B.Sc. COMPUTER SCIENCE (COGNITIVE SYSTEMS)

CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum and Syllabus

Regular (2021 – 2022)

Enable | Enlighten | Enrich
KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

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)

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FACULTY OF ARTS, SCIENCE AND HUMANITIES

UNDER – GRADUATE PROGRAMMES

(REGULAR PROGRAMME)

REGULATIONS
(2021)

CHOICE BASED CREDIT SYSTEM (CBCS)

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Annexure I

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

			Board under the 10+2 pattern taking Biology or Botany or Zoology as subjects at the Higher Secondary level.
8	B. Sc.	Information Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
9	B. Sc.	Computer Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
10	B.Sc.	Computer Science(Cognitive Systems)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3-year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
11	B.Sc.	Computer Science (Artificial Intelligence and Data Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern preferably taking Mathematics/Statistics/Computer/Information Science being one of the subjects (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking computer science/maths as one of the subject.
12	BCA	Computer Application	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
13	B.Sc.	Applied Science (Material Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking the respective subject as one of the subject.

14	B.Sc.	Applied Science (Foundary Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern taking Physics as one of the subjects at the Higher Secondary level (OR) 3 year diploma after 10^{th} or 10+2 pattern of education taking the respective subject as one of the subject.
15	B. Com.	Commerce	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
16	B.Com (CA)	Commerce with Computer Applications	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern.
17	B. Com. (PA)	Commerce with Professional Accounting	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
18	B. Com. (BPS)	Commerce with Business Process Services	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
19	B.B.A.	Business Administration	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
20	B. Com	Financial Analytics	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .
21	B. Com	International Accounting and Finance	Candidates who have passed Higher Secondary Education (XII) or any equivalent Examination conducted by a State Government or a University or Board under the 10+2 pattern .

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FACULTY OF ARTS, SCIENCE AND HUMANITIES
UNDER-GRADUATE PROGRAMMES
REGULAR MODE
REGULATIONS - 2021

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

1 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

1.1 U.G. Programmes Offered

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

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

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

1.2 Mode of Study

Full-Time

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

1.3 Admission Requirements (Eligibility)

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

2. DURATION OF THE PROGRAMMES

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

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

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

3. CHOICE BASED CREDIT SYSTEM

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

3.2. Credits

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

4. STRUCTURE OF THE PROGRAMME

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

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

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

4.2.1. Core Course

Core course consists of theory and practical for Department domains for which examinations shall be conducted at the end of each semester. The students have to study 12 Core Courses compulsorily. Students have to earn 62 Credits in Core Course.

4.2.2. Discipline Specific Electives (DSE)

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

4.2.3. Generic Elective

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

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

Note: A particular elective course will be offered only if at least one third of the students in a class choose that course. If less, the elective selected has to be studied as a self-study course only. Students have to earn 19 Credits in Generic Elective and 25 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 8 Credits in Skill Enhancement Courses.

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

4.2.5. Project Work

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

4.2.6. Ability Enhancement Course

Ability Enhancement Course-1

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

Ability Enhancement Compulsory Course-2

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

4.2.7. Internship

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

5.0 Value Added Courses

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

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

6.0 Online Course

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

7.0 Extension Activities

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

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

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

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

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

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

5. MEDIUM OF INSTRUCTION

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

6. MAXIMUM MARKS

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

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

7. REQUIREMENTS TO APPEAR FOR THE END SEMESTER EXAMINATION

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

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

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

8. a. FACULTY MENTOR

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

b. **ONLINE COURSE COORDINATOR**

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

9. CLASS COMMITTEE

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

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

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

10. COURSE COMMITTEE FOR COMMON COURSES

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

11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

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

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

Theory Courses

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

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

Practical Courses

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

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

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

11.3 Pattern of Test Question Paper

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

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

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

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

11.4 Attendance

Marks Distribution for Attendance

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

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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 x 1 = 20 Marks) Question No. 1 to 20 Online Multiple Choice Questions
Part- B	5 Questions of 2 marks each(5 x 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 x 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.

GPA of a Semester = Sum of the product of the GP by the corresponding credits of the courses offered in that Semester / Sum of the credits of the courses of that Semester

i.e. **GPA** of a Semester = $\frac{\sum_i CiGPi}{\sum_i Ci}$

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

i.e. **CGPA** of the entire programme = $\frac{\sum_n \sum_i CniGPni}{\sum_n \sum_i Cni}$

where,

Ci is the credit fixed for the course 'i' in any semester

GPi 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, IoT, Image processing, Green computing, web designing, mobile computing and networking for efficient design of computer based system of varying complexity.

l) Apply standard software Engineering practices and strategies in software project development using open-source programming environment to deliver a quality for business success.

m) Be acquainted with the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems.

n) An ability to produce cost effective, quality and maintainable software products and solutions (services) meeting the global standards and requirements with the knowledge acquired and using the emerging techniques, tools and software engineering methodologies and principles and able to comprehend and write effective project reports in multidisciplinary environment in the context of changing technologies.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO I : To be a working Information Technology (IT) professional with core competencies that can be used on multi-disciplinary projects

PEO II : To understand the importance of relationship building within the IT industry

PEO III : To understand the need for lifelong learning in the exploration and journey in IT

PEO IV : To understand, evaluate and practice ethical behavior within the IT industry

PEO V : To be cognizant of security issues and their impacts on industry

MAPPING of PEOs and POs

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

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)
Coimbatore-21
Faculty of Arts, Science and Humanities
Department of Computer Science
UG Curriculum (CBCS)- (2021 – 2022) Batch
Program: B.Sc Computer Science (Cognitive Systems)

Course code	Name of the course	Objectives and out comes		Instruction hours / week			Credit(s)	Maximum Marks			Category	Page No
		PEOs	POs	L	T	P		CIA	ESE	Total		
								40	60	100		
SEMESTER - I												
21LSU101	Language –I	IV	d,e	04	-	-	4	40	60	100	AEC	1
21ENU101	English - I	I	a,b,c	04	-	-	4	40	60	100	AEC	5
21CGU101	Object Oriented Programming using C++	I	a,b,c	04	-	-	4	40	60	100	Core	6
21CGU102	Operating Systems	I	b,c,g	04	-	-	4	40	60	100	Core	8
21CGU103	Web Designing	I	h,j	03	-	-	3	40	60	100	Core	10
21CGU111	Object Oriented Programming using C++ - Practical	I	a,b,c, g	-	-	04	2	40	60	100	Core	12
21CGU112	Operating Systems - Practical	I	a,c,g	-	-	04	2	40	60	100	Core	14
21CGU113	Problem Solving using Worksheets – Practical	III	b,h,j	-	-	03	3	40	60	100	Core	15
Semester Total				**19**	**-**	**11**	**26**	**320**	**480**	**800**		
SEMESTER – II												
21LSU201	Language – II	IV	d,e	04	-	-	4	40	60	100	AEC	16
21ENU201	English – II	II	d,f	04	-	-	4	40	60	100	AEC	20
21CGU201	Computer Networks	I	c,h,i	04	-	-	4	40	60	100	Core	21
21CGU202	Information Technology Information Library	III	a,b	04	-	-	4	40	60	100	Core	23
21CGU203	Discrete Structures	IV	e,i	05	-	-	4	40	60	100	Allied	25
21CGU211	Computer Networks – Practical	I	a,c,h,i	-	-	03	2	40	60	100	Core	27
21CGU212	Web Technologies - Practical	III	a,b,j	-	-	03	1	40	60	100	Core	28
21AEC201	Environmental Studies	IV	d,e	03	-	-	3	40	60	100	AEC	29
Semester Total				**24**	**-**	**6**	**26**	**320**	**480**	**800**		

SEMESTER – III												
21CGU301	Data Structures	I	a,b,g,h	04	-	-	4	40	60	100	Core	31
21CGU302	Python Programming	III	a,b,h,k	04	-	-	4	40	60	100	Core	33
21CGU303	Virtualization and Cloud	III	a,b,j,k	04	-	-	4	40	60	100	Core	35
21CGU304A	Infrastructure Management	I	a,b,c,m	03	-	-	3	40	60	100	SEC	37
21CGU304B	Android Programming	IV	c,d,e,i									39
21CGU311	Data Structures - Practical	I	a,b,g,h	-	-	04	2	40	60	100	Core	41
21CGU312	Python Programming-Practical	III	a,b,h,k	-	-	04	2	40	60	100	Core	43
21CGU313	Virtualization and Cloud-Practical	III	a,b,j,k	-	-	04	2	40	60	100	Core	44
21CGU314A	Infrastructure Management- Practical	I	a,b,c,m	-	-	03	1	40	60	100	SEC	45
21CGU314B	Android Programming – Practical	IV	c,d,e,i	-	-							46
Semester Total				**15**	**-**	**15**	**22**	**320**	**480**	**800**		
SEMESTER – IV												
21CGU401	Programming in JAVA	I	a,b,c,m	04	-	-	4	40	60	100	Core	48
21CGU402	Database Management System	IV	c,d,e,l	04	-	-	4	40	60	100	Core	50
21CGU403	Cognition and Problem Solving	I	a,b,g,h	04	-	-	4	40	60	100	AEC	52
21CGU404A	Process Management	III	a,b,h,j,k	03	-	-	3	40	60	100	SEC	54
21CGU404B	Programming in MATLAB	III	a,b,h,j,k									56
21CGU411	Programming in JAVA – Practical	I	a,b,c,m	-	-	04	2	40	60	100	Core	58
21CGU412	Database Management System- Practical	IV	c,d,e,l	-	-	04	2	40	60	100	Core	60
21CGU413	Statistical Analysis - R Programming - Practical	I	a,b,g,h	-	-	04	2	40	60	100	Core	61
21CGU414A	Devops tools- Practical	III	a,b,h,j,k			03	1	40	60	100	SEC	63
21CGU414B	Programming in MATLAB – Practical	III	a,b,h,j,k									64
Semester Total				**15**	**-**	**15**	**22**	**320**	**480**	**800**		
SEMESTER –V												
21CGU501	Information Security and Cyber Laws	I	c,g	04	-	-	4	40	60	100	Core	67
21CGU502A	Introduction to Digital Technology	I	b,e,m	04	-	-	4	40	60	100	DSE	69
21CGU502B	Machine Learning	III	a,b,h,j									71

21CGU503A	Software Testing	II	a,b,h,j	04	-	-	4	40	60	100	DSE	73
21CGU503B	Data Mining	I	a,b,h									75
21CGU504A	Client Relationship Management	II	d,e,f	03	-	-	3	40	60	100	DSE	77
21CGU504B	Introduction to Data Science	IV	c,e,i,l									79
21CGU511	Information Security and Cyber Laws – Practical	I	b,e,m	-	-	04	2	40	60	100	Core	81
21CGU512A	Introduction to Digital Technology – Practical	III	a,b,h,j	-	-	04	2	40	60	100	DSE	83
21CGU512B	Machine Learning - Practical	III	a,b,h,j									84
21CGU513A	Software Testing - Practical	I	c.g	-	-	04	2	40	60	100	DSE	86
21CGU513B	Data Mining - Practical	III	a,b,h									87
21CGU514A	Client Relationship Management – Practical	II	d,e,f	-	-	03	1	40	60	100	DSE	89
21CGU514B	Introduction to Data Science – Practical	IV	c,e,i,l	-	-							90
	Semester Total			**15**	**-**	**15**	**22**	**320**	**480**	**800**		
SEMESTER –VI												
21CGU601	PHP Programming	III	a,b,h,j ,k	04	-	-	4	40	60	100	Core	92
21CGU602A	Artificial Intelligence	IV	c,d,e	04	-	-	4	40	60	100	DSE	94
21CGU602B	Digital Image Processing	I	a,c,g, m									96
21CGU603A	Computer Graphics	I	a,d,g, m	03	-	-	3	40	60	100	DSE	98
21CGU603B	Complier Design	V	e,j,l									100
21CGU611	PHP Programming - Practical	III	a,b,h,j ,k	-	-	04	2	40	60	100	Core	102
21CGU612A	Artificial Intelligence-Practical	IV	c,d,e	-	-	04	2	40	60	100	DSE	103
21CGU612B	Digital Image Processing-Practical	I	a,c,g, m									105
21CGU613A	Computer Graphics – Practical	I	a,d,g, m	-	-	03	1	40	60	100	DSE	107
21CGU613B	Complier Design - Practical	V	e,j,l									109
21CGU691	Project	II	d,e,f,	08	-	-	6	40	60	100		111
	ECA / NCC / NSS / Sports / General interest etc			Good								
	Semester Total			**19**	**-**	**11**	**22**	**280**	**420**	**700**		
	Grand Total			**107**	**-**	**73**	**140**	**1880**	**2820**	**4700**		

Ability Enhancement Courses (AEC)		
Semester	**Course Code**	**Name of the Course**
I	21LSU101	Language –I
	21ENU101	English– I
II	21LSU201	Language –II
	21ENU201	English-II
IV	21CGU403	Cognition and Problem Solving

Generic Elective Courses (GE) /Allied Courses		
Semester	**Course Code**	**Name of the Course**
II	21CGU203	Discrete Structures

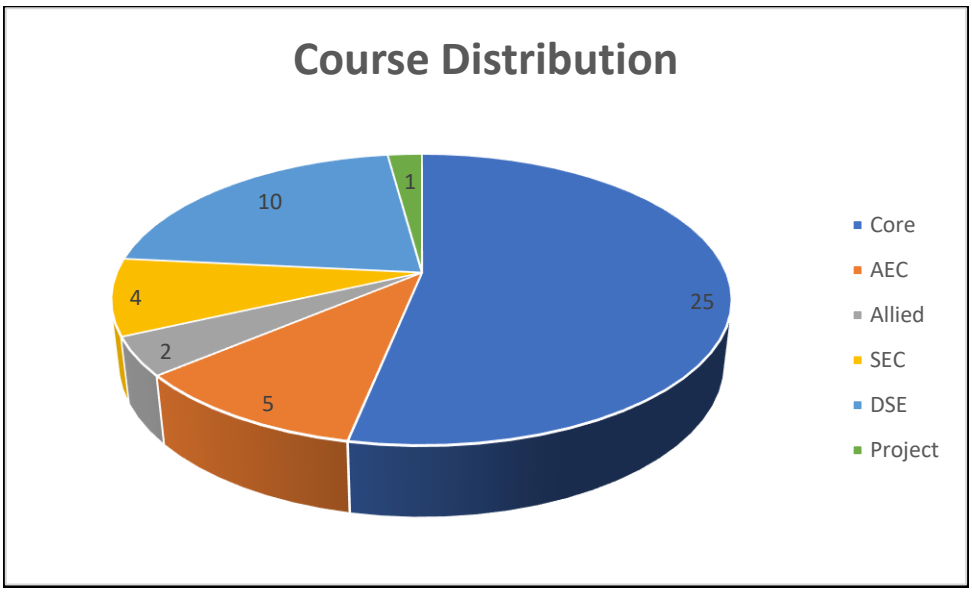
Core Courses (CC)		
Semester	**Course Code**	**Name of the Course**
I	21CGU101	Object Oriented Programming using C++
	21CGU102	Operating Systems
	21CGU103	Web Designing
	21CGU111	Object Oriented Programming using C++ - Practical
	21CGU112	Operating Systems - Practical
	21CGU113	Problem solving using Worksheets - Practical
II	21CGU201	Computer Networks
	21CGU202	Information Technology Information Library
	21CGU211	Computer Networks - Practical
	21CGU212	Web Technologies - Practical
III	21CGU301	Data Structures
	21CGU302	Python Programming
	21CGU303	Virtualization and Cloud
	21CGU311	Data Structures - Practical
	21CGU312	Python Programming - Practical
	21CGU313	Virtualization and Cloud - Practical
IV	21CGU401	Programming in JAVA
	21CGU402	Database Management System
	21CGU411	Programming in JAVA - Practical
	21CGU412	Database Management System - Practical
V	21CGU501	Information Security and Cyber Laws
	21CGU511	Information Security and Cyber Laws- Practical
VI	21CGU601	PHP Programming
	21CGU611	PHP Programming - Practical
	21CGU691	Project

Skill Enhancement Courses(SEC)		
Semester	**Course Code**	**Name of the Course**
III	21CGU304A	Infrastructure Management
	21CGU304B	Android Programming
	21CGU314A	Infrastructure Management - Practical
	21CGU314B	Android Programming - Practical
IV	21CGU404A	Process Management
	21CGU404B	Programming in MATLAB
	21CGU414A	Devops Tools - Practical
	21CGU414B	Programming in MATLAB - Practical

