive Bayes algorithms
- To apply linear and logistic regression on the data set
- To analyze data using decision trees, neural networks and clustering algorithms
- To build data science applications using Python based Scikit-Learn toolkit

Course Outcomes (COs)

At end of this course, the students will be able to:

1. Demonstrate understanding of the mathematical foundations needed for data science.
2. Collect, explore, clean, munge and manipulate data.
3. Implement models such as k-nearest Neighbours, Naive Bayes algorithms
4. Apply linear and logistic regression on the data set
5. Analyse data using decision trees, neural networks and clustering algorithms
6. Build data science applications using Python based Scikit-Learn toolkit

List of Programs:

1. Write coding to load iris dataset
2. Write coding to use KNN (K nearest neighbors) classifier.
3. Write coding for fitting a line to (x,y) data i.e. *simple linear regression* using iris dataset.
4. Write coding to transform the data to two-dimensional using iris dataset.
5. Demonstrates how to generate a dataset and bicluster it using the Spectral Co-Clustering algorithm.
6. Demonstrates how to generate a checkerboard dataset and bicluster it using the Spectral Biclustering Algorithm.
7. Compare the calibration of four different models: Logistic regression, Gaussian Naive Bayes, Random Forest Classifier and Linear SVM.
8. To show the output of the K-Means++ function for generating initial seeds for clustering.

Reference Websites:

1. https://scikitlearn.org/stable/auto_examples/bicluster/plot_spectral_coclustering.html#sphx-glr-auto-examples-bicluster-plot-spectral-coclustering-py
2. https://scikitlearn.org/stable/auto_examples/bicluster/plot_spectral_biclustering.html#sphx-glr-auto-examples-bicluster-plot-spectral-biclustering-py
3. https://scikitlearn.org/stable/auto_examples/calibration/plot_compare_calibration.html#sphx-glr-auto-examples-calibration-plot-compare-calibration-py
4. https://scikitlearn.org/stable/auto_examples/classification/plot_digits_classification.html#sphx-glr-auto-examples-classification-plot-digits-classification-py

21ADU414A**Data Communication and Networks – 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**

- 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. (2019). Data Communications and Networking .6th Edition.New Delhi: THM.
2. Alberto Leon-Garcia, Indra Widjaja (2017). Communication Network .4th Edition.Mc Graw Hill Education.
3. Sathish Jain, Madhulika Jain, Vineeta Pillai, Kratika. (2016). A Level Data Communication & Network Technologies. BPB Publication.
4. Tanenbaum, A. S. (2016). Computer Networks .7th Edition.New Delhi: PHI.

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1. http://docwiki.cisco.com/wiki/Introduction_to_WAN_Technologies

2. www.w3schools.com/tcpip/default.asp
3. <http://www.engppt.com/2009/12/networking-fourouzan-ppt-slides.html>
4. <http://citengg.blogspot.com/p/behrouz-forouzancomputer-networks4th.html>
5. http://www.crectirupati.com/sites/default/files/lecture_notes/DCN%20NOTES.pdf
6. <http://172.16.25.76/course/view.php?id=1831>

21ADU414B**TCP/IP – 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**

To get an architectural overview of the TCP/IP Protocol Suite

- To understand about subnets using IP classes
- To understand the key features and functions of ARP Protocol.
- To understand how basic routing protocol works.
- To understand about DNS and its applications
- To understand the concepts of Remote Login and VPN

Course Outcomes (COs)

At the completion of the course, students will:

1. Have the ability to analyze and differentiate networking protocols used in TCP/IP protocol suite
2. Understand the routing IP datagrams and checksum.
3. Exposed to unicast and multicast routing.
4. Learn about host name resolution and the Domain Name System (DNS).
5. Learn about services and operations of DHCP Servers and Domain Name Servers
6. Understand about SMTP and SNMP.