Discipline Specific Elective Courses (DSE)		
Semester	**Course Code**	**Name of the Course**
V	21CGU502A	Introduction to Digital Technology
	21CGU502B	Machine Learning
	21CGU503A	Software Testing
	21CGU503B	Data Mining
	21CGU504A	Client Relationship Management
	21CGU504B	Introduction to Data Science
	21CGU512A	Introduction to Digital Technology - Practical
	21CGU512B	Machine Learning - Practical
	21CGU513A	Software Testing - Practical
	21CGU513B	Data Mining - Practical
	21CGU514A	Client Relationship Management - Practical
	21CGU514B	Introduction to Data Science - Practical
VI	21CGU602A	Artificial Intelligence
	21CGU602B	Digital Image Processing
	21CGU603A	Computer Graphics
	21CGU603B	Compiler Design
	21CGU612A	Artificial Intelligence- Practical
	21CGU612B	Digital Image Processing - Practical
	21CGU613A	Computer Graphics - Practical
	21CGU613B	Compiler Design - Practical

Course Distribution Table:

Category	No. of Courses		Total
	Theory	- Practical	
Core	12	13	25
AEC	5	0	5
Allied	1	1	2
SEC	2	2	4
DSE	5	5	10
Project	1	0	1
Total	26	21	47



Semester – I

21LSU101 LANGUAGE- 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’ குறித்தபன்நோக்குஅணுகுமுறையிலானஆய்வுச்சிந்தனைமேம்பாடு.
- வேலைவாய்ப்புக்குரியசுயதிறன்மேம்பாட்டுடன், படைப்பாக்கத்திறன்மேம்பாடும்பெற்றிருத்தல் .
- சமுதாயமற்றும்வாழ்வியல்மதிப்புகளைப்பேணுவதற்குக்கருவியாகஇலக்கியங்களைநாடுகின்றமனப்பான்மைவளர்ச்சி.
- மொழிபெயப்புத்துறைசார்ந்தவேலைவாய்புத்திறன்பெற்றிருத்தல்

தாள்கள்வரிசையும்தேர்வுச்செயல்திட்டமும்பகுதி-I தமிழ்

-

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண் அக/எழுத்து	மொத்தம்	மதிப்பீடு
ஒன்று	I	4	3	40 / 60	100	4

அலகு – I : தமிழ்இலக்கியவரலாறு– I

(8மணிநேரம்)

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– தலைவி கூற்று-110

ஐங்குறுநூறு :மருதம் –தோழிகூற்று-வேட்கைப்பத்து:வாழிஆதன்வாழிஅவினி - 6

பதிற்றுப்பத்து: சிதைந்ததுமன்ற- 27

பரிபாடல்:புறத்திரட்டு- மதுரைநகர்ச்சிறப்பு –

உலகம்ஒரு நிறையாத்தான்-7, மாயோன் கொப்பூழ்-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 (10மணிநேரம்)

1. **திருவள்ளுவர்- திருக்குறள்**– அதிகாரம் 67 – வினைத்திட்பம், அதிகாரம் 100 - பண்புடைமை
2. **முன்றுறையரையனார் – பழமொழி நானூறு**5 பாடல்கள்

உணற்குஇனிய 5, பரந்ததிறலாரை 32, நெடியதுகாண்கிலாய் 46, இனியாரும் 153, உரைசான்ற 195.

3. **ஔவையார் – கொன்றைவேந்தன்** (1- 50 பாடல்கள்)

அன்னையும்பிதாவும் – புலையும்கொலையும்களவும்தவிர்

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

தேர்ந்தெடுக்கப்பட்ட5பாடல்கள்)

சின்னவோர்பொருள், கடவுளைவருந்தி, எப்புவிகளும், வைத்தவர், ஈன்றவர்

அலகு - IV :காப்பிய இலக்கியம் (10மணிநேரம்)

(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) - என்னேயிஃதென்னே – மீவிசும்பிற்றோன்றுமால்.

(ஆ). மணிமேகலை(5 மணிநேரம்)

பசியின்கொடுமை: பாத்திரம்பெற்றகாதை:

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

சிறைக்கோட்டம்அறக்கோட்டமாக்கியகாதை:மாவண்கிள்ளிக்குகாவலன்உரைத்தவை:

‘பைஞ்சேறுமெழுகாப்பசும்பொன்மண்டபத்து -
அறவோர்க்காக்கினன்அரசாள்வேந்தன்’ (116-163).

அலகு- V :அடிப்படைஇலக்கணமும்பயன்பாட்டுத்தமிழும் -I

(8மணிநேரம்)

அ).எழுத்து, சொல், பொருள் இலக்கணங்கள்(4 மணிநேரம்)

1. முதல்மற்றும்சார்பெழுத்துகள்- பெயர்,வினை, இடை, உரிச்சொல்முதலானஅடிப்படைஇலக்கணவிளக்கப்பயிற்சிகள்

2). அகத்திணைமற்றும்புறத்திணைஇலக்கணங்கள்

ஆ). கடிதப்பயிற்சி(4 மணிநேரம்)

1. தன்விவரக்குறிப்புடன்வேலைவேண்டிவிண்ணப்பம்எழுதுதல்
2. பல்கலைக்கழகப்பன்னாட்டுக்கருத்தரங்கச்செய்தியைநாளிதழில்வெளியிடவேண்டிநாளிதழின்பதிப்பாசிரியருக்குக்கடிதம்
3. கருத்தரங்கப்பங்கேற்புக்குஅனுமதிக்கடிதம்
4. பல்கலைக்கழகவிழாவுக்குத்தலைமையேற்கவேண்டி, மாவட்டஆட்சியருக்குவிண்ணப்பம்
5. கல்விகடன்வேண்டிவங்கிமேலாளருக்குவிண்ணப்பம்
6. வசிப்பிடத்திற்குஅடிப்படைவசதிவேண்டிவட்டாட்சியருக்குவிண்ணப்பம்
7. தேசியவிருதுபெற்றநண்பனுக்குப்பாராட்டுக்கடிதம்

8. புத்தகங்கள்அனுப்பிஉதவவேண்டி,
பதிப்பகத்தாருக்குவிண்ணப்பம்

Semester – I

21ENU101 ENGLISH -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 Objective:

- 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 Outcome:

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

UNIT - I:**Grammar**
Types of Sentences, Subject and Predicate,Parts of Speech,Tenses, Preposition and Articles

UNIT –II:Communication Exercise
Importance of Business Language- Words often Confused- Words often Misspelt- Common Errors in English-Charts and Pictorial Writing.

UNIT – III: **Interpersonal Skills**
Greetings & Introduction- Giving & Denying Permission- Telephone Etiquette-
Oral Presentation – Plan, PowerPoint Presentation- Preparation of Speech- Audience psychology- Secrets of Good Delivery

UNIT - IV: LSRW Skills
Listening- Listening and its types, Basic Listening Lessons
Speaking- Basics of speaking, Regular English, Business English, Interview English
Reading- Reading and its purposes, Types of Reading, Reading Techniques
Writing- Types of Writing, Components of Writing, Language and Style with accordance to the contexts

UNIT - V: Literature
Prose: Let's Do What India Needs fromUs -Dr.A.P.J. Abdul Kalam
Poem: A Prayer for My Daughter - W.B. Yeats
Short Story: Sparrows- K. Ahmad Abbas

Suggested Reading:

1. Hewings Martin,2013Advanced Grammar in Use, CambridgeUniversity Press
2. Haines *Simon,2015 Advanced Skills, A resource Book of Advanced- Level Skill Activities*

Semester-I

21CGU101 OBJECT ORIENTED PROGRAMMING USING C++ 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 ,MikeMurach& Associates Inc.
3. Bjarne Stroustroup, 2014, Programming - Principles and Practice using C++, 2nd Edition,Addison-Wesley.
4. Stefan Bjornander, 2016,C++ Windows Programming, Published byPacktPublishingLtd.
5. Harry, H. Chaudhary, 2014, Head First C++ Programming: The Definitive Beginner's Guide, First Create space Inc, O-D Publishing, LLC USA.
6. Debasish Jana, 2014,C++ And Object-Oriented Programming Paradigm,PublishedbyPHI Learning Pvt. Ltd
7. Richard L. Stegman, 2016, Focus on Object-oriented Programming with C++,6th Edition, CreateSpace Independent Publishing Platform.

Websites

1. www.programmingsimplified.com
2. www.programiz.com / cpp-programming
3. www.cplusplus.com
4. www.learncpp.com
5. www.udemy.com
6. https://nptel.ac.in/courses/106101208/

LMS

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

Semester – I

21CGU102 OPERATING SYTSEMS 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 recognize the concepts and principles of Windows operating system.
- To provide students with the basic knowledge and skills of memory in Windows
- To provide device and Process management and techniques in Windows environment.
- To able to do server monitoring of Windows
- To able to create group policy in Windows 2012.
- Install MS Windows 2012 environment.

Course Outcomes (COs)

1. Ability to work in Windows 7 operating system, its tools and utilities.
2. Install and configure Windows 2012 server and client.
3. Use administrative tools and backup management for Windows 2012 server.
4. Understand device and Process management and techniques in Windows environment.
5. Monitor server OS of Windows
6. Create group policy in Windows 2012.

Unit I - WINDOWS

Windows-Hardware Basics, Operating System overview and Windows, Windows 7 Essential, Client OS-Windows 7-Users and Groups-IP Configuration, Client OS-Windows 7 Tools and Utilities-Client OS Windows 7- Installation-Features-Disk Management-File Systems.

Unit II - Server OS

Server OS-Windows Server 2012 Overview-Server DNS-Zone Creation - DHCP - PRACTICAL-Advanced server storage Management-server ADS concepts and FSMO-Server OS Windows Server 2012 Roles and features- Server OS Windows Server 2012 File and Print Services.

Unit III - OS MONITORING

Server OS monitoring and managing Windows Server 2012-Server OS Windows Server 2012 DNS and DHCP- Server OS Windows server 2012 Administrative Tools and ADS

Unit IV - SERVER OS

Server OS-Windows Server 2012-Storage and Backup Management-Client OS Windows 7 Devices and Printers-Server OS Windows Server 2012 Installation.

Unit V - GROUP POLICY MANAGEMENT

Group Policy Management-Server Windows Server 2012- File and print services-Group Policy-Server Storage Management –Server Scenario- Server OS Windows Server 2012-DNS and DHCP -Server- ADS scenario.

Suggested Readings

1. Mitch Tulloch, “Windows 7 Essential Guidance”, 2009.
2. William PanekTylor Wentworth, “Microsoft Windows 7 Administration”, Wiley Publishing, 2010
3. Charles Edge, Chris Barker EhrenSchwiebert, “Beginning MacOSX Snow Leopard Server”, 2010

4. Greg Tomsho, “Guide to Operating System”, 5th Edition, 2017.

Web Sites

1. https://searchitchannel.techtarget.com/tip/Windows-7-user-accounts-and-groups-management
2. https://docs.microsoft.com/
3. https://www.microsoft.com/en-in/evalcenter/evaluate-windows-server-2012

Semester – I

21CGU103 WEB DESIGNING 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 concepts and architecture of the World Wide Web.
- To understand and practice markup languages
- To understand the technologies used in Web Programming.
- To know the importance of object-oriented aspects of Scripting.
- To understand and practice embedded dynamic scripting on client-side Internet Programming
- To design an interactive website using HTML, CSS and JavaScript.

Course Outcomes (COs)

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

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

Unit I - HTML

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

Unit II – Frames

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

Unit III - CSS

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

Unit IV – JavaScript Programming

Introduction to JavaScript: Utility of JavaScript-Evolution of the JavaScript Language-JavaScript Versions and Browser Support- Differences Between Client-Side vs. Server-Side JavaScript-Statements and Operators-Variable Declarations- Operators and Statements- Operator Precedence- Implementing Control Constructs: Conditional and Looping Constructs-

Implementing Functions: Defining Functions-Calling Functions- Passing Arguments- Local vs. Global Variables- Using the Return Statement-Nested Functions.

Unit V - JavaScript Objects

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

Suggested Readings

1. "Web Coding & Development All-in-One For Dummies",PaulMcFedries ,2018 "Fundamentals of Web Development" ,Randy Connolly, Ricardo Hoar ,2017
2. Principles of web design.,Joelsklar,sixth edition,2015
3. "HTML and CSS: Design and Build Websites" ,Jon Duckett,2014
4. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013

Websites

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

Semester-I

21CGU111 OBJECT ORIENTED PROGRAMMING USING C++- PRACTICAL 4H – 2C

Instruction Hours / week: L:0 T: 0 P:4 **Marks:** Internal:**40**External:**60**Total: **100**

End Semester Exam :3 Hours

Course Objectives

- 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 ofPrograms

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 ,MikeMurach& Associates Inc.
3. Bjarne Stroustroup, 2014, Programming - Principles and Practice using C++, 2nd Edition,Addison-Wesley.
4. Stefan Bjornander, 2016,C++ Windows Programming, Published byPacktPublishingLtd.
5. Harry, H. Chaudhary, 2014, Head First C++ Programming: The Definitive Beginner's Guide, First Create space Inc, O-D Publishing, LLC USA.

6. Debasish Jana, 2014,C++ And Object-Oriented Programming Paradigm,PublishedbyPHI Learning Pvt. Ltd
7. Richard L. Stegman, 2016, Focus on Object-oriented Programming with C++,6th Edition, CreateSpace Independent Publishing Platform.

Websites

1. www.programmingsimplified.com
2. www.programiz.com / cpp-programming
3. www.cplusplus.com
4. www.learncpp.com
5. www.udemy.com

Semester – I

21CGU112 OPERATING SYSTEMS- PRACTICAL 4H – 2C

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

Course Objectives

- To recognize the concepts and principles of Windows operating system.
- To provide students with the basic knowledge and skills of memory in Windows
- To provide device and Process management and techniques in Windows environment.
- To able to do server monitoring of Windows
- To able to create group policy in Windows 2012.
- Install MS Windows 2012 environment.

Course Outcomes (COs)

1. Ability to work in Windows 7 operating system, its tools and utilities.
2. Install and configure Windows 2012 server and client.
3. Use administrative tools and backup management for Windows 2012 server.
4. Understand device and Process management and techniques in Windows environment.
5. Monitor server OS of Windows
6. Create group policy in Windows 2012.

List of programs

1. Installation of client and server OS
2. Create server and play roles
3. Zone creation and DHCP
4. File and print services
5. Devices and printers
6. Group policy
7. Server storage management
8. Server scenario
9. ADS Scenario based
10. DNS and DHCP

Semester – I

21CGU113 PROBLEM SOLVING USING WORKSHEETS – PRACTICAL3H – 3C

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

Course Objectives

- Write functions in Microsoft Excel to perform basic calculations and to convert number to text and text to number.
- Create applications using VBA code in Excel
- Construct formulas, including the use of built-in functions, and relative and absolute references.
- To be able to develop macros.
- To be able to Format worksheets.
- To create an interactive worksheet.
-

Course Outcomes (COs)

1. Create and design a spreadsheet for general office use.
2. Demonstrate the basic mechanics and navigation of an Excel spreadsheet.
3. Demonstrate the use of basic functions and formulas
4. Create applications using VBA code in Excel
5. Ability to develop macros.
6. Creating interactive worksheets

List of programs

1. Create sales dashboard (such as Market wise, Product wise, quarter wise sales) in Excel using VBA code
2. Create randomized quiz question paper in Excel using VBA code.
3. Design an attendance tracker using login time of the employee in Excel using VBA code to perform the operation like if employee is late, and then lock the system.