List of Programs

1. Simple router configuration.
2. Access and utilize the router to set basic parameters.
3. Connect configure and verify operation status of a device interface.
4. Implement static and dynamic addressing services for hosts in a LAN environment.
5. Identify and correct common problems associated with IP addressing and host configurations.
6. Configure verify and troubleshoot RIPv2.
7. Perform and verify routing configuration tasks for a static or default route given.
8. Configure verify and troubleshoot NAT operation on a router.
9. Configure and verify a PPP connection between routers.

Suggested Readings

1. Jason Edelman, Scott Lowe .(2018), Network Programmability and Automation, O'Reilly
2. Jeff Doyle, Jennifer DeHaven Carroll. (2017), Routing TCP/IP, Volume 1. 2nd Edition, Cisco Press.
3. Behrouz, A. Forouzan. (2016). TCP/IP Protocol Suite. 6th Edition. Tata McGraw Hill Publication. New Delhi:
4. Andrews, S. Tanenbaum. (2014). Computer Networks. 5thEdition.:Prentice Hall of India Private Ltd. New Delhi.
5. Buck Graham. (2013). TCP/IP Addressing. 2nd edition. Harcourt India Private Limited. New

Delhi

6. Douglas, E. Comer. (2010). Computer Networks and Internets. 5th Edition. Pearson Education. New Delhi.

7. William Stallings. (2010). Data and Communication Network. 8th edition. Tata McGraw Hill. New Delhi

Web Sites

1. en.wikipedia.org/wiki/Internet_protocol_suitehttp://docwiki.cisco.com/wiki/Introduction_to_WAN_Technologies
2. www.yale.edu/pclt/COMM/TCPIP.HTM
3. www.w3schools.com/tcpip/default.asp

22SSD401**Soft Skill Development- II****Semester – IV
4H – 1C**

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

1. To understand the prime concepts of Employability and Skill Development.
2. To augment the knowledge in Analytical and Mathematical Skills
3. To develop and nurture the soft skills of the students through individual and group activities
4. To vitalize the all-round development of the students by emphasizing on Soft skills and Aptitude
5. To embellish self-esteemed individuals by mastering inter-personal skills, team management skills and leadership skills
6. To steer and bestow right module of training that meets the industry needs and improve their employability accomplishments.

Course Outcomes (COs)

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

- To promote communication skills as well as optimistic personality traits.
- Enhance their employability quotient and thrive in the professional space.
- Understand the progression in grammar and verbal reasoning.
- To elevate and enrich their personal and professional efficacies.
- To sketch their goals and also gets to know diversities in the field of their career planning.
- To pertain learning in different competitive exams/entrance exams for placement/higher studies.

Unit I Inductive And Deductive Calculations

- Geometry and Mensuration
- Coding and Decoding
- Odd Man Out and Analogy
- Logical Sequence of Words
- Direction

Unit II Selection And Arrangement

- Permutation and Combination
- Probability
- Data Arrangement
- Cube and Dice
- Image Analysing
- Puzzles

Unit III- Understanding and Analysing data

- Problems on Ages

- Data Interpretation
- Logarithms
- Syllogism
- Data Sufficiency
- Blood Relation

Unit IV- Banking Problems

- Percentage
- Profit and Loss
- Interest Calculation

Unit V- Advancement Towards Grammar and Behavioural skills

- Statement and Assumption
- Verbal Analogy
- Jumbled Sentence
- Error Spotting
- Sentence Completion
- Sentence Correction
- Implementing and Enhancing Soft Skills

Suggested Readings:

1. Deepak Agarwal and Mr. D.P Gupta .(2018). Quantitative Aptitude.
2. Sarvesh K Verma .(2017). Quantitative Aptitude - Quantum CAT.
3. Barun K Mitra. (2016). Personal Development and Soft Skills, Oxford Higher Education
4. Sangeetha Sharma, Gajendra Singh Chauhan. (2015). Soft skills an integrated approach to maximize personality , Wiley Publishing.
5. P.K.Mittal . (2004).Numerical Ability and Quantitative Aptitude for Competitive examinations

22ADU501	Fundamentals of Artificial Intelligence	Semester – V 4H – 4C
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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. Russell, S. and Norvig, P. (2021). Artificial Intelligence: A Modern Approach, 4th Edition, Prentice Hall.
2. Professor Lewis Brown. (2019). Applied Artificial Intelligence.
3. Patterson (2015) .Introduction to Artificial Intelligence. Pearson Education.
4. Elaine Rich, Kevin Knight, Shivasankar B. Nair. (2014) Artificial Intelligence The McGraw Hill publications, 4th Edition.
5. George F. Luger. (2010). Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th Edition.