Semester – II

21LSU201 LANGUAGE-II 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 திறனைமேம்படுத்துதல்.
- 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

1. இந்தியகுடியுரிமைப்பணிமுதலானபோட்டித்தேர்வுகளில், விருப்பப்பாடமாகஇடம்பெறுகின்ற, ‘தமிழ்இலக்கியவரலாறு’ குறித்தமுழுமையானஅறிமுகம்பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல்மற்றும்தொல்லியல்சார்ந்தஆவணத்தேடலுக்குரியஆய்வுமனப்பான்மையுடன், இலக்கியங்களைஅணுகுதல்.
3. தமிழின்வளர்ச்சித்துறையாகிய, ‘அறிவியல்தமிழ்’;‘இணையதமிழ்’ குறித்தபன்நோக்குஅணுகுமுறையிலானஆய்வுச்சிந்தனைமேம்பாடு.
4. வேலைவாய்ப்புக்குரியசுயதிறன்மேம்பாட்டுடன், படைப்பாக்கத்திறன்மேம்பாடும்பெற்றிருத்தல் .
5. சமுதாயமற்றும்வாழ்வியல்மதிப்புகளைப்பேணுவதற்குக்கருவியாகஇலக்கியங்களைநாடுகின்றமனப்பான்மைவளர்ச்சி.
6. மொழிபெயப்புத்துறைசார்ந்தவேலைவாய்புத்திறன்பெற்றிருத்தல்

அலகு – I :தமிழ்இலக்கியவரலாறு- II
(5மணிநேரம்)

தமிழ்இலக்கியவரிசையில்திருமுறைகளும்நாலாயிரத்திவ்யப்பிரப

ந்தமும்-பன்னிருதிருமுறைகள்அறிமுகம்-
திருமுறைஆசிரியர்களின்இலக்கியப்பங்களிப்பு-
திருமுறைகளில்பக்திநெறியும்சமுதாயநோக்கும்-
சமயக்குரவரின்அருள்நெறி- பன்னிருஆழ்வார்கள்வரலாறு-
ஆழ்வார்களின்இலக்கியப்பங்களிப்பு-
திவ்யப்பிரபந்தத்தில்பக்திநெறியும்இலக்கியநயமும்-
தமிழில்சிற்றிலக்கியக்காலமும்கருத்தும்-
தொண்ணூற்றாறுவகைச்சிற்றிலக்கியவரிசை- தமிழ்மொழியின்கவிதை - சிறுகதை – உரைநடை –இலக்கியங்களின்தோற்றம் – வளர்ச்சி – உத்திகள்–நாட்டுப்புறஇலக்கியங்கள்-
கொங்குநாட்டார்வாய்மொழிவழக்காறுகள்.

அலகு – II :பக்திஇலக்கியமும்சிற்றிலக்கியமும்: (12 மணிநேரம்)

அ). பக்திஇலக்கியம்(6 மணிநேரம்)

1. **1. சைவம்-** பெரியபுராணம் – இளையான்குடிமாறநாயனார்புராணம் -(**19 பாடல்கள்**)

(அம்பொன்நீடிய, கொண்டுவந்து, ஆளுநாயகர், செல்வம்மேவிய, மாரிக்காலத்து, ஈரமேனியை, நமக்குமுன்பிங்கு, செல்லல்நீங்க,மற்றம்மாற்றம், உள்ளம்அன்பு, காலினால்தடவி, வந்தபின்மனைவியாரும், முறித்தவைஅடுப்பின், வழிவரும்இளைப்பினோடும், மனைவியார்கொழுநர், கணவனார்தம்மை, அழுந்தியஇடருள், மாலயற்கரிய, அன்பனேஅன்பர்பூசை)

2. வைணவம் – ஆண்டாள்நாச்சியார்திருப்பாவை: (**11 பாடல்கள்**)**:**மார்கழித்திங்கள், வையத்து வாழ்வீர்காள், ஓங்கிஉலகளந்த, ஆழிமழைக்கண்ணா, மாயனைமன்னுவடமதுரை, சிற்றம்சிறுகாலே, ஒருத்திமகனாய், மாலேமணிவண்ணா, கூடாரைவெல்லும், கறவைகள்பின்சென்று, வங்கக்கடல்கடைந்த.

ஆ). சிற்றிலக்கியம் (6 மணிநேரம்)

1. முக்கூடற்பள்ளு- 2 பாடல்கள் - சித்திரக்காலிவாலான் (நெல்வகைகள்)

குற்றாலத்திரிகூடமால்வரை (மீன்வகைகள்)

2. நந்திகலம்பகம்- 5 பாடல்கள்- என்னையேபுகழ்ந்தேன், பதிதொறுபுயல்பொழி,

இந்தப்புவியில், அடிவிளக்கும்துகில், வானுறுமதியை

3. மதுரைச்சொக்கநாதர்தமிழ்விடுதூது –தமிழின்சிறப்பு

பாடியருளபத்துப்பாட்டும்-விளம்பக்கேள்.

அலகு – III: கவிதையும்சிறுகதையும் (16 மணிநேரம்)

அ). கவிதை இலக்கியம் (8 மணிநேரம்)

1. மகாகவிபாரதியார் –கண்ணன் – என்சீடன்
2. புரட்சிக்கவிஞன்பாரதிதாசன் –இளையார்ஆத்திசூடி-அழுபவன்கோழை
3. கவிமணிதேசிகவிநாயகம்பிள்ளை–கோயில்வழிபாடு
4. கவிக்கோ. அப்துல்ரகுமான் –பாருக்குள்ளே நல்ல நாடு
5. சிற்பிபாலசுப்பிரமணியன் –மலையாளக் காற்று
6. கவிஞர்தாமரை –தொலைந்துபோனேன்
7. கவிஞர்கரிகாலன்–விடுதலை

ஆ). சிறுகதைஇலக்கியம்(8 மணிநேரம்)

1. சாபவிமோசனம் – புதுமைப்பித்தன்
2. நகரம் –சுஜாதா
3. அந்நியர்கள் –ஆர். சூடாமணி
4. இந்நாட்டுமன்னர் –நாஞ்சில்நாடன்

அலகு – IV :உரைநடைஇலக்கியம் (8 மணிநேரம்)

1. ஆளுமைத்திறன்அறிவோம்- தன்னம்பிக்கைமாதஇதழிலிருந்து
2. திருக்குறளும்சமுதாயவியலும்– முனைவர்புரிசைநடராசன்
3. தமிழ் – உயர்தனிச்செம்மொழி – முனைவர்இரா. குணசீலன்
4. நொய்யல் – முனைவர் ப. தமிழரசி

அலகு- V :அடிப்படைஇலக்கணமும்பயன்பாட்டுத்தமிழும்– II(7மணிநேரம்)

இலக்கணப்பயிற்சி: 1. அணிஇலக்கணம்

உவமையணி-பிறிதுமொழிதல்அணி-சிலேடைஅணி-தீவகஅணி-ஏகதேசஉருவகஅணி – வேற்றுமையணி–
பின்வருநிலையணிக்கானவிளக்கங்கள்.

2. **துறைசார்கலைச்சொல்பயன்பாட்டாக்கம்**
3. **படைப்பிலக்கியப்பயிற்சிகள்**
   1. மரபுக்கவிதை, புதுக்கவிதை, சிறுகதை, கட்டுரைபடைப்பாக்க உத்திகள்- பயிற்சிகள்
   2. எழுத்தாளருடனானநேர்காணல்மற்றும்களஆய்வுக்கானவினாநிரல்தயாரித்தல்நுட்பங்களும்பயிற்சிகளும்.
4. **மொழிபெயர்ப்புப்பயிற்சிகள்**
   1. தமிழ்-ஆங்கிலமொழிபெயர்ப்புப்பயிற்சிகள் -2.
   2. ஆங்கிலம்-தமிழ்மொழிபெயர்ப்புப் பயிற்சிகள்-2.

பாடநூல்:கற்பகச்சோலை – தமிழ்ஏடு.
கற்பகம்உயர்கல்விகலைக்கழகத்தமிழ்த்துறை வெளியீடு.

Semester – II

21ENU201 ENGLISH -II 4H – 4C

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

Course Objective:

- 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 Outcome:

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

UNIT –I – Grammar

Voice,Idioms and Phrases, Clauses and Reported Speech

UNIT –II –Business and Technical Reports

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

UNIT –III – Communication Practice

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

UNIT –IV –LSRW Skills

Listening- Listening Talks and Presentations
Speaking - Public Speaking- Preparatory steps, Time Management, Handling Questions and Meeting unexpected situations
Reading - Language of Newspapers, Magazines and Internet
Writing -Writing Paragraphs and Essays- Content Writing

UNIT –V –Literature

Prose- Morals in the Indian Context by Francis Nicholas Chelliah
Poetry- Telephone Conversation by Wole Soyinka
Short Stories-The Last Leaf by O' Henry

Books for References

Oxford Handbook of Writing: St. Martins Handbook of Writing 2013 CU Press
Sound Business, Julian Treasure 2012OUP

Semester – II

21CGU201 COMPUTER NETWORKS 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 master the fundamentals of data communications networks by gaining a working knowledge of data transmission concepts.
- 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 correction methods and can implement the data link layer protocols
4. Understand channel error detection and correction, MAC protocols, Ethernet and WLAN.
5. Learn different medium access method to avoid collision and to learn about routing table.
6. Learn basic functionalities of transport layer and application layer.

Unit I- INTRODUCTION

Introduction - Applications – LAN – WAN – MAN - Network Hardware - Network Software: Protocol Hierarchies – Connection-oriented and connectionless services. Reference Models: OSI Reference Model – TCP/IP Reference Model – Comparison of OSI and TCP/IP.

Unit II- NETWORK BASICS

Network Basics - Protocols, Topology - Guided Transmission Media: Magnetic Media – Twisted Pair – Coaxial Cable – Fiber Optics. Wireless Transmission: Electromagnetic Spectrum – Radio Transmission – Microwave Transmission – Communication Satellites: Geostationary, Medium-Earth Orbit, Low Earth-orbit Satellites.

Unit III - IP ADDRESSING

IP Addressing Version 4 – IP Addressing Version 6 – Subnetting Advanced VLSM - Switch Basic - VLAN - VTP / CDP - Subnetting Basic Version 4 - Network Quiz - Routing Static

Unit IV - ROUTING ALGORITHMS

Routing algorithms – Congestion Control Algorithms - CISCO IOS / Managing / Password recovery - Routing Dynamic Routing protocols OSPF RIP EIGRP - Network Advanced Routing Dynamic Routing protocols - OSPF RIP EIGRP

Unit V - MONITORING

Monitoring Network Devices - Overview of ACL\NAT\WAN\Wireless

Suggested Readings

1. David J.Wetherall, Andrew S.Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2012.
2. Behrouz A. Forouzan, "Data Communication and Networking", 4th Edition, Tata McGraw Hill, 2007.
3. SilviuAngelescu, “CCNA Certification All-In-One for Dummies”, Wiley Publishing. Inc.

Web Sites

1. https://www.geeksforgeeks.org/basics-computer-networking/
2. https://www.cisco.com/c/en_in/solutions/small-business/resource-center/networking/networking-basics.html
3. http://ecomputernotes.com/computernetworkingnotes/communication-networks/describe-the-different-transmission-media
4. https://www.tutorialspoint.com/ipv4/ipv4_addressing.htm
5. https://en.wikipedia.org/wiki/IPv6_address
6. https://en.wikipedia.org/wiki/Cisco_IOS

Semester – II

21CGU202 INFORMATION TECHNOLOGYINFORMATION LIBRARY4H – 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 be able to design a knowledge based system.
- To understand Service lifecycle model
- To know the Key Principles Models and Concepts of service management
- To understand the process management and risk management
- To know the Challenges in providing IT Infrastructure Services
- To understand the event management concepts.

Course Outcomes (COs)

1. Design a knowledge based system.
2. Understand service lifecycle model
3. Know the key principles models and concepts of service management
4. Understand the process management and risk management
5. Know the challenges in providing IT infrastructure services
6. Understand the event management concepts.

Unit I

Introduction ITIL - Service Life Cycle Model - What is ITIL - Components and Phases of a Service Life Cycle - Main concept of Service life cycle - Service management as a Practice - IT today and IT opportunity

Unit II

What is a Service - What is Service management - what comprises value - the 4 Ps of Service Design - Key It service management roles - Key Principles Models and Concepts

Unit III

Process - Functions - Specific Roles - RACI - Risk Management - Business Case - Life Cycle Phases - Service Strategy - Service Design - Service Transition - Service operation - CSI

Unit IV

Automation - Evolution of IT Infrastructure Services - Challenges in providing IT Infrastructure Services - The future state of IT Infrastructure Services - Automation and Analytics - the approach of the future

Unit V

SNOC - Event Management - Objectives of Event Management - Scope of event management - Value to the organization - Draw IT Infrastructure facilities for Hospital Management System, e - governance and Banking Sector

Suggested Readings

1. Service Support (CCTA): Part 15 (IT Infrastructure Library)

2. IT Infrastructure Risk & Vulnerability Library: A Consolidated Register of Operational & Technology Infrastructure Vulnerabilities for IT Assurance Professionals
3. IT Infrastructure Risk and Vulnerability Library: A Consolidated Register of Operational and Technology Infrastructure Vulnerabilities for IT Assurance Professionals (Japanese Edition)

Semester – II

21CGU203 DISCRETE STRUCTURES 5H – 4C

Instruction Hours / week: L: 5 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The concepts of truth table and logical connectives and its properties.
- The basic concepts of sets, types of sets, functions and relations.
- About Pigeonhole principle, permutation and combination, mathematical induction.
- How to solve the problems using recurrence relations and generating functions.
- The basic concepts of graphs and its types.
- Basic terminology of trees and properties of trees.

Course Outcomes (COs)

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

1. Familiar with prepositional logic.
2. Acquire a fundamental understanding sets and functions.
3. Understand the concepts of mathematical induction.
4. Describe the method of recurrence relations.
5. Get wide knowledge about graphs and trees
6. Know about the concept of trees and its properties.

UNIT I

Prepositional Logic: Prepositions - Truth tables - Logical Connectives - Wellformed Formulas - Demorgan's Law - Tautologies and Contradictions - PDNF and PCNF – Equivalences - Inference Theory - Rules of universal specification and generalization.

UNIT II

Sets: Introduction -Finite and infinite sets - Uncountably infinite sets - Relations and its types - Properties of Binary Relations –Closure -Partial Ordering Relations - Definition of Functions and its classification – Types of functions -Composition of functions.

UNIT III

Combinatorics: Pigeonholeprinciple - Permutationand Combination - Mathematical Induction - Principle of Inclusion and Exclusion.

UNIT IV

Recurrences: Recurrence Relations - Generating Functions -Linear Recurrence Relations with Constant Coefficients and their Solution.

UNIT V

Graph Theory: Introduction - Basic Terminology -Graph Representation - Types of graphs - Multigraphs and Weighted Graphs - Graph Isomorphism –Connectivity - Euler and Hamiltonian Paths and Circuits -Trees -Basic Terminology and Properties of Trees.

SUGGESTED READINGS

1. Kenneth Rosen., (2019). Discrete Mathematics and Its Applications (8th ed.), McGraw Hill Company, New Delhi.
2. Tremblay,J.P., and Manohar R., (2008). Discrete Mathematical Structures with Applications to Computer Science(1st ed.), McGraw-Hill Book Company, New Delhi.
3. Sharma J. K., (2011).Discrete Mathematics (Third Edition),Rajiv Beri for Macmillan Publishers India Ltd.New Delhi.
4. Dr.Singaravelu A., and Dr.Jeyaraman M.P., (2019).Discrete Mathematics,Meenakshi Agency Chennai.
5. Hein,J.L., (2010). Discrete Structures, Logic, and Computability (3rd ed.), Jones and BartlettPublishers, New Delhi.
6. Hunter,D.J.(2016). Essentials of Discrete Mathematics(3rd ed.). Jones and Bartlett Publishers, New Delhi.

Website Links:

1. https://youtu.be/u4IQh46VoU4
2. https://youtu.be/fZqfkJ-cb28
3. https://www.youtube.com/watch?v=6WGWFwgXhd4
4. https://www.youtube.com/watch?v=HmQR8Xy9DeM
5. https://www.youtube.com/watch?v=_-QZQNSmIpw

Semester – II

21CGU211 COMPUTER NETWORKS- PRACTICAL 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 analyze and differentiate networking protocols used in TCP/IP protocol suite.
- 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

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. To compare and contrast IP routing protocols

Requirements:

Cisco packet tracer software (Freeware)

List of programs

1. Switch basic VLAN
2. Routing Static
3. Switch basic commands
4. Switch basic STP
5. Dynamic Routing protocols OSPF, RIP, EIGRP

Semester – II

21CGU212 WEB TECHNOLOGIES- 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 understand the principles of creating an effective web page.
- To learn the language of HTML, DHTML, XML and JavaScript .
- To understand the principles XML documents.
- To Create tables and frames
- To insert a graphic and links within a web page.
- To insert ordered and unordered lists within a web page.

Course Outcomes (COs)

1. Analyze a web page and identify its elements and attributes.
2. Create a HTML page with formatting text tags, tables and lists.
3. Creating a HTML file with Frames.
4. Create web pages using XHTML and Cascading Styles sheets.
5. Build dynamic web pages using JavaScript (client side programming).
6. Create XML documents.

List of programs

1. Using Formatting Tag
2. Implementation of Table Tags
3. Using List Tags
4. Implementation of frames and frame sets
5. XML and XML documents
6. Java script to perform validations
7. Java script to perform calculations

Semester – II

21AEC201 ENVIRONMENTAL STUDIES 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 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 understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- To apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- To reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Course Outcomes (COs)

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

Unit I – Introduction - Environmental Studies & Ecosystems

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

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

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

Unit III - Biodiversity and its Conservation

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

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

Unit IV - Environmental Pollution

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

Unit V - Social Issues and the Environment

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

Suggested Readings

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

Semester – III

21CGU301 DATA STRUCTURES 4H – 4C

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

Course Objectives

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

Course Outcomes (COs)

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

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

Unit I

Abstract Data Types– **List** – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

Unit II

StackIntroduction– 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 traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap.

Unit IV

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

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

Semester – III

21CGU302 PYTHON PROGRAMMING 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 Learn Syntax and Semantics of Python
- To create Functions in Python.
- To Understand the basic logic statements in Python
- To Handle Strings in Python.
- To Understand Lists, Dictionaries in Python.
- To Build GUI applications

Course Outcomes (COs)

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

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

Unit I - ALGORITHMIC PROBLEM SOLVING

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

Unit II - DATA, EXPRESSIONS, STATEMENTS

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

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

Unit IV -LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

Unit V - FILES, MODULES, PACKAGES

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

Suggested Readings

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

Websites

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

Semester – III

21CGU303 VIRTUALIZATION AND CLOUD 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 objective of this course is

- To understand basic concepts of distributed computing,
- To Provide a good understanding of the concepts, standards in Cloud computing
- To make the student understand about the cloud service providers and their usage.
- To learn how to secure the data in cloud depending.
- To understand the various service level agreements.
- Understand the basic principles of Cloud Computing, Virtualization and Data centers

Course Outcomes(COs)

After successfully completing the course the students should be able to

1. Understand what is Cloud Computing.
2. Know the architecture of the cloud and the usage of clouds.
3. Secure their data from the security issues.
4. Understand What is Virtualization.
5. Understand Cloud Types and Cloud Service Deployment Models (IaaS*, PaaS*, SaaS*).
6. Learn How to Create Virtual Machines (VM) using vSphere.

Unit I - DISTRIBUTED SYSTEMS

Distribute a system - Distributed algorithm - Distributed Data Stores - Distributed Computing - File Systems - Distributed Messaging - Distributed Applications – Distributed Transaction - Parallel and distributed computing - Applications.

Unit II - CLOUD CONCEPTS

Introduction Cloud Computing - Advantages of Cloud - Public Cloud - five essential characteristics - three service models - Four deployment models - Benefits of Cloud Computing - Cloud Vendors - Traditional Infrastructure setup and Challenges – AWS.

Unit III - VIRTUALIZATION

Introduction to vSphere and the Software - Defined Data Center Creating Virtual Machines - VCenter Server - Configuring and Managing - Virtual Networks Configuring and Managing Virtual Storage - Virtual Machine Management - Resource Management and Monitoring.

Unit IV - VIRTUAL MACHINES

vSphere HA - vSphere Fault Tolerance - Protecting Data vSphere DRS - Network Scalability - vSphere Update Manager and Host Maintenance - Storage Scalability - Securing Virtual Machines.

Unit V - DATACENTER

Data center overview -Components - Provisions - Need of Data Center - Data Center Architecture - Different Racks - Data center architecture for cloud computing - role of data center in cloud computing.

Suggested Readings

1. Jean Dollimore formerly of Queen Mary, Tim Kindberg, "Distributed Systems Concepts and Design", 5th Edition Cambridge University, University of London
2. VenkataJosyula , Malcolm Orr , Greg Page, "Cloud Computing: Automating the Virtualized Data Center", 1st Edition.
3. Brian J.S. Chee, Curtis Franklin Jr., "Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center", 1st Edition.

Websites

1. https://www.ibm.com/support/knowledgecenter/en/SSAL2T_8.2.0/com.ibm.cics.tx.doc/concepts/c_wht_is_distd_comptg.html
2. https://www.w3schools.in/cloud-computing/cloud-virtualization/
3. http://www.vmwarearena.com/what-is-vmware-vsphere-beginners-guide-to-vmware-virtualization/
4. https://aws.amazon.com/getting-started/tutorials/

Semester – III

21CGU304A INFRASTRUCTURE MANAGEMENT 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 objective of this course is to

- To learn the installation and configuration process for System Center 2012 R2 Operations Manager standard and DataCenter features,
- To acquire knowledge on monitor services, devices, and operations for many computers in a single console by showing state, health, and performance information, as well as alerts generated for availability, performance, configuration and security situations.
- To design and provision custom views to relevant support teams.
- To understand how to deploy agents
- To Work with management packs
- To Create dashboards and custom visualizations

Course Outcomes (COs)

After successfully completing the course the students should be able to

1. Install a new System Center 2012 Operations Manager Management Group
2. Design and provision custom views to relevant support teams.
3. Understand how to deploy agents
4. Work with management packs
5. Create dashboards and custom visualizations
6. Tune, optimize, maintain and troubleshoot System Center Operations Manager

Unit I - INTRODUCING WINDOWS 10

Overview of Deploying Windows 10- Configure Devices and Drivers- Perform Post installation Configuration Task- Managing Apps in Window.

Unit II- MS SCCM Basics

Overview of System Center 2012 R2 Configuration Manager-Planning and Deploying a Stand-Alone Primary Site- Planning and Configuring Role-Based Administration- Planning and Deploying a Multiple-Site Hierarchy- Replicating Data and Managing Content in Configuration Manager 2012-Planning Resource Discovery and Client Deployment- Configuring Internet and Cloud-Based Client Management- Maintaining and Monitoring System Center 2012 Configuration Manager.

Unit III - OVERVIEW OF SYSTEM CENTER 2012 R2 OPERATIONS MANAGER

Operations Manager Introduction and Basic Concepts- Reason to use Operations Manager- What's New in 2012 R2 Operations Manager- System Requirements- Operations Manager Components. Planning & Installation: Deployment Scenarios-Order of Installation- Installation Process- SQL Server Configuration- Operations Console- Web Console.

Unit IV - ADMINISTRATION

Agent Deployment- Security of manual agent- Agent and Agent less managed systems-Role Based Security- Reporting server- Object Discovery. Management Packs: Management Pack Overview- Pre-Installed Management Packs- Importing Management Packs- Overrides.

Unit V - MONITORING OVERVIEW

Overriding of MPs- Creating Rules and Monitors- Agentless Monitoring- Demo on Role Based Security- Creating Groups- Configuring Notifications. Operations Manager Reporting: Installing SQL Reporting Services- Installing Operations Manager Reporting- Creating, Viewing and Customizing Reports- Dashboard- Considerations for High Availability and Disaster Recovery.

Suggested Readings

1. Kerrie Meyler, Gerry Hampson, “System Center Configuration Manager Current Branch Unleashed System” 1st Edition, 2018.
2. SlawekLigus, “Effective Monitoring and Alerting: For Web Operations” 1st Edition, 2012.

Websites

1. http://systemcentermvp.com/2017/05/10/operations-manager-basic-concepts-nutshell/
2. http://techgenix.com/introduction-system-center-operations-manager-2012-part1/
3. https://www.business.com/articles/microsoft-scom-for-beginners/
4. https://docs.microsoft.com/en-us/system-center/scom/manage-agentless-monitoring

Semester – III

21CGU304B ANDROID PROGRAMMING 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 compare the differences between Android and other mobile development environments.
- To learn the Object-oriented features of Kotlin and APIs for Android Development.
- To describe the working of Android applications, life cycle, manifest, and Intents
- To demonstrate the implementation of Form widgets for Android App development.
- To learn the SQLite database connectivity and database operations with android
- To design and develop useful Android applications with compelling user. interfaces .by using, extending, and creating your own layouts and Views and using Menus.

Course Outcomes (Cos)

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

1. Analyze the Architecture and features of Android with another Mobile Operating System.
2. Evaluate the standard of Kotlin language for developing Android Applications
3. Apply knowledge for creating user Interface and develop activity for Android App.
4. Evaluate the user interface architecture of Android for developing Android Apps
5. Understand the implementation of SQLite database operations with Android.
6. Design and implement Database Application and Content providers.

Unit I -Introduction

History of Android, Introduction to Android Operating Systems-Android Development Tools-Android Debug Bridge-Android Software Development Kit-Android Virtual Device- Android Architecture-Comparison between Android and Apple IOS- Android Application Components.

Unit II -OOPs Concepts of Kotlin Language

- Inheritance-Polymorphism-Interfaces- Abstract class-Threads- Overloading and Overriding-Exception Handling- Kotlin APIs for Android.

Unit III -Creating a Hello World project

Role of XML in Android Development -Working with the AndroidManifest.xml -Features of Android Eclipse and Android Studio -Android Services - Android Service lifecycle – Android Foreground service -Android Background service.

Unit IV -User Interface Architecture of Android

Application context- intents- Activity life cycle- Fragment Life Cycle. **User Interface Design:** Layout Manager- Form widgets- Text Fields- Layouts- Button control- toggle buttons- Spinners (Combo boxes)-Images- Menus-Dialog.

Unit V -Introduction to SQLite database

Connecting SQLite with Android-SQLite Data Types-Cursors and content values-SQLite Open Helper-Adding- Updating and Deleting Content using SQLite Database.

Suggested readings

1. Peter Spath (2019). Learn Kotlin for Android Development, APress Publications

2. James C.Sheusi,(2013). Android application development for Java programmers, Cengage Learning.

Websites

1. http://www.developer.android.com
2. http://developer.android.com/about/versions/index.html
3. http://developer.android.com/training/basics/firstapp/index.html
4. http://developer.android.com/guide/components/activities.html
5. http://developer.android.com/guide/components/fundamentals.html
6. http://developer.android.com/guide/components/intents-filters.html.
7. http://developer.android.com/training/multiscreen/screensizes.html
8. http://developer.android.com/guide/topics/ui/controls.html
9. http://developer.android.com/guide/topics/ui/declaring-layout.html
10. http://developer.android.com/training/basics/data-storage/databases.html
11. https://nptel.ac.in/courses/106106156/
12. http://172.16.13.33/course/view.php?id=606

Semester – II

21CGU311 DATA STRUCTURES - PRACTICAL 4H – 2C

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

Course Objectives

- 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 (Author)-Data Structures and Algorithms using C, Khanna Publishing, Fifth Edition - 2018
2. Reema Thareja, ―Data Structures Using C‖, Second Edition , Oxford University Press, 2011
3. Mark Allen Weiss. (2011). Data Structures and Algorithms Analysis in Java (3rd ed.). Pearson Education.
4. Goodrich, M., &Tamassia, R. (2013). Data Structures and Algorithms Analysis in Java(4th ed.). Wiley.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, ―Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.

6. Sartaj Sahni. (2011). Data Structures, Algorithms and applications in C++(2nd ed.). Universities Press.

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

Semester – III

21CGU312 PYTHON PROGRAMMING- PRACTICAL 4H – 2C

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

Course Objectives

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

Course Outcomes (COs)

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

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

List of programs

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

Semester – III

21CGU313 VIRTUALIZATION AND CLOUD - PRACTICAL 4H – 2C

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

Course Objectives

The objective of this course is

- To understand basic concepts of distributed computing,
- To Provide a good understanding of the concepts, standards in Cloud computing
- To make the student understand about the cloud service providers and their usage.
- To learn how to secure the data in cloud depending.
- To understand the various service level agreements.
- Understand the basic principles of Cloud Computing, Virtualization and Data centers

Course Outcomes(COs)

After successfully completing the course the students should be able to

1. Understand what is Cloud Computing.
2. Know the architecture of the cloud and the usage of clouds.
3. Secure their data from the security issues.
4. Understand What is Virtualization.
5. Understand Cloud Types and Cloud Service Deployment Models (IaaS*, PaaS*, SaaS*).
6. Learn How to Create Virtual Machines (VM) using vSphere.

List of programs

1. Working with hypervisors
2. Creating account in AWS
3. Exploring AWS services like storage, machine image, pricing models, data bases

Semester – III

21CGU314A INFRASTRUCTURE MANAGEMENT- 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

The objective of this course is to

- To learn the installation and configuration process for System Center 2012 R2 Operations Manager standard and DataCenter features,
- To acquire knowledge on monitor services, devices, and operations for many computers in a single console by showing state, health, and performance information, as well as alerts generated for availability, performance, configuration and security situations.
- To design and provision custom views to relevant support teams.
- To understand how to deploy agents
- To Work with management packs
- To Create dashboards and custom visualizations

Course Outcomes (COs)

After successfully completing the course the students should be able to

1. Install a new System Center 2012 Operations Manager Management Group
2. Design and provision custom views to relevant support teams.
3. Understand how to deploy agents
4. Work with management packs
5. Create dashboards and custom visualizations
6. Tune, optimize, maintain and troubleshoot System Center Operations Manager

List of programs

1. Working with SCCM
2. Working with SCOM

Semester – III

21CGU314B ANDROID PROGRAMMING- PRACTICAL 3H – 1C

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

Course Objectives

- To compare the differences between Android and other mobile development environments.
- To learn the Object-oriented features of Kotlin and APIs for Android Development.
- To describe the working of Android applications, life cycle, manifest, and Intents
- To demonstrate the implementation of Form widgets for Android App development.
- To learn the SQLite database connectivity and database operations with android
- To design and develop useful Android applications with compelling user. interfaces .by using, extending, and creating your own layouts and Views and using Menus.

Course Outcomes (Cos)

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

1. Analyze the Architecture and features of Android with another Mobile Operating System.
2. Evaluate the standard of Kotlin language for developing Android Applications
3. Apply knowledge for creating user Interface and develop activity for Android App.
4. Evaluate the user interface architecture of Android for developing Android Apps
5. Understand the implementation of SQLite database operations with Android.
6. Design and implement Database Application and Content providers.

List of Programs

1. Create an Android Application for implementing Button control.
2. Create an android program for implementing progress bar control.
3. Create an Android application for creating login page for checking Loginid and Password
4. Create an Android application for implementing Spinner control in Android Application
5. Create an Android application for implementing context menu.
6. Create an Android Application with list of any three courses in your college and on selecting a particular course HoD of that course should appear at the bottom of the screen.
7. Create an Android application with three option buttons with three color names and When the particular color is selected, the background color of the App should change.
8. Create an Android Application for drawing any image on screen
9. Create an Android application for implementing date picker control.
10. Create an Android application for creating sub menu.

Suggested readings

1. John Horton,Android Programming for Beginners, 2015, Packt Publishing Ltd
2. John Horton, Android Programming with Kotlin for Beginners, 2019, Packt Publishing Ltd
3. James C.Sheusi,(2013). Android application development for Java for Java programmers,Cengage Learning.

Websites

1. http://www.developer.android.com
2. http://developer.android.com/about/versions/index.html
3. http://developer.android.com/training/basics/firstapp/index.html
4. http://developer.android.com/guide/components/activities.html
5. http://developer.android.com/guide/components/fundamentals.html

6. http://developer.android.com/guide/components/intents-filters.html.
7. http://developer.android.com/training/multiscreen/screensizes.html
8. http://developer.android.com/guide/topics/ui/controls.html
9. http://developer.android.com/guide/topics/ui/declaring-layout.html
10. http://developer.android.com/training/basics/data-storage/databases.html

Semester – IV

21CGU401 PROGRAMMING IN JAVA 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 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, Java the Complete Reference, 8th Edition.
2. ISRD Group, Introduction to object oriented programming through Java.
3. James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley, 2014, The Java Language Specification, Java SE 8th Edition (Java Series), Published by Addison Wesley.
4. Joshua Bloch, 2008, Effective Java, 2nd Edition, Publisher: Addison-Wesley.
5. Cay S. Horstmann, Gary Cornell, 2012, Core Java 2 Volume 1 ,9th Edition, Printice Hall.
6. Cay S. Horstmann, Gary Cornell, 2013,Core Java 2 Volume 2 - Advanced Features, 9thEdition,Printice Hall.
7. Bruce Eckel, 2002, Thinking in Java, 3rd Edition, PHI.
8. E. Balaguruswamy, 2009, Programming with Java, 4th Edition, McGraw Hill.
9. Paul Deitel, Harvey Deitel, 2011, Java: How to Program, 10th Edition, Prentice Hall.
10. David J. Eck, 2009, Introduction to Programming Using Java, Published by CreateSpace Independent Publishing Platform.
11. John R. Hubbard, 2004, Programming with JAVA, Schaum's Series, 2nd Edition.
12. Ken Arnold, James Gosling, David Homes, 2005, The Java Programming Language, 4thEdition.