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>

22ADU502A**Data Visualization****4H – 4C****Semester – V**

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 datasources 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-evidenceadhoc analysis with parameters, Editing views in tableau Server.

Suggested Readings:

1. Daniel G. Murray and the Inter works BI team . (2019). Tableau your data. Wiley Publications
2. Joshua N. Millign. (2019). Learning Tableau -2019.3rd Edition- Packt publications Student Activity
3. Ashutosh Nandeshwar. (2018). Tableau Data Visualization Cookbook , PACKT publishing.
4. Alexandru C. Telea. (2017). Data Visualization principles and practice. 2nd Edition, CRC Publications
5. Noah Iliinsky, Julie Steele (2011) Designing Data Visualizations: Representing Informational Relationships
6. Nussbaumer Knaflig (2014). Storytelling with Data: A Data Visualization Guide for Business Professionals.

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>

22ADU502B**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 ExpressionsBasic Regular Expression Patterns -Finite State Automata -Regular Languages andFSAs – Morphology - Inflectional Morphology - Derivational Morphology – Finite – StateMorphological Parsing - Combining an FST Lexicon and Rules -Porter Stemmer

UnitII -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 ofSpeech 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 – EarleyParsing -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 TheirSenses - 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 – DiscoursePlanning – Machine Translation -Transfer Metaphor – Interlingua – Statistical Approaches.

Suggested Readings

1. D. Jurafsky and J. Martin. (2020). Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition.
2. Steven Bird, Ewan Klein, and Edward Loper.(2019). Natural Language Processing with Python, O'Reilly Publishers.
3. Ian H Witten and Elbert, Mark A. Hall. (2013). Data mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann Publishers.

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

21ADU503A**Software Engineering****Semester – V
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 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. Pressman, R.S. (2019). Software Engineering: A Practitioner's Approach. 7th edition. New Delhi:McGraw-Hill.
2. Aditya P. Mathur, Foundations of Software Testing (2018). Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education.
3. Jalote, P. (2018). An Integrated Approach to Software Engineering. 2nd edition. New Delhi: New Age International Publishers.
4. Aggarwal, K.K., & Singh, Y. (2017). Software Engineering. 2nd edition. New Delhi: New Age International Publishers.
5. Sommerville, I. (2016). Software Engineering. 8th edition. New Delhi: Addison Wesley.
6. Lisa Crispin and Janet Gregory. (2015). Agile Testing: A Practical Guide for Testers and Agile Teams .

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1. http://en.wikipedia.org/wiki/Software_engineering
2. <http://www.onesmartclick.com/engineering/software-engineering.html>
3. <https://www.javatpoint.com/selenium-tutorial>
4. <https://nptel.ac.in/courses/106105087/>
5. <http://qascript.com/free-selenium-webdriver-ebook/>

21ADU503B**Software Project Management****Semester – V
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 understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization's strategic goals.

Course Outcomes:**At the end of the course, the students should be able to:**

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

Unit I

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

Unit II

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

Unit III

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –

Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

Unit IV

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

Unit V

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

Suggested Readings

1. Anna Murray.(2016). The Complete Software Project Manager: Mastering Technology from Planning to Launch and Beyond. Wiley Publications.
2. Bob Hughes and Mike Cotterell (2015), Software Project Management, 6th Edition, New Delhi: Tata McGraw Hill
3. Royce. (2014), Software Project Management, 3rd Edition, New Delhi: Addisison Wesley.
4. Kelkar (2012), “Software Project Management”, 3rd edition, Prentice Hall India.