Websites

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

NPTEL

7. https://nptel.ac.in/courses/106105191/

LMS

8. http://172.16.25.76/course/view.php?id=1827

Semester – IV

21CGU402 DATABASE MANAGEMENT SYSTEM 4H – 4C

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

Course Objectives

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

Course Outcomes(COs)

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

Unit I- DATABASE CONCEPTS-A RELATIONAL APPROACH

Database - Relationships - DBMS - Relational data model - Integrity rules - Theoretical relational languages.**Database Design**: Data modeling -Dependency - Database design - Normal forms - Dependency diagrams - Denormalization

UnitII -STRUCTURED QUERY LANGUAGE (SQL)

Introduction – DDL - Naming rulesandconventions - Datatypes-Constraints-Creatingatable- Displaying table information - Altering an existing table – Dropping, renaming, and truncating table - Table types

Unit III -WORKING WITH TABLES

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

Unit IV- PL/SQL

Fundamentals - Block structure - comments - Data types – Other data types - Variable declaration - Assignment operation - Bind variables - Substitution variables - Printing.

Control Structures and Embedded SQL: Control structures - Nested blocks - SQL in PL/SQL - Data manipulation - Transaction control statements

Unit V-PL/SQL CURSORS AND EXCEPTIONS

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

Suggested Readings

1. Nilesh Shah, "Database Systems Using ORACLE", PHI, 2nd Edition, 2011

Websites

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

Semester – IV

21CGU403 COGNITION AND PROBLEM SOLVING 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 critical thought and its interaction with knowledge
- To understand problem solving and how it uses critical thought to develop solutions to problems
- To explore project based learning as a specific method of problem solving
- To examine design thinking as a sub-set of project based learning and its scaffold process for learning
- To define argumentation and how it employs a critical though process
- To examine specific methodologies and instruments of application for argumentation

Course Outcomes(COs)

1. The student has basic knowledge of cognitive psychology.
2. The student has knowledge of how human cognition works from attention, sensation, perception, action, language processes, problem solving and thinking to learning and memory.
3. Understand Critical Thought and its interaction with knowledge
4. Understand Problem Solving and how it uses Critical Thought to develop solutions to problems
5. The student has developed a scientific attitude comprising the ability of reflection and logic reasoning.
6. The student has developed an ability of critical thinking including respect for scientific data and ethical values.

Unit I- INTRODUCTION TO COGNITION

Meaning cognitive processes, Development of cognitive psychology: Structuralism, Functionalism, Behaviourism, Memory Research, Gestalt Psychology, Emergence of cognitive psychology, Information Processing, Connectionism, Alternate approaches to cognitive psychology, Research Methods in Cognitive Psychology.

Unit II-PERCEPTUAL PROCESSES

Object Recognition- theories of object recognition, Bottom-Up and Top-Down Processing, Face Perception, Change Blindness. Attention: Divided attention, Selective Attentkon, Visual attention and Auditory attention. Consciousness: Varieties, Subliminal Perception. Visual Perception ¨Perceptual Organizational Processes, Multisensory interaction and Integration – Synesthesia, Comparing the senses, Perception and Action.

Unit III-MEMORY

Working Memory: Research on Working Memory, Factors affecting the capacity of working Memory, Baddeley's Working Memory Approach. Long Term Memory: Encoding and Retrieval in Long Term Memory, Autobiographical Memory. MemoryStrategies: Practice, Mnemonics using Imagery, Mnemonics using organization, The Multimodal Approach, Improving Prospective Memory. Metacognition :Metamemory, TOT, Metacomprehension.

Unit IV-PROBLEM SOLVING, REASONING AND DECISION MAKING

VUCA World Problem Solving – Types of problem, Understanding the problem, Problem-Solving Approaches, Factors that influence Problem Solving.crativity.Reasoning – Inductive and Deductive Reasoning Decision Making – Heuristics in decision making – representativeness, availability and Anchoring and adjustment.The framing effect, Overconfidence in decisions, The Hindsight Bias.

Unit V-FUTURE SKILLS

Critical thinking, Adaptive thinking, Cognitive Load Management, Design thinking, Virtual Collaboration and Cultural Sensitivity

Suggested Readings

1. Matlin M.W. (2003) 'Cognition' 5th Edition, Wiley Publication.
2. Riegler, B.R., Reigler, G.L. (2008), Cognitive Psychology – Applying the Science of Mind. 2nd Edition, Pearson Education.
3. Benjafield J G (2007). 'Cognition' 3rd Edition. Oxford University Press.
4. Goldstein B.E.(2008) 'Cognitive Psychology' 2nd Edition, Wadsworth.

Websites

1. https://nptel.ac.in/courses/109103134/23
2. https://lockwoodresource.com/problem-solving-in-a-vuca-world-what-kind-of-problem-are-you-solving-by-lisa-solomon/
3. https://www.instructionaldesign.org/theories/cognitive-load/

Semester – IV

21CGU404A PROCESS MANAGEMENT 3H – 3C

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

Course Objectives

- To provide students with a theoretical as well as practical understanding of software development practices and process models
- To understand Agile development and testing in Scrum.
- To acquire knowledge about Devops principles
- To learn to use Lean UX.
- To learn the basics of Sprint
- To understand Design Thinking principles

Course Outcomes (COs)

After successfully completing the course the students should be able to

1. Have practical understanding of software development practices and process models
2. Understand Agile development and testing in Scrum.
3. Understand about Devops principles
4. Learn to use Lean UX,Sprint
5. Differentiate Devops and Agile principles
6. Usage of Scrum and design thinking principles for software development

Unit I - SOFTWARE AND SOFTWARE ENGINEERING

The Nature of Software –The Unique Nature of WebApps-Software Engineering- Software Process-Software Engineering Practice-Software Myths. Software Process Model: A Generic Process Model- Process Assessment and Improvement –Perspective Process Models-Specialized Process Model-The Unified Process.

Unit II - AGILE

Agile Methodology-Manifesto-Principles of Agile-Agile Methodologies-Challenges with Agile. Scrum: Overview of Scrum-Scrum Roles-Scrum Ceremonies-Scrum Artifacts-Extreme programming vs Scrum.

Unit III - DEVOPS

Introduction to Devops-Principles-Automation-Performance Measurement through KPIS and Metrics-Agile and Devops-Agile Infrastructure-Velocity-Lean Startup UPS.

Unit IV - LEAN UX AND AGILE ANTI-PATTERNS

Sprint -Staggered sprints -Sprint zero and design sprints- Dual-track Agile- Listening to Scrum's rhythms- Listening to Scrum's rhythms- Participation- Design is a team sport- Coordinating multiple Lean UX teams- Managing up and out – Agile anti-patterns.

Unit V- DESIGN THINKING

Introduction to Design Thinking – Lean thinking - Actionable Strategy- The Problem with Complexity - Vision and Strategy - Defining Actionable Strategy Act to Learn - Leading Teams to Win.

Suggested Readings

1. Roger S Pressman, “Software Engineering APractioners Approach”, 7th Edition 2010
2. KalloriVikraman, “Introduction to Devops”, 1st Edition, 2016.
3. Stephen Haunts, “Essential of Scrum” Addison-Wesley Professional; 1st Edition, 2012
4. Jeff Gothelf, Josh Seiden, “Lean UX”, 2nd Edition, 2016.
5. Jonny Schneider, “Understanding Design Thinking, Lean, and Agile” O’Reilly Media 2017.
6. Jeff Gothelf , "Lean vs. Agile vs. Design Thinking”, Sense and Respond Press,2017.

Websites

1. https://www.tutorialspoint.com/sdlc/sdlc_overview.htm
2. https://existek.com/blog/sdlc-models/
3. https://www.agilealliance.org/agile101/
4. https://devops.com/
5. http://theleanstartup.com/principles

Semester – IV

21CGU404B PROGRAMMING IN MATLAB 3H – 3C

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

Course Objectives

- To understand the need for simulation/implementation for the verification of mathematical functions.
- To understand the main features of the MATLAB program development environment to enable their usage in the higher learning.
- To implement simple mathematical functions/equations in numerical computing environment such as MATLAB.
- To interpret and visualize simple mathematical functions and operations thereon using plots/display.
- To analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools.
- To apply MATLAB tools for implementation/simulation and visualization of basic mathematical functions

Course Outcomes (Cos)

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

1. Understand the need for simulation/implementation for the verification of mathematical functions.
2. Understand the main features of the MATLAB program development environment to enable their usage in the higher learning.
3. Implement simple mathematical functions/equations in numerical computing environment such as MATLAB.
4. Interpret and visualize simple mathematical functions and operations thereon using plots/display.
5. Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools.
6. Apply MATLAB tools for implementation/simulation and visualization of basic mathematical functions

UnitI- INTRODUCTION TO PROGRAMMING

Components of a computer, working with numbers, Machine code, Software hierarchy.

UnitII- PROGRAMMING ENVIRONMENT

MATLAB Windows, A First Program, Expressions, Constants, Variables and assignment statement, Arrays.

UnitIII- GRAPH PLOTS

Basic plotting, Built in functions, Generating waveforms, Sound replay, load and save. Procedures and Functions: Arguments and return values, M-files, Formatted console input-output , String handling,

UnitIV- CONTROL STATEMENTS

Conditional statements: If, Else, Else-if, Repetition statements: While, for loop

UnitV- MANIPULATING TEXT

Writing to a text file, Reading from a text file, Randomisingandsorting a list, searching a list. **GUI Interface**: Attaching buttons to actions, Getting Input, Setting Output

Suggested Readings

1. Amos Gilat. MATLAB: An Introduction with Applications(2nd ed). New Delhi: Wiley.
2. Moler,C.B.(2004). Numerical Computing with MATLAB.NewDelhi:SIAM.

Websites

1. https://www.mathworks.in/help/matlab/
2. https://www.tutorialspoint.com/matlab/
3. http://www.matrixlab-examples.com/matlab-tutorial.html

Semester – IV

21CGU411 PROGRAMMING IN JAVA - PRACTICAL 4H – 2C

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

Course Objectives

- 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 $1+x+x^2+x^3+$……..
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, 2014, Java Complete Reference, 9th Edition, Tata McGraw Hill, New Delhi.
2. ISRD Group, 2007, Introduction to Object Oriented Programming through Java, 1st Edition, Tata McGraw Hill, New Delhi
3. Deitel H.M. and P.J.Deitel, 2005, Java-How to Program, 6th Edition, Pearson Education, New Delhi.
4. Dr.S Somasundaram, 2004, Java Programming**,** 1st Edition, Techmedia. New Delhi.
5. E.Balagurusamy, 2010, Programming with Java – A Primer, 4th Edition, Tata McGraw Hill, New Delhi.

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/

Semester – IV

21CGU412 DATABASE MANAGEMENT SYSTEM - PRACTICAL 4H – 2C

Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

- 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. Effectiveuse of Procedures, Functions, Packages, and Triggers.

List of programs

1. Using Differentoperators
2. using ControlStructures
3. implement Built-infunctions
4. implement update and Altertable
5. implementing PL/SQLBlock
6. implement PL/SQL table and record
7. using Functions
8. using Cursors
9. using Triggers

Semester – IV

21CGU413STATISTICAL ANALYSIS - R PROGRAMMING – PRACTICAL4H – 2C

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

Course Objectives :

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

- To acquire the computing tasks such as using conditional processing statements, loops, and writing one's own functions.
- To perform advanced graphing of data and statistical modeling of data.
- To use statistical distribution functions in R
- To read Structured Data into R from various sources
- To understand split-apply-combine (group-wise operations) in R
- To perform basic statistical modeling of data using R

Course Outcome:

1. Learn how to install and configure software necessary for a statistical programming environment.
2. Discuss generic programming language concepts as they are implemented in a high-level statistical language.
3. The course covers practical issues in statistical computing which includes programming in R, reading data into R, accessing R packages, writing R functions, debugging, and organizing and commenting R code.
4. Import external data into R for data processing and statistical analysis
5. Learn the main R data structures – vector and data frame
6. Design and develop R applications for data analytics.

List of Programs:

1. Write a program to demonstrate functions and operators
2. **Vectors:** Grouping values into vectors, then doing arithmetic and graphs with them
3. **Matrices:** Creating and graphing two-dimensional data sets
4. **Summary Statistics:** Calculating and plotting some basic statistics: mean, median, and standard deviation
5. **Factors:** Creating and plotting categorized data
6. **Data Frames:** Organizing values into data frames, loading frames from files and merging them
7. Write a program to design R as a calculator
8. Write a program to demonstrate Probability distributions
9. Write a program to demonstrate Importing and exporting data
10. Write a program to Establish a Regression

Suggested Readings

1. Daniel Navarro,(2013). *Learning Statistics with R*. University of Adelaide Publications.
2. Garrett Grolemund and Hadley Wickham (2016). *R for Data Science*
3. Hadley Wickham, (2014).*Advanced R Programming*, (1st ed.)
4. JeffreyStanton,(2013). *Introduction to Data Science, with Introduction to R*, Version3 ,
5. Roger.D.Peng, (2015).*R Programming for Data Science*

Websites

1. https://www.r-project.org/
2. https://www.datamentor.io/r-programming/

3. https://www.datacamp.com/courses/free-introduction-to-r?utm_
4. https://www.coursera.org/learn/r-programming
5. https://172.16.25.76/Course/View.php?id = 2216
6. https://nptel.ac.in/courses/111104100/
7. https://nptel.ac.in/content/syllabus_pdf/111104100.pdf
8. https://www.edx.org/learn/r-programming

Semester – IV

21CGU414A DEVOPS TOOLS- 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 provide students with a theoretical as well as practical understanding of software development practices and process models
- To learn to use Apache Maven.
- To acquire knowledge about Nexus Artifacts
- To build and test your software projects with Jenkins
- To setup LAMP
- To learn to use Docker.

Course Outcomes (COs)

After successfully completing the course the students should be able to

1. practical understanding of software development practices and process models
2. Device revision control systems using Apache Maven
3. To build and test your software projects with Jenkins, Nexus Artifacts
4. Setup LAMP in Linux environment
5. Setup and use Docker
6. Monitoring the system

List of programs

Introduction to DevOps – Tools and settings

1. Revision Controls System
2. Configuration Management
3. Build Automation -Introduction with Maven
4. Nexus Artifacts/Proxy Tool
5. Jenkins Framework
6. LAMP Setup
7. Working with Docker
8. System Monitoring

Semester – IV

21CGU414B PROGRAMMING IN MATLAB - 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 understand the need for simulation/implementation for the verification of mathematical functions.
- To understand the main features of the MATLAB program development environment to enable their usage in the higher learning.
- To implement simple mathematical functions/equations in numerical computing environment such as MATLAB.
- To interpret and visualize simple mathematical functions and operations thereon using plots/display.
- To analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools.
- To apply MATLAB tools for implementation/simulation and visualization of basic mathematical functions

Course Outcomes (Cos)

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

1. Understand the need for simulation/implementation for the verification of mathematical functions.
2. Understand the main features of the MATLAB program development environment to enable their usage in the higher learning.
3. Implement simple mathematical functions/equations in numerical computing environment such as MATLAB.
4. Interpret and visualize simple mathematical functions and operations thereon using plots/display.
5. Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools.
6. Apply MATLAB tools for implementation/simulation and visualization of basic mathematical functions

List of programs

1. Write a program to assign the following expressions to a variable A and then to print out the value of A.
a. (3+4)/(5+6)
b. $2\Pi^2$
c. √2
d. (0.0000123 + 5.67×10-3) × 0.4567×10-4

2. Celsius temperatures can be converted to Fahrenheit by multiplying by 9, dividing by 5, and adding 32. Assign a variable called C the value 37, and implement this formula to assign a variable F the Fahrenheit equivalent of 37 Celsius.

3. Set up a vector called N with five elements having the values: 1, 2, 3, 4, 5. Using N, create assignment statements for a vector X which will result in X having these values:
a. 2, 4, 6, 8, 10

b. 1/2, 1, 3/2, 2, 5/2
c. 1, 1/2, 1/3, 1/4, 1/5
d. 1, 1/4, 1/9, 1/16, 1/25

4. A supermarket conveyor belt holds an array of groceries. The price of each product (in pounds) is [0.6, 1.2 ,0.5, 1.3] ; while the numbers of each product are [3, 2 ,1 ,5]. Use MATLAB to calculate the total bill.

5. The sortrows(x) function will sort a vector or matrix X into increasing row order. Use this function to sort a list of names into alphabetical order.

6. The ―identity‖ matrix is a square matrix that has ones on the diagonal and zeros elsewhere. You can generate one with the eye() function in MATLAB. Use MATLAB to find a matrix B, such that when multiplied by matrix A=[1 2; -1 0] the identity matrix I=[1 0; 0 1] is generated. That is A*B=I.

7. Create an array of N numbers. Now find a single MATLAB statement that picks out from that array the 1,4,9,16,…,√Nth entries, i.e. those numbers which have indices that are square numbers.

8. Draw a graph that joins the points (0,1), (4,3), (2,0) and (5,-2).

9. The seeds on a sunflower are distributed according to the formula below. Plot a small circle at each of the first 1000 co-ordinates :

$$r_n = \sqrt{n}$$

$$\theta_n = \frac{137.51}{180}\pi n$$

10. Calculate 10 approximate points from the function y=2x by using the formulae:
    i. xn = n
    ii. yn = 2n + rand - 0.5

Fit a line of best fit to these points using the function polyfit() with degree=1, and generate co-ordinates from the line of best fit using polyval(). Use the on-line help to find out how to use these functions. Plot the raw data and the line of best fit.

11. Calculate and replay 1 second of a sinewave at 500Hz with a sampling rate of 11025Hz. Save the sound to a file called ex35.wav. Plot the first 100 samples.

12. Calculate and replay a 2 second chirp. That is, a sinusoid that steadily increases in frequency with time, from say 250Hz at the start to 1000Hz at the end.

13. Build a square wave by adding together 10 odd harmonics: 1f, 3f, 5f, etc. The amplitude of the nth harmonic should be 1/n. Display a graph of one cycle of the result superimposed on the individual harmonics.

14. Write a function called FtoC (ftoc.m) to convert Fahrenheit temperatures into Celsius. Make sure the program has a title comment and a help page. Test from the command window with:
i. FtoC(96)
ii. lookfor Fahrenheit
iii. helpFtoC

15. Write a program to input 2 strings from the user and to print out (i) the concatenation of the two strings with a space between them, (ii) a line of asterisks the same length as the concatenated strings, and (iii) the reversed concatenation. For example:
i. Enter string 1: Mark
ii. Enter string 2: Huckvale
iii. Mark Huckvale
iv. **********
v. elavkcuH kraM

Semester – V

21CGU501 INFORMATION SECURITY AND CYBER LAWS 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 provides an overview of Information Security and Assurance.
- To provide an exposure to the spectrum of security activities methods methodologies and procedures with emphasis on practical aspects of Information Security.
- To explain concepts related to applied cryptography including the four techniques for crypto-analysis symmetric and asymmetric cryptography, digital signature, message authentication code, hash functions and modes of encryption operations.
- To explain common vulnerabilities in computer programs including buffer overflowVulnerabilities time-of-check to time-of-use flaws incomplete mediation.
- To understand the concepts of cryptographic utilities and authentication mechanisms to design secure applications
- To understand the various Cyber laws and its sections with case studies.

Course Outcomes(COs)

A student who successfully completes this course should at a minimum be able to:

1. Explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
2. State the basic concepts in information security
3. Explain concepts related to applied cryptography including the four techniques for crypto-analysis symmetric and asymmetric cryptography, digital signature, message authentication code, hash functions and modes of encryption operations.
4. Explain common vulnerabilities in computer programs including buffer overflowVulnerabilities time-of-check to time-of-use flaws incomplete mediation.
5. Understand the concepts of cryptographic utilities and authentication mechanisms to design secure applications
6. Understand the various Cyber laws and its sections with case studies.

Unit I - Course Introduction

Computer network as a threat, hardware vulnerability, software vulnerability, importance of data security.
Digital Crime: Overview of digital crime, criminology of computer crime.

Unit II - Information Gathering Techniques

Tools of the attacker, information and cyber warfare, scanning and spoofing, password cracking, malicious software, session hijacking

Unit III - Risk Analysis And Threat

Risk analysis, process, key principles of conventional computer security, security policies, authentication, data protection, access control, internal vs external threat, security assurance, passwords, authentication, and access control, computer forensics and incident response

Unit IV- Introduction To Cryptography And Applications

Important terms, Threat, Flaw, Vulnerability, Exploit, Attack, Ciphers, Codes, Caeser Cipher, Rail-Fence Cipher, Public key cryptography (Definitions only), Private key cryptography (Definition and Example)

Safety Tools and Issues : Firewalls, logging and intrusion detection systems, Windows and windows XP / NT security, Unix/Linux security, ethics of hacking and cracking

Unit V- Cyber Laws

CYBER LAWSto be covered as per IT 2008:

• Chapter 1: Definitions 88
• Chapter 2: Digital Signature And Electronic Signature
• [Section 43] Penalty and Compensation for damage to computer, computer system, etc.
• [Section 65] Tampering with Computer Source Documents
• [Section 66 A] Punishment for sending offensive messages through communication service, etc.
• [Section 66 B] Punishments for dishonestly receiving stolen computer resource or communication device
• [Section 66C] Punishment for identity theft
• [Section 66D] Punishment for cheating by personation by using computer resource
• [Section 66E] Punishment for violation of privacy
• [Section 66F] Punishment for cyber terrorism
• [Section 67] Punishment for publishing or transmitting obscene material in electronic form
• [Section 67A] Punishment for publishing or transmitting of material containing sexually explicit act, etc. in electronic form[Section 67B] Punishment for publishing or transmitting of material depicting children in sexually explicit act, etc. in electronic form
• [Section 72] Breach of confidentiality and privacy

Suggested Readings

1. M. Merkow, J. Breithaupt. 2005. Information Security Principles and Practices. Pearson Education. 2005.
2. G.R.F. Snyder, T. Pardoe. 2010. Network Security. Cengage Learning.
3. A. Basta, W.Halton. 2008. Computer Security: Concepts, Issues and Implementation. Cengage Learning India.
4. Nina Godbole & SUNIT Belapure.(2013) CYBER SECURITY. Wiley India Pvt.Ltd.New Delhi.

Websites

1. http://www.csc.ncsu.edu/faculty/ning
2. csrc.nist.gov/publications/nistpubs/800-12/handbook.pdf
3. www2.warwick.ac.uk/fac/sci/dcs/teaching/modules/cs134/

Semester – V

21CGU502A INTRODUCTION TO DIGITAL TECHNOLOGY 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 digital technology
- To introduce the concept s of cloud , big data, digital marketing
- To introduce the principles of Artificial Intelligence, Block chain technology
- To recognize the use of Digital technology in various Industries
- To understand the principles of Automatix, Automation Anywhere
- To understand and create Bots

Course Outcomes (COs)

A student who successfully completes this course should be able to

1. Understand the fundamental concepts of digital technology
2. Comprehend the concept s of cloud , big data, digital marketing
3. Familiarize the principles of Artificial Intelligence, Block chain technology
4. Recognize the use of Digital technology in various Industries
5. Understand the principles of Automatix, Automation Anywhere
6. Create bots and understand its various types

Unit I - DIGITAL PRIMER

Why is Digital Different?- Digital Metaphors On Cloud 9-A Small Intro to Big Data-Social Media & Digital Marketing-Artificial Intelligence- Unchain the Block chain-Internet of Everything-Immersive Technology.

Unit II- DIGITAL FOR INDUSTRIES

Manufacturing and Hi-tech-Banking and Financial Services-Insurance and Healthcare-Retail-Travel & Hospitality-Communications, Media & Information Services-Government.

Unit III - AUTOMATIX

Art of RPA-Introduction - Setting the Context-RPA Prelude-RPA Demystified-RPA vs BPM RPA Implementations-RPA in Industries-RPA Tools-Automatix - Art of RPA

Unit IV - AUTOMATION ANYWHERE

Getting Started with AA Enterprise-Exploring AA Enterprise-AA Enterprise – Architecture.

Unit V - Knowing the Bots

More AboutTaskBots-AA Enterprise - All About Recorders-Designers-MetaBots-Cognitive RPA.

Suggested Readings

1. Richard Murdoch, “Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant”
2. Kelly Wibbenmeyer, “The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization”

Websites

1. https://en.wikipedia.org/wiki/Robotic_process_automation
2. https://en.wikipedia.org/wiki/Automatix_(software)
3. https://www.automationanywhereuniversity.com/
4. https://www.automationanywhere.com/in/products/iq-bot

Semester – V

21CGU502B MACHINE LEARNING 4H – 4C

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

Course Objectives

- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research**.**
- To recognize the characteristics of machine learning that make it useful to real-world problems.
- To characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.
- To effectively use machine learning toolboxes.

Course Outcomes(COs)

On successful completion of the course the student should be

1. Remember the basic concepts and techniques of Machine Learning.
2. Develop skills of using recent machine learning software for solving practical problems.
3. of doing independent study and research**.**
4. To recognize the characteristics of machine learning that make it useful to real-world problems.
5. To characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.
6. To effectively use machine learning toolboxes.

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

Unit IV - Tree and Rule Models

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

Unit V - Reinforcement Learning

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

Suggested Readings

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

Web Sites

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

Semester – V

21CGU503A SOFTWARE TESTING 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 learn about different type of applications and testing, along with the purpose of automation testing.
- To gain insight into the evolution of Selenium
- To get an overview of Selenium nd its components and compare commonly used automation tool with Selenium automation tools.
- Explore the features and use of Selenium-WebDriver
- To record and importing tests with Selenium IDE
- To learn data driven testing using TestNG

Course Outcomes (COs)

1. Understand Selenium Architecture and its components
2. Work with Selenium RC
3. Understand Selenium WebDriver
4. Use WebDriver advanced features e.g. taking screenshots, handling cookies and managing exceptions
5. Create Data driven, Keyword driven and Hybrid test framework
6. Record and importing tests with Selenium IDE andWrite Test cases using TestNG

Unit I - INTRODUCTION TO AUTOMATION

Planning before Automation - Introduction to Selenium - Installing Selenium Components.

Unit II - USING SELENIUM IDE

Managing User Interface Controls - Basics of Java- Creating First Selenium Web Driver Script.

Unit III- SELENIUM METHODS

Common Selenium Web Driver Methods - Verification Point in Selenium - Exploring the Features of Web Driver.

Unit IV- HANDLING POP-UP DIALOGS AND MULTIPLE WINDOWS

Working with Dynamic UI Objects- Data driven testing using TestNG - Selenium Functions, Common Questions and Tips.

Unit V - REPORTING IN SELENIUM

Batch Execution- Automation Frameworks - Understanding Selenium Grid.

Suggested Readings

1. AdithyaGarg, Ashish Mishra “A Practitioner’s Guide to Test Automation Using Selenium”, Tata McGraw Hill Education, 2015.

2. NavneeshGarg, “Test Automation Using Selenium WebDriver with Java”, AdactIn Group Pvt Ltd. 2014.
3. SatyaAvasarala, “Selenium Web Driver - PRACTICAL Guide”, Packt Publishing, 2014.
4. Rex Allen Jones II, “Selenium Web Driver for Functional Automation Testing”, Test 4 Success, LLC. 2016.
5. David Burns,” Selenium 1.0 Testing Tools”, Packt Publishing, 2010.

Websites

1. https://www.seleniumhq.org/docs/
2. https://www.javatpoint.com/selenium-tutorial
3. https://www.softwaretestingmaterial.com/selenium-tutorial/

Semester – V

21CGU503B DATA MINING 4H – 4C

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

Course Objectives

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

Course Outcomes (COs)

Upon completion of this course students will be able to:

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

UNIT I- Introduction

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

UNIT II - Classification

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

UNIT III - Cluster analysis

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

UNIT IV- Web data mining

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

UNIT V -Data warehousing

Introduction - Operational data sources- data warehousing - Data warehousing design - Guidelines for data warehousing implementation - Data warehousing metadata - Online analytical processing (OLAP): Introduction - OLAP characteristics of OLAP system -

Multidimensional view and data cube - Data cube implementation - Data cube operations OLAP implementation guidelines.

Suggested Readings

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

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

Semester – V

21CGU504A CLIENT RELATIONHIP MANAGEMENT 3H – 3C

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

Course Objectives

- to Acquire knowledge about ServiceNow platform
- To get comprehensive knowledge of ITSM principles and architecture.
- To get acquainted with various features of Service Now platform and tool.
- To use Flows and Workflows for process automation
- To use various script types used throughout the platform
- To capturing and moving configurations between instances, using update sets

Course Outcomes (COs)

1. Task management using assignment rules, presence, and work notes
2. Protecting ServiceNow instance data using Access Control rules
3. Populating the database using import sets
4. Using Flows and Workflows for process automation
5. Various script types used throughout the platform
6. Capturing and moving configurations between instances, using update sets

Unit I - SERVICE NOW INTERMEDIATE LEVEL

Administrator-ServiceNow Introduction-ServiceNow Platform UI ServiceNow ITSM overview-Managing Users, Groups and Roles, departments, companies and Assignment Rules-Tables, Columns,Attributes,Dictionary Entries ,Schema Map-Managing Forms , Layouts and Lists-Dictionary Overrides and Simple Reference Qualifiers.

Unit II - SYSTEM PROPERTIES

Incident management - - Problem management- - Change management- Overview of other ITSM Modules - Overview of other ITSM Modules- SLA Basics-Introduction to Client and Server Side Scripting-server-side scripting - Server Side Glide API -server-side scripting - Server Side Glide API -Server Side script Debugging-Server Side Scripting Best Practices-Business Rules-Client Side APIs-UI Policies and Data Policies-Client Scripts -Client Side script Debugging.

Unit III - CLIENT SCRIPTS & CLIENT GLIDE APIS-BEST PRACTICES

Client-side scripting & policies (UI and Data)-Modularize programming using UI Actions (both Server and Client Side)-Script Include-Glide AJAX-UI Pages and UI Macros-Managing Update Sets-Custom Applications Automated Test Framework –Events-Inbound/Out Bound notifications-Mail Templates and Scripts.

Unit IV - MANAGE WORKFLOWS

Managing Stage Sets -Manage Workflows -Manage Workflows -Flow Designer (Over view)-Service Catalogs, Categories, Items and variables-Manage Execution Plans and workflows-Cart Layouts-Client scripts and UI policies-Record Producers-Order Guides & Scriptable Order Guides-Scheduled Jobs. VTB Agent Intelligence (Over View)-Restrict access to applications and application modules-Automatically create application Access Controls -Manually create, test,

and debug Access Controls-Managing ServiceNow imports and exports-Managing Import Sets and Transform Map-Configure and run Reports and Dashboards Security Controls-Database Views.

Unit V - SERVICENOW SERVICE PORTALS OVERVIEW

ServiceNow Service portals core components -Scripting in Service Portal-ITSM Virtual Agent – Overview-Performance Analytics Overview-Servicenow on Mobile-Servicenow Integration Overview.

Suggested Readings

1. Tim Woodruff, "Learning ServiceNow: Administration and development on the Now platform, for powerful IT automation", 2nd Edition, Packt Publishing Ltd., 2018.
2. AshishRudraSrivastava "ServiceNow Cook Book" Packt Publishing Ltd, 2017.
3. Andrew Kindred , "Mastering ServiceNow Scripting" Packt Publishing2018.

Websites

1. https://www.servicenow.com/products/it-service-management.html
2. https://www.servicenow.com/content/dam/servicenow-assets/public/en-us/doc-type/resource-center/data-sheet/ds-itsm.pdf
3. https://www.guru99.com/servicenow-tutorial.html

Semester – V

21CGU504B INTRODUCTION TO DATA SCIENCE 3H – 3C

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

Course Objective

- To provide an overview of a new language R used for data science.
- To introduce students to the R programming environment and related eco-system and thus provide them with an in-demand skill-set, in both the research and business environments
- To introduce the extended R ecosystem of libraries and packages
- To demonstrate usage of as standard Programming Language.
- To familiarize students with how various statistics like mean median etc. can be collected for data exploration in R
- To enable students to use R to conduct analytics on large real life datasets.

Course Outcomes (COs)

1. Install and use R for simple programming tasks.
2. Extend the functionality of R by using add-on packages
3. Extract data from files and other sources and perform various data manipulation tasks on them.
4. Code statistical functions in R.
5. Use R Graphics and Tables to visualize results of various statistical operations on data.
6. Apply the knowledge of R gained to data Analytics for real life applications.

Unit I - DATA SCIENTIST'S TOOL BOX

Turning data into actionable knowledge, introduction to the tools that will be used in building data analysis software: version control, markdown, git, GitHub, R, and RStudio.

Unit II -R PROGRAMMING BASICS

Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling

Unit III - GETTING AND CLEANING DATA

Obtaining data from the web, from APIs, from databases and from colleagues in various formats.basics of data cleaning and making data ―tidy.

Unit IV - EXPLORATORY DATA ANALYSIS

Essential exploratory techniques for summarizing data, applied before formal modeling commences, eliminating or sharpening potential hypotheses about the world that can be addressed by the data, common multivariate statistical techniques used to visualize high-dimensional data.