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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>

21ADU504A**Data Mining****4H – 4C****Semester – V**

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, (2018) “Introduction to Data Mining”, First edition, Pearson Education.
2. Mohammed J. Zaki, Wagner Meira, Jr.(2017). DataMining and Analysis Fundamental Concepts and Algorithms, Cambridge University Press, May 2017
3. Han, Kamber& Pei. (2017). Data Mining: Concepts and Techniques”, Morgan Kaufmann Publisher, Third Edition
4. G.K. Gupta. (2016). Introduction to Data mining with case studies, 2nd Edition, PHI Private limited, New Delhi.

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>

21ADU504B**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 (2019), Machine Learning, Tata McGraw Hill Publications
2. Y. S. Abu - Mostafa, M. Magdon-Ismail, and H.-T. Lin. (2018).Learning from Data, AMLBook Publishers.
3. P. Flach. (2017). Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press.
4. K. P. Murphy. (2017). Machine Learning: A Probabilistic Perspective, MIT Press,
5. D. Barber. (2015). 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

22ADU511 Fundamentals of Artificial Intelligence – Practical**Semester – V
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 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. Russell, S. and Norvig, P. (2021). Artificial Intelligence: A Modern Approach, 4th Edition, Prentice Hall.
2. Professor Lewis Brown. (2019). Applied Artificial Intelligence.
3. Patterson (2015). Introduction to Artificial Intelligence. Pearson Education.
4. Elaine Rich, Kevin Knight, Shivasankar B. Nair. (2014) Artificial Intelligence The McGraw Hill publications, 4th Edition.
5. George F. Luger. (2010). Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th Edition.

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>

		Semester- V
22ADU512A	Data Visualization– Practical	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 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. Daniel G. Murray and the Inter works BI team . (2019). Tableau your data. Wiley Publications
2. Joshua N. Millign. (2019).Learning Tableau -2019.3rd Edition- Packt publications Student Activity
3. AshutoshNandeshwar. (2018). Tableau Data VisualizationCookbook , PACKT publishing.
4. Alexandru C. Telea. (2017). Data Visualization principles and practice. 2nd Edition, CRC Publications
5. Noah Iliinsky, Julie Steele (2011) Designing Data Visualizations: Representing Informational Relationships
6. NussbaumerKnafllic (2014). Storytelling with Data: A Data Visualization Guide for Business

Professionals.

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>

22ADU512B**Natural Language Processing- 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 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. Lexical Analyzer
5. Semantic Analyzer
6. Sentiment Analysis

Suggested Readings

1. D. Jurafsky and J. Martin. (2020). Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition.
2. Steven Bird, Ewan Klein, and Edward Loper.(2019). Natural Language Processing with Python, O'Reilly Publishers.
3. Ian H Written and Elbef, MarkA.Hall. (2013). Data mining: Practical Machine Learning Tools and Techniques,Morgan Kaufmann Publishers.

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

22ADU513A**Software Engineering - 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 DataFlow • Data Dictionary, UseCases
3.	Project Management: <ul style="list-style-type: none"> • Computing FP • Effort • Schedule, Risk Table, Timelinechart
4.	Design Engineering: <ul style="list-style-type: none"> • Architectural Design • Data Design, Component LevelDesign
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

Suggested Readings

1. Pressman, R.S. (2019). Software Engineering: A Practitioner's Approach. 7th edition. New Delhi: McGraw-Hill.
2. Aditya P. Mathur, Foundations of Software Testing (2018). Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education.
3. Jalote, P. (2018). An Integrated Approach to Software Engineering. 2nd edition. New Delhi: New Age International Publishers.
4. Aggarwal, K.K., & Singh, Y. (2017). Software Engineering. 2nd edition. New Delhi: New Age International Publishers.
5. Sommerville, I. (2016). Software Engineering. 8th edition. New Delhi: Addison Wesley.
6. Lisa Crispin and Janet Gregory. (2015). Agile Testing: A Practical Guide for Testers and Agile Teams