Unit V- REPRODUCIBLE RESEARCH

Concepts and tools behind reporting modern data analyses in a reproducible manner, To write a document using R markdown, integrate live R code into a literate statistical program, compile R markdown documents using knitr and related tools, and organize a data analysis so that it is reproducible and accessible to others.

Suggested Readings

1. Rachel Schutt., &Cathy O'Neil.(2013). Doing Data Science: Straight Talk from the Frontiline. Schroff/O'Reilly.
2. Foster Provost.,&Tom Fawcett.(2013). Data Science for Business What You Need to Know About Data Mining and Data-Analytic Thinking. O'Reilly.
3. John, W. Foreman. (2013). Data Smart: Using data Science to Transform Information into Insight. John Wiley & Sons.
4. Ian Ayres. (2007). Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart (1st ed.). Bantam.
5. EricSeigel. (2013).PredictiveAnalytics:ThePowertoPredictwhoWillClick,BuyLie,or Die (1sted.). Wiley.
6. Matthew, A. Russel. (2013). Mining the Social Web: Data mining Facebook, Twitter, Linkedln, Goole+,GitHub, and More (2nd ed.). O'Reilly Media.

Websites

1. https://www.iqonlinetraining.com/data-science-tutorial/
2. https://www.edx.org/course/introduction-to-r-for-data-science-2
3. https://www.tutorialspoint.com/r/index.htm
4. https://www.w3schools.in/r/

Semester – V

21CGU511 INFORMATION SECURITY AND CYBER LAWS– PRACTICAL4H – 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 provides an overview of Information Security and Assurance.
- To provide an exposure to the spectrum of security activities methods methodologies and procedures with emphasis on practical aspects of Information Security.
- To explain concepts related to applied cryptography including the four techniques for crypto-analysis symmetric and asymmetric cryptography, digital signature, message authentication code, hash functions and modes of encryption operations.
- To explain common vulnerabilities in computer programs including buffer overflow Vulnerabilities time-of-check to time-of-use flaws incomplete mediation.
- To understand the concepts of cryptographic utilities and authentication mechanisms to design secure applications
- To use various tools to implement various cryptographic algorithms.

Course Outcomes(COs)

A student who successfully completes this course should at a minimum be able to:

1. Explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
2. State the basic concepts in information security
3. Explain concepts related to applied cryptography including the four techniques for crypto-analysis symmetric and asymmetric cryptography, digital signature, message authentication code, hash functions and modes of encryption operations.
4. Explain common vulnerabilities in computer programs including buffer overflow Vulnerabilities time-of-check to time-of-use flaws incomplete mediation.
5. Understand the concepts of cryptographic utilities and authentication mechanisms to design secure applications
6. Use various tools to implement various cryptographic algorithms.

ListofPrograms

1. Demonstrate the use of Network tools: ping, ipconfig, ifconfig, tracert, arp, netstat, whois
2. Use of Password cracking tools : John the Ripper, Ophcrack. Verify the strength of passwords using these tools.
3. Perform encryption and decryption of Caesar cipher. Write a script for performing these operations.
4. Perform encryption and decryption of a Rail fence cipher. Write a script for performing these operations.
5. Use nmap/zenmap to analyse a remote machine.
6. Use Burp proxy to capture and modify the message.
7. Demonstrate sending of a protected word document.
8. Demonstrate sending of a digitally signed document.
9. Demonstrate sending of a protected worksheet.
10. Demonstrate use of steganography tools.
11. Demonstrate use of gpg utility for signing and encrypting purposes.

Suggested Readings

1. M. Merkow, J. Breithaupt. 2005. Information Security Principles and Practices. Pearson Education. 2005.
2. G.R.F. Snyder, T. Pardoe. 2010. Network Security. Cengage Learning.
3. A. Basta, W.Halton. 2008. Computer Security: Concepts, Issues and Implementation. Cengage Learning India.
4. Nina Godbole & SUNIT Belapure.(2013) CYBER SECURITY. Wiley India Pvt.Ltd.New Delhi.

Websites

1. http://www.csc.ncsu.edu/faculty/ning
2. csrc.nist.gov/publications/nistpubs/800-12/handbook.pdf
3. www2.warwick.ac.uk/fac/sci/dcs/teaching/modules/cs134/

Semester – V

21CGU512A INTRODUCTION TO DIGITAL TECHNOLOGY- PRACTICAL4H – 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 digital technology
- To introduce the concept s of cloud , big data, digital marketing
- To introduce the principles of Artificial Intelligence, Block chain technology
- To recognize the use of Digital technology in various Industries
- To understand the principles of Automatix, Automation Anywhere
- To understand and create Bots

Course Outcomes (COs)

A student who successfully completes this course should be able to

1. Understand the fundamental concepts of digital technology
2. Comprehend the concept s of cloud , big data, digital marketing
3. Familiarize the principles of Artificial Intelligence, Block chain technology
4. Recognize the use of Digital technology in various Industries
5. Understand the principles of Automatix, Automation Anywhere
6. Create bots and understand its various types

List of programs

1. Creating bots for automatic software installation
2. Creating bots for automatic software patch installation
3. Creating bots for file transfer
4. Creating bots for automatic file backup

Semester – V

21CGU512B MACHINE LEARNING- PRACTICAL 4H – 2C

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

Course Objectives

- To understand the various characteristics of Intelligent agents
- To learn about the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.
- To effectively use machine learning toolboxes to design and develop machine learning applications.

Course Outcomes (Cos)

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

1. Identify problems that are amenable to solution by AI methods.
2. Identify appropriate AI methods to solve a given problem.
3. Formalize a given problem in the language/framework of different AI methods.
4. Implement basic AI algorithms.
5. Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
6. To effectively use machine learning toolboxes to design and develop machine learning applications.

List of Programs

1. Perform elementary mathematical operations in Octave/MATLAB like addition, multiplication, division and exponentiation.
2. Perform elementary logical operations in Octave/MATLAB (like OR, AND, Checking for Equality, NOT, XOR).
3. Create, initialize and display simple variables and simple strings and use simple formatting for variable.
4. Create/Define single dimension / multi-dimension arrays, and arrays with specific values like array of all ones, all zeros, array with random values within a range, or a diagonal matrix.
5. Use command to compute the size of a matrix, size/length of a particular row/column, load data from a text file, store matrix data to a text file, finding out variables and their features in the current Course Objectives.
6. Perform basic operations on matrices (like addition, subtraction, multiplication) and display specific rows or columns of the matrix.
7. Perform other matrix operations like converting matrix data to absolute values, taking the negative of matrix values, adding/removing rows/columns from a matrix, finding the maximum or minimum values in a matrix or in a row/column, and finding the sum of some/all elements in a matrix.
8. Create various type of plots/charts like histograms, plot based on sine/cosine function based on data from a matrix. Further label different axes in a plot and data in a plot.
9. Generate different subplots from a given plot and color plot data.
10. Use conditional statements and different type of loops based on simple example/s.
11. Perform vectorized implementation of simple matrix operation like finding the transpose of a matrix, adding, subtracting or multiplying two matrices.

12. Implement Linear Regression problem. For example, based on a dataset comprising of existing set of prices and area/size of the houses, predict the estimated price of a given house.
13. Based on multiple features/variables perform Linear Regression. For example, based on a number of additional features like number of bedrooms, servant room, number of balconies, number of houses of years a house has been built – predict the price of a house.
14. Implement a classification/ logistic regression problem. For example based on different features of students data, classify, whether a student is suitable for a particular activity. Based on the available dataset, a student can also implement another classification problem like checking whether an email is spam or not.
15. Use some function for regularization of dataset based on problem 14.
16. Use some function for neural networks, like Stochastic Gradient Descent or back propagation - algorithm to predict the value of a variable based on the dataset of problem

Suggested Readings

1. SantanuChattopadhyaya. (2011). Systems Programming. New Delhi: PHI.
2. Alfred, V. Aho., Monica, S. Lam., RaviSethi.,& Jeffrey, D. Ullman. (2006). Compilers:Principles, Techniques, andTools (2nd ed.). New Delhi: Prentice Hall.
3. Dhamdhere, D. M. (2011). Systems Programming. New Delhi: Tata McGraw Hill.
4. Leland Beck., & Manjula, D. (2008). System Software: An Introduction to System Programming(3rd ed.). New Delhi: Pearson Education.
5. Grune, D., Van Reeuwijk, K., Bal, H. E., Jacobs, C. J. H.,&Langendoen, K.(2012).ModernCompiler Design (2nd ed.). Springer.

Semester – V

21CGU513A SOFTWARE TESTING- PRACTICAL 4H – 2C

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

Course Objectives

- To learn about different type of applications and testing, along with the purpose of automation testing.
- To gain insight into the evolution of Selenium
- To get an overview of Selenium nd its components and compare commonly used automation tool with Selenium automation tools.
- Explore the features and use of Selenium-WebDriver
- To record and importing tests with Selenium IDE
- To learn data driven testing using TestNG

Course Outcomes (COs)

1. Understand Selenium Architecture and its components
2. Work with Selenium RC
3. Understand Selenium WebDriver
4. Use WebDriver advanced features e.g. taking screenshots, handling cookies and managing exceptions
5. Create Data driven, Keyword driven and Hybrid test framework
6. Record and importing tests with Selenium IDE andWrite Test cases using TestNG

List of programs

1. Write a test case based on controls.
2. Test data in a flat file.
3. Manual test case to verify student grade
4. Write and test a program to select the number of students who have scored more than 60 in any one subject(or all Subjects)
5. Write and test a program to login a specific web page.
6. Write and test a program to get the number of list items in a list / combo box.
7. Test a HTML file.
8. Test a program in MS Excel for Data Driven Wizard.
9. Test the addition of two values in C++ Program.

Semester – V

21CGU513B DATA MINING- PRACTICAL 4H - 2C

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

Course Objectives

- 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

ListofPrograms

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 errorrate.
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 supermarketanalysis.
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 amongthem.

Suggested Readings

1. Steinbach Tan, Kumar, “Introduction to Data Mining”, First edition, Pearson Education; 2016.

2. Mohammed J. Zaki, Wagner Meira, Jr.“Data Mining and Analysis Fundamental Concepts and Algorithms”, Cambridge University Press, May 2014
3. Han, Kamber& Pei, “Data Mining: Concepts and Techniques”,Morgan Kaufmann Publisher, Third Edition,2013
4. G.K. Gupta, "Introduction to Data mining with case studies", 2nd Edition, PHI Private limited, New Delhi, 2011.
5. Arun K Pujari, "Data Mining Techniques", 10th impression, University Press, 2008.

Websites

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

4.

Semester – V

21CGU514A CLIENT RELATIONHIP MANAGEMENT - PRACTICAL 3H – 1C

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

- acquainted with various features of Service Now platform and tool.
- To use Flows and Workflows for process automation
- To use various script types used throughout the platform
- To capturing and moving configurations between instances, using update sets

Course Outcomes (COs)

1. Task management using assignment rules, presence, and work notes
2. Protecting ServiceNow instance data using Access Control rules
3. Populating the database using import sets
4. Using Flows and Workflows for process automation
5. Various script types used throughout the platform
6. Capturing and moving configurations between instances, using update sets

List of programs

1. Creating tickets for servicing requests from clients
2. Creating reports of status of client services

Semester – V

21CGU514B INTRODUCTIONTO DATA SCIENCE- 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 provide an overview of a new language R used for data science.
- To introduce students to the R programming environment and related eco-system and thus provide them with an in-demand skill-set, in both the research and business environments
- To introduce the extended R ecosystem of libraries and packages
- To demonstrate usage of as standard Programming Language.
- To familiarize students with how various statistics like mean median etc. can be collected for data exploration in R
- To enable students to use R to conduct analytics on large real life datasets.

Course Outcomes (COs)

1. Describe what Data Science is and the skill sets needed to be a data scientist.
2. Explain in basic terms what Statistical Inference means.
3. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
4. Use R to carry out basic statistical modeling and analysis.
5. Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
6. Describe the Data Science Process and how its components interact.

List of programs

1. Write a program that prints _hello World to thescreen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to12.
4. Write a function that returns the largest element in alist.
5. Write a function that computes the running total of alist.
6. Write a function that tests whether a string is apalindrome.
7. Implement linearsearch.
8. Implement binarysearch.
9. Implement matrices addition , subtraction andMultiplication
10. Fifteen students were enrolled in a course. There ages were: 20 20 20 20 20 21 21 21 22 22 22 22 23 2323
    i. Find the median age of all students under 22 years
    ii. Find the median age of allstudents
    iii. Find the mean age of all students
    iv. Find the modal age for all students
    v. Two more students enter the class. The age of both students is 23. Whatisnowmean, mode and median?
11. Following table gives a frequency distribution of systolic blood pressure. Compute all the measures ofdispersion.

Midpoint	95.5	105.5	115.5	125.5	135.5	145.5	155.5	165.5	175.5
Number	5	8	22	27	17	9	5	5	2

12. Obtain probability distribution of , where X is number of spots showing when a six-sided symmetric die (i.e. all six faces of the die are equally likely) is rolled. Simulate randomsamples of sizes 40, 70 and 100 respectively and verify the frequency interpretation ofprobability.
13. Make visual representations of data using the base, lattice, and ggplot2 plotting systems in R, apply basic principles of data graphics to create rich analytic graphics from availabledatasets.
14. Use Git / Github software to create Githubaccess count. Also, create a repo usingGithub.

Suggested Readings

1. Rachel Schutt., &Cathy O'Neil.(2013). Doing Data Science: Straight Talk from the Frontiline. Schroff/O'Reilly.
2. Foster Provost.,&Tom Fawcett.(2013). Data Science for Business What You Need to Know About Data Mining and Data-Analytic Thinking. O'Reilly.
3. John, W. Foreman. (2013). Data Smart: Using data Science to Transform Information into Insight. John Wiley & Sons.
4. Ian Ayres. (2007). Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart (1st ed.). Bantam.
5. EricSeigel. (2013).PredictiveAnalytics:ThePowertoPredictwhoWillClick,BuyLie,or Die (1sted.). Wiley.
6. Matthew, A. Russel. (2013). Mining the Social Web: Data mining Facebook, Twitter, Linkedln, Goole+,GitHub, and More (2nd ed.). O'Reilly Media.

Websites

1. https://www.iqonlinetraining.com/data-science-tutorial/
2. https://www.edx.org/course/introduction-to-r-for-data-science-2
3. https://www.tutorialspoint.com/r/index.htm
4. https://www.w3schools.in/r/

Semester – VI

21CGU601 PHP PROGRAMMING 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 write basic PHP syntax using various operators.
- To write PHP scripts to handle HTML forms.
- To analyze different tasks using PHP functions.
- To understand the regular expressions in PHP.
- To learn array data structure using PHP scripts.
- To work with open source applications that deal with database and website development.

Course Outcomes (COs)

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

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

Unit I -Introduction to PHP

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

Unit II -Handling HTML form with PHP

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

Unit III -PHP Functions

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

Unit IV -String Manipulation and Regular Expression

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

Unit V -Array

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

Suggested Readings

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

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

Semester – VI

21CGU602A ARTIFICIAL INTELLIGENCE 4H – 4C

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

Course Objectives

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

Course Outcomes (COs)

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

Unit I - INTRODUCTION TO Al AND PRODUCTION SYSTEMS

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem solving methods – Problem graphs, Matching. Heuristic functions - Hill Climbing-Depth first and Breath first search, A* Algorithm, Simulated Annealing, Constraints satisfaction.

Unit II - REPRESENTATION OF KNOWLEDGE

Game playing –Predicate logic – Representing Instance and Isa Relationship, Introduction to predicate calculus, Resolution, Knowledge representation -Production based system, Frame based system

Unit III - KNOWLEDGE INFERENCE & PLANNING.

Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors -Basic plan generation systems – Strips -Advanced plan generation systems – K strips.

Unit IV- MACHINE LEARNING AND EXPERT SYSTEMS

Learning- Machine learning, Adaptive Learning.Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge. Typical expert

systems–MYCIN, DART, XOON, Expert systems shells

Unit V – PROLOG

Programming in Logic (PROLOG): Introduction, Prolog variables, Syntax, Using rules, Input and Output predicates, Procedural and declarative meanings, Arithmetic operation, unification, lists, control structures, use of fail, CUT, Not.

Suggested Readings

1. Kevin Knight and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill-2017.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
3. Ivan Brako,PROLOG: Programming for Artificial Intelligence,3rd edition Pearson, 2011
4. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
5. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
6. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.