Websites

1. http://en.wikipedia.org/wiki/Software_engineering
2. <http://www.onesmartclick.com/engineering/software-engineering.html>
3. <https://www.javatpoint.com/selenium-tutorial>
4. <https://nptel.ac.in/courses/106105087/>
5. <http://qascript.com/free-selenium-webdriver-ebook/>

22ADU513B**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. Anna Murray.(2016). The Complete Software Project Manager: Mastering Technology from Planning to Launch and Beyond. Wiley Publications.
2. Bob Hughes and Mike Cotterell (2015), Software Project Management, 6th Edition, New Delhi: Tata McGraw Hill
3. Royce. (2014), Software Project Management, 3rd Edition, New Delhi: Addison's Wesley.
4. Kelkar (2012), "Software Project Management", 3rd edition, Prentice Hall India.

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>

21ADU514A**Data Mining - Practical****Semester– V
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 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 ReutersGrain – 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 forvote 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 RandomForest as classifiers.
10. Use any three clustering algorithm on Vehicle data set and find best among them.

Suggested Readings

1. Steinbach Tan, Kumar, (2018) “Introduction to Data Mining”, First edition, Pearson Education.
2. Mohammed J. Zaki, Wagner Meira, Jr.(2017). DataMining and Analysis Fundamental Concepts and Algorithms, Cambridge University Press, May 2017
3. Han, Kamber& Pei. (2017). Data Mining: Concepts and Techniques”, Morgan Kaufmann Publisher, Third Edition
4. G.K. Gupta. (2016). Introduction to Data mining with case studies, 2nd Edition, PHI Private limited, New Delhi.

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>

22ADU514B**Machine Learning - 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 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 (2019), Machine Learning, Tata McGraw Hill Publications
2. Y. S. Abu - Mostafa, M. Magdon-Ismael, and H.-T. Lin. (2018). Learning from Data, AML Book Publishers.
3. P. Flach. (2017). Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press.
4. K. P. Murphy. (2017). Machine Learning: A Probabilistic Perspective, MIT Press,
5. D. Barber. (2015). 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

22ADUOE501**E-Commerce Technologies****Semester – V
3H-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 design components, systems and /or processes to meet required specifications for a web presence.
- To learn the development of electronic business from its origins in electronic data interchange to its current growing importance.
- To secure & work as an effective member or leader of diverse teams within a multi-level, multi-disciplinary and multi-cultural setting for the Group Website Research Project.
- To be aware of global perspectives of M-Commerce (needs, rules/ regulations, and specifications)
- To demonstrate effective and integrative team-work through mobile technology.
- To design and develop effective and efficient E-commerce applications

Course Outcomes(COs)

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

1. Discuss electronic commerce and the stakeholders and their capabilities and limitations in the strategic convergence of technology and business.
2. Gain the global nature and issues of electronic commerce as well as understand the rapid technological changes taking place and electronic payment options.
3. Identify advantages and disadvantages of E-security technology.
4. Demonstrate awareness of ethical, social and legal aspects of M-commerce
5. Analyse features of existing M-commerce businesses, and propose future directions or innovations for specific businesses.
6. Explain the added value, risks and barriers in the adoption of electronic fund transfer

Unit I: An Introduction to Electronic commerce

What is E-Commerce (Introduction And Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce.

Unit II: Electronic Business

Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Electronic Commerce and Electronic Business (C2C) (C2G, G2G, B2G, B2P, B2A, P2P, B2A,C2A, B2B, B2C).

Unit III: E-data

Electronic data exchange introduction, concepts of EDI and Limitation, Application of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment system, Payment types, Value exchange system, credit card system electronic fund transfer, Paperless bill, modern payment cash, Electronic cash, Banner, Shopping Bots.

Unit IV: Mobile Commerce

Introduction-Infrastructure of M-Commerce-Types of mobile commerce service-Wireless Application Protocol(WAP), Generation of Mobile Wireless Technology, Components of Mobile Commerce.

Unit V: Mobile Commerce-Theory and Applications

The Ecology of Mobile Commerce-Mobile business services-Mobile portal-Factors influencing the Adoption of Mobile Gaming services-Mobile data technologies and small business adoption and diffusion

Suggested Readings

1. David Whiteley, .(2019).E-Commerce:Strategy,Technologies and Application. McGraw Hill Education.
2. Bharat Bhasker. (2017). Electronic Commerce: Framework, Technologies and Application.McGrawHill Education. 4th Edition.
3. Paul May, (2017). Mobile Commerce. Cambridge University Press.
4. Gaurav Gupta and Sarika Gupta. (2015). E-Commerce . Khanna Book Publishing Company. 2nd Edition
5. M.Suman &N.Divakara Reddy. (2015). Advanced Ecommerce and mobile Commerce .Himalaya Publishing House.

Websites

- 1.<http://www.economicdiscussion.net/business/e-commerce/31868>
- 2.<https://feinternational.com/blog/what-is-e-commerce-an-introduction-to-the-industry/>
- 3.<https://searchcio.techtarget.com/definition/e-commerce>
- 4.<https://www.toppr.com/guides/business-environment/emerging-trends-in-business/electronic-commerce/>
- 5.<https://searchmobilecomputing.techtarget.com/definition/m-commerce>
- 6.<https://www.toppr.com/guides/business-environment/emerging-trends-in-business/m-commerce/>
- 7.<https://bbamantra.com/m-commerce/>
- 8.<https://nptel.ac.in/content/storage2/courses/106108103/pdf/PPTs/mod13.pdf>
- 9.<http://172.16.25.76/course/view.php?id=1846>

22ADU591	Internship	Semester – V H – 2C
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Instruction Hours / week: L: 0 T: 0 P: 0 Marks: Internal: 100 External: 0 Total: 100
End Semester Exam: 3 Hours

22ADU601**Soft Computing in Data Science****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 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, Narosa. (2020). An introduction to Fuzzy Control, Publication, First Edition.
2. Ke-Lin Du and Madisetti NS Swamy (2018). Neural networks in a soft computing framework”, , Springer Science & Business Media, First Edition, 2018.
3. Sivanandam. S.N and Deepa. S.N . (2018). Principles of Soft Computing, , Wiley India Edition, Third Edition..
4. Ross. J.T, John Wiley & Sons.(2014). “Fuzzy Logic with Engineering Applications”, , Fourth Edition, 2014.
5. Priddy. L.K and Keller. E.P . (2015). Artificial Neural Networks: An Introduction., SPIE Press, First Edition.

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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

22ADU602A**Artificial Intelligence for Cyber Security****4H-4C****Semester -VI****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 Pvt Ltd.
2. Leslie F. Sikos. (2019). AI in Cybersecurity, Springer Nature Switzerland AG.
3. Alessandro Parisi. (2019). Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing.
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>

22ADU602B**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 analyse 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, (2018). Computer Forensics and Investigations, Cengage Learning, 6th Edition.
2. Eoghan Casey. (2016). Handbook of Digital Forensics and Investigation, Academic Press, 1st Edition.
3. John R Vacca. (2010). Computer Forensics”, Cengage Learning, 3rd Edition, 2005

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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

22ADU603A**Big Data Analytics****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**

- 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:

1. Understand the fundamental concepts of big data and analytics
2. Work with big data tools and its analysis techniques
3. Analyze data by utilizing clustering and classification algorithms
4. Learn and apply different mining algorithms and recommendation systems for large volumes of data
5. Perform analytics on data streams
6. 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

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. David Loshin. (2019). Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Morgan Kaufmann/Elsevier Publishers.
2. EMC Education Services. (2018). Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley publishers.
3. Bart Baesens . (2017). Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publishers.
4. Dietmar Jannach and Markus Zanker. (2017). Recommender Systems: An Introduction. Cambridge University Press.
5. Kim H. Pries and Robert Dunnigan. (2016). Big Data Analytics: A Practical Guide for Managers " CRC Press.
6. Jimmy Lin and Chris Dyer. (2015). Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers.

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1. <https://www.ibm.com/analytics/big-data-analytics>
2. <https://www.simplilearn.com/what-is-big-data-analytics-article>

22ADU603B

Deep Learning

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 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)

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

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

UnitIV-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. NavinKumarManaswi. (2018). Deep Learning with Applications Using Python, Apress, 1stEdition.
2. Francois Chollet. (2018). Deep Learning with Python, Manning Publications, 1st Edition.
3. RagavVenkatesan,Baoxin Li. (2018).Convolution Neural Networks in Visual Computing, CRC Press, 1st Edition.
4. Ian Good Fellow, YoshuaBengio and Aaron Courville. (2017). Deep Learning, MIT Press, 1st Edition
5. Phil Kim. (2017). Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence, APress,3rd Edition.
6. Joshua F. Wiley, R . (2016). Deep Learning Essentials, Packt Publications, 1st Edition.

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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

22ADU611**Soft Computing in Data Science - 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 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, Publication, First Edition.
2. Ke-Lin Du and Madiseti NS Swamy (2018). Neural networks in a soft computing framework”, , Springer Science & Business Media, First Edition, 2018.

3. Sivanandam. S.N and Deepa. S.N . (2018). Principles of Soft Computing, , Wiley India Edition, Third Edition..
4. Ross. J.T, John Wiley & Sons.(2014). “Fuzzy Logic with Engineering Applications”, , Fourth Edition, 2014.
5. Priddy. L.K and Keller. E.P . (2015). Artificial Neural Networks: An Introduction., SPIE Press, First Edition.

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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

22ADU612A**Artificial Intelligence for Cyber Security-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:**

- 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 Pvt Ltd.
2. Leslie F. Sikos. (2019). AI in Cybersecurity, Springer Nature Switzerland AG.
3. Alessandro Parisi. (2019). Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing.
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>

22ADU612B**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 analyse 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, (2018). Computer Forensics and Investigations, Cengage Learning, 6th Edition.
2. Eoghan Casey. (2016). Handbook of Digital Forensics and Investigation, Academic Press, 1st Edition.
3. John R Vacca. (2010). Computer Forensics", Cengage Learning, 3rd Edition, 2005

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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

22ADU613A**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. David Loshin. (2019). Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Morgan Kaufmann/Elsevier Publishers.
2. EMC Education Services. (2018). Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley publishers.
3. Bart Baesens . (2017). Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publishers.
4. Dietmar Jannach and Markus Zanker. (2017). Recommender Systems: An Introduction. Cambridge University Press.
5. Kim H. Pries and Robert Dunnigan. (2016). Big Data Analytics: A Practical Guide for Managers " CRC Press.
6. Jimmy Lin and Chris Dyer. (2015). Data-Intensive Text Processing with MapReduce", Synthesis

Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers.

Websites

1. <https://www.ibm.com/analytics/big-data-analytics>
2. <https://www.simplilearn.com/what-is-big-data-analytics-article>

22ADU613B**Deep Learning - 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 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. Navin Kumar Manaswi. (2018). Deep Learning with Applications Using Python, Apress, 1st Edition.
2. Francois Chollet. (2018). Deep Learning with Python, Manning Publications, 1st Edition.
3. Ragav Venkatesan, Baoxin Li. (2018). Convolution Neural Networks in Visual Computing, CRC Press, 1st Edition.
4. Ian Good Fellow, YoshuaBengio and Aaron Courville. (2017). Deep Learning, MIT Press, 1st Edition

5. Phil Kim. (2017). Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence, APress, 3rd Edition.
6. Joshua F. Wiley, R . (2016). Deep Learning Essentials, Packt Publications, 1st Edition.

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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

Semester – VI**22ADU691 Project 8H – 6C**

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

VALUE ADDED COURSES

S.No	Name of the Value-Added Course
1.	Data Analytics
2.	Artificial Intelligence
3.	Internet of things
4.	PC Assembling and Troubleshooting
5.	Android Application Development
6.	Photoshop
7.	Web Designing
8.	Selenium
9.	Cyber Forensics
10.	Network Programming with Cisco Packet Tracer Tool
11.	Database Design and Administration