Web Sites

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://www.tutorialspoint.com/artificial_intelligence/index.htm

Semester – VI

21CGU602B DIGITAL IMAGE PROCESSING 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 a digital image processing system.
- To understand concepts of image enhancement techniques.
- To apply various Image Transforms.
- To analyze various Compression techniques and Morphological concepts
- To know various segmentation techniques, and object descriptors.
- To apply color models and various applications of image processing

Course Outcomes (COs)

1. Remember the fundamental concepts of image processing.
2. Explain different Image enhancement techniques
3. Understand and review image transforms
4. Analyze the basic algorithms used for image processing &image compression with morphological image processing.
5. Contrast Image Segmentation and Representation
6. Design & Synthesize Color image processing and its real world applications

Unit I - Introduction

Introduction: Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization. Spatial Domain Filtering: Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, smoothing filters, sharpening filters, gradient and Laplacian.

Unit II – Transforms and Properties

Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering.

Unit III– Image Restoration

Image Restoration, Basic Framework, Interactive Restoration, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Image Compression-Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Run length coding.

Unit IV – Image Compression

FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation

Wavelet based Image Compression: Wavelet series expansion, Discrete Wavelet Transform (DWT),Continuous Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding, Digital Image Watermarking

Unit V - Morphological Image Processing

Basics, SE, Erosion, Dilation, Opening, Closing, Boundary Detection, skeletons, pruning. Image Segmentation: Boundary detection-based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding.

Suggested Readings

1. Rafael C. Gonzalez,Richard E. Woods, Digital Image Processing (4th Edition), 2017, Pearson Education
2. Mark Nixon, Feature Extraction and Image Processing for Computer Vision, Third Edition, 2012, Elsevier
3. Wilhelm Burger,Mark J. Burge, Principles of Digital Image Processing: Fundamental Techniques (Undergraduate Topics in Computer Science), 2011, Springer
4. Maria Petrou,CostasPetrou, Image Processing: The Fundamentals, 2010, Wiley Publications
5. Wilhelm Burger,Mark J. Burge, Principles of Digital Image Processing: Core Algorithms (Undergraduate Topics in Computer Science), 2009, Springer
6. Rafael C. Gonzalez,Richard E. Woods,Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed.,2009, Gatesmark Publishing
7. Gonzalez, R. C., & Woods, R. E. (2008). Digital Image Processing (3rd ed.). New Delhi: Pearson Education.
8. Rafael, C. Gonzalez., Richard, E. Woods., & Steven Eddins. (2004). Digital Image Processing using MATLAB. New Delhi: Pearson Education.

Websites

1. http://www.imageprocessingplace.com/DIP-3E/dip3e_classroom_presentations_downloads.htm
2. https://www.tutorialspoint.com/dip/index.htm
3. https://www.javatpoint.com/digital-image-processing-tutorial
4. https://nptel.ac.in/courses/117/105/117105135/
5. http://172.16.25.76/course/view.php?id=101

Semester – VI

21CGU603A COMPUTER GRAPHICS 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 describe characteristics and functioning of common graphics input/output devices
- To learn the basic principles of 3- dimensional computer graphics
- To Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition
- To Provide an understanding of mapping from a world coordinates to device coordinates and projections.
- To extract scene with different clipping methods and its transformation to graphics display device.
- To explore projections and visible surface detection techniques for display of 3D scene on 2D screen

Course Outcomes(COs)

1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Use of geometric transformations on graphics objects and their application in composite form.
4. Extract scene with different clipping methods and its transformation to graphics display device.
5. Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.
6. Render projected objects to naturalize the scene in 2D view and use of illumination models for this..

Unit I - A Survey of Computer Graphics

Video Display Devices- Refresh cathode-Ray Tubes-Raster Scan Displays-Random Scan Displays-Color CRT Monitors-Direct –View Storage Tubes-Flat Panel Displays-Raster Scan Systems-Three Dimensional Viewing Devices-Random Scan Systems.

Unit II - Input Devices

Keyboards-Mouse –Track Ball and Space ball-Joysticks-Data Glove- digitizers-Image Scanners-Touch Panels-Light Pens-Voice Systems-**Hard Copy Devices**: Printers and Plotters

Unit III - Point and Lines- Line Drawing Algorithms

DDA Algorithm- Bresenhams Line Algorithm. **Circle Generating Algorithms**: Mid Point Circle Algorithm. Two Dimensional Geometric Transformations: **Basic Transformations**: Translation-Rotation-Scaling-**Composite Transformations**: Translations-Rotations- Scaling. General Pivot Point Rotation- General Fixed Point Scaling.

Unit IV - Two Dimensional Viewing

The Viewing Pipeline- Window to view port Transformation-**Clipping Operations**-Point Clipping -Line Clipping: Cohen Sutherland Line Clipping. Polygon Clipping: Sutherland – Hodgeman Polygon Clipping-Text Clipping.

Unit V Three – Dimensional Display Methods

Parallel Projection- three Dimensional Geometric Transformations: Translation-Rotations-Scaling. **Projections**: Parallel Projections-Perspective Projections. **Visible Surface Detection Methods**: Classification of Visible Surface Detection Algorithms-Back Face Detection- Depth Buffer Method- Area Sub division Method.

Suggested Readings

1. John F Hughes;Andries Van Dam;MorganMcGuire;David F Sklar;James D Foley;Steven K Feiner;Kurt Akeley,2018 ,Computer Graphics: Principles and Practice by Pearson
2. V. Scott Gordon, 2018,Computer Graphics Programming in OpenGL with Java (2e)Publisher: Mercury
3. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V 9th Edition, Kindle Edition byJohn Kessenich (Author), Graham Sellers (Author), Dave Shreiner (Author) 2016.
4. Interactive Computer Graphics: A Top-Down Approach with WebGL (7th Edition) 7th Edition by Edward Angel (Author), Dave Shreiner (Author),2014.
5. Donald Hearn and M. Pauline Baker. 2007. Computer Graphics-C Version, 2nd Edition, Pearson Education, New Delhi.

Websites

1. www.cgshelf.com
2. www.cgtutorials.com
3. www.allgraphicdesign.com
4. https://nptel.ac.in/courses/106/102/106102063/

Semester – VI

21CGU603B COMPLIER DESIGN 3H – 3C

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

Course Objectives

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand syntax-directed translation and intermediate code generation
- To learn to implement run-time storage administration.
- To learn to implement code optimization and code generator.
- Learn how to optimize and effectively generate machine codes

Course Outcomes (COs)

1. Understand the different phases of compiler.
2. Apply different parsing algorithms to develop the parsers for a given grammar.
3. Understand syntax-directed translation and run-time environment.
4. Develop the run- time storage administration.
5. Understand to implement code optimization techniques and a simple code generator.
6. Learn about Code optimization

Unit I

Introduction to Compliers: Compliers and Translator – Need of Translator – The structure of a Complier – Lexical analysis – Syntax analysis – Intermediate code generation – optimization – code generation – Complier – writing tools. Finite automata and lexical Analysis: The role of the lexical analysis – A simple approach to the design of lexical analysers- Regular expressions to finite automata – Minimizing the number of states of a DFA.

UnitII

The Syntactic specification of programming languages: context free grammars – derivations and parse trees – capabilities of context free grammars. Basic parsing techniques: Parsers – shift – reduce parsing – operator – precedence parsing – top down parsing – predictive parsers.

Unit III

Syntax – directed translation: syntax – directed translation schemes – implementation of syntax – directed translators – intermediate code – postfix notation – parse trees and syntax trees – 3 address code – quadruples and triples – translation of assignment statements – Boolean expressions – statements that alter the flow of control. Symbol tables: the contents of a symbol table – data structures for symbol table – representing scope information.

Unit IV

Run time storage administration: Implementation of a simple stack allocation scheme – implementation of block-structured languages – storage allocation in block structured languages. Error deduction and recovery: errors – lexical phase errors – syntactic phase errors – semantic errors.

Unit V

Introduction of code optimization: The principle sources of optimization – loop optimization – the DAG representation of basic blocks – value numbers and algebraic laws – Global data flow analysis. Code generation: Object programs – problems in code generation – a machine model –

a simple code generator – register allocation and assignment – code generation from DAG's – peepholes optimization.

Suggested Readings

1. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles,Techniques and Tools‖, Second Edition, Pearson Education, 2009.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Steven S. Muchnick, Advanced Compiler Design and Implementation‖, MorganKaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.
5. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures:
6. A Dependence based Approach, Morgan Kaufmann Publishers, 2002.

Websites

1. http://www.vssut.ac.in/lecture_notes/lecture1422914957.pdf
2. https://www.iith.ac.in/~ramakrishna/Compilers-Aug14/
3. https://swayam.gov.in/nd1_noc20_cs13/preview
4. https://nptel.ac.in/courses/106105190/
5. .http://172.16.25.76/course/view.php?id=1847

Semester – VI

21CGU611 PHPPROGRAMMING- PRACTICAL 4H – 2C

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

Course Objectives

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

Course Outcomes (COs)

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

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

List of Programs

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

Suggested Readings

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

Semester – VI

21CGU612A ARTIFICIAL INTELLIGENCE - PRACTICAL 4H – 2C

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

Course Objectives

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

Course Outcomes (COs)

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

List of Programs

Write the following programs using PROLOG

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

Suggested Readings

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill- 2017.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
3. Ivan Brako, PROLOG: Programming for Artificial Intelligence,3rd edition Pearson, 2011
4. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

5. Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.
6. Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.

Web Sites

https://nptel.ac.in/courses/106/105/106105077/

Semester – VI

21CGU612B DIGITAL IMAGE PROCESSING - PRACTICAL 4H – 2C

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

Course Objectives

- To understand the fundamental concepts of a digital image processing system.
- To understand concepts of image enhancement techniques.
- To apply various Image Transforms.
- To analyze various Compression techniques and Morphological concepts
- To know various segmentation techniques, and object descriptors.
- To apply color models and various applications of image processing

Course Outcomes (COs)

1. Remember the fundamental concepts of image processing.
2. Explain different Image enhancement techniques
3. Understand and review image transforms
4. Analyze the basic algorithms used for image processing &image compression with morphological image processing.
5. Contrast Image Segmentation and Representation
6. Design & Synthesize Color image processing and its real world applications

List of Programs

1. Write program to read and display digital image using MATLAB orSCILAB
   a. Become familiar with SCILAB/MATLAB Basiccommands
   b. Read and display image inSCILAB/MATLAB
   c. Resize givenimage
   d. Convert given color image into gray-scaleimage
   e. Convert given color/gray-scale image into black &whiteimage
   f. Draw imageprofile
   g. Separate color image in three R G &Bplanes
   h. Create color image using R, G and B three separateplanes
   i. Flow control and LOOP inSCILAB
   j. Write given 2-D data in imagefile

2. To write and execute image processing programs using point processingmethod
   a. Obtain Negativeimage c. Obtain Flipimage
   b. Thresholding d. Contraststretching
3. To write and execute programs for image arithmeticoperations
   a. Addition of twoimages
   b. Subtract one image from otherimage
   c. Calculate mean value ofimage
   d. Different Brightness by changing meanvalue
4. To write and execute programs for image logicaloperations
   a. AND operation between twoimages
   b. OR operation between twoimages
   c. Calculate intersection of twoimages
   d. Water Marking using EX-ORoperation
   e. NOT operation (Negativeimage)
5. To write a program for histogram calculation and equalizationusing

a. Standard MATLABfunction
b. Program without using standard MATLABfunctions
c. CProgram

6. To write and execute program for geometric transformation ofimage
   a. Translation
   b. Scaling
   c. Rotation
   d. Shrinking
   e. Zooming
7. To understand various image noise models and to write programsfor
   a. imagerestoration
   b. Remove Salt and PepperNoise
   c. Minimize Gaussiannoise
   d. Median filter and Weinerfilter
8. Write and execute programs to remove noise using spatialfilters
   a. Understand 1-D and 2-D convolutionprocess
   b. Use 3x3 Mask for low pass filter and high passfilter
9. Write and execute programs for image frequency domainfiltering
   a. Apply FFT on givenimage
   b. Perform low pass and high pass filtering in frequencydomain
   c. Apply IFFT to reconstructimage
10. Write a program in C and MATLAB/SCILAB for edge detection using different edge detectionmask
11. Write and execute program for image morphological operations erosion anddilation.
12. To write and execute program for wavelet transform on given image and perform inverse wavelet transform to reconstructimage.

Suggested Readings

1. Gonzalez, R. C., & Woods, R. E. (2008). Digital Image Processing(3rd ed.). New Delhi: Pearson Education.
2. Jain, A. K. (1989). Fundamentals of Digital image Processing. New Delhi: Prentice Hall ofIndia.
3. Castleman, K. R. (1996). Digital Image Processing. New Delhi: PearsonEducation.
4. Schalkoff. (1989). Digital Image Processing and Computer Vision. New York: John Wiley andSons.
5. Rafael, C. Gonzalez., Richard, E. Woods.,& Steven Eddins. (2004). Digital Image Processing using MATLAB. New Delhi: Pearson Education.

Websites

1. http://www.imageprocessingplace.com/DIP-3E/dip3e_classroom_presentations_downloads.htm
2. https://www.tutorialspoint.com/dip/index.htm
3. https://www.javatpoint.com/digital-image-processing-tutorial

Semester – VI

21CGU613A COMPUTER GRAPHICS - PRACTICAL 3H – 1C

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

- To describe characteristics and functioning of common graphics input/output devices
- To learn the basic principles of 3- dimensional computer graphics
- To Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition
- To Provide an understanding of mapping from a world coordinates to device coordinates and projections.
- To extract scene with different clipping methods and its transformation to graphics display device.
- To explore projections and visible surface detection techniques for display of 3D scene on 2D screen

Course Outcomes(COs)

1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Use of geometric transformations on graphics objects and their application in composite form.
4. Extract scene with different clipping methods and its transformation to graphics display device.
5. Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.
6. Render projected objects to naturalize the scene in 2D view and use of illumination models for this..

List of Programs

1. Program to draw a line using DDA algorithm.
2. Program to draw a line using Bresenham‟s algorithm.
3. Program to draw a circle using Bresenham‟s algorithm.
4. Program to implement the Character generation algorithm.
5. Program to implement the Polygon clipping alogorithm.
6. Program to implement the Text clipping algorithm.
7. Program to implement the line Clipping algorithm.
8. Program to implement the 2D Translation, 2D Rotation and 2D scaling.
9. Program to implement the 3D Translation, 3D Rotation and 3D scaling.
10. Program to implement the Shearing and Reflection of an object.

Suggested Readings

1. John F Hughes;Andries Van Dam;MorganMcGuire;David F Sklar;James D Foley;Steven K Feiner;Kurt Akeley,2018 ,Computer Graphics: Principles and Practice by Pearson
2. V. Scott Gordon, 2018,Computer Graphics Programming in OpenGL with Java (2e)Publisher: Mercury
3. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V 9th Edition, Kindle Edition by John Kessenich (Author), Graham Sellers (Author), Dave Shreiner (Author) 2016.

4. Interactive Computer Graphics: A Top-Down Approach with WebGL (7th Edition) 7th Edition by Edward Angel (Author), Dave Shreiner (Author),2014.

Web Sites

1. www.cgshelf.com
2. www.cg**tutorials**.com
3. www.allgraphicdesign.com

NPTEL WEBSITE

1.https://nptel.ac.in/courses/106/102/106102063/
2.https://nptel.ac.in/courses/106106090/
3.http://www.nptelvideos.in/2012/11/computer-graphics.html

Semester – VI

21CGU613B COMPLIER DESIGN- 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 learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand syntax-directed translation and intermediate code generation
- To learn to implement run-time storage administration.
- To learn to implement code optimization and code generator.
- Learn how to optimize and effectively generate machine codes

Course Outcomes (COs)

1. Understand the different phases of compiler.
2. Apply different parsing algorithms to develop the parsers for a given grammar.
3. Understand syntax-directed translation and run-time environment.
4. Develop the run- time storage administration.
5. Understand to implement code optimization techniques and a simple code generator.
6. Learn about Code optimization

LIST OF PROGRAMS:

1. Implementation of Symbol Table
2. Implementation of Lexical Analyzer using Lex Tool
   - **a)** The program replaces the substring abc by ABC from the given input string:
   - **b)** Well formedness of brackets
   - **c)** Finding vowels and consonant in a string
   - **d)** Finding the capital
   - **e)** It is used to display the Keywords and identifiers in the given program.
3. Construction Of Operator Precedence Parse Table
4. Generate YACC specification for a few syntactic categories.
   a)Implementation Of Calculator Using Yacc.
5. Generation of code for a given intermediate code.
6. Implementation of code optimization techniques

Suggested Readings

1. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education, 2009.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Steven S. Muchnick, Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.
5. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures:
6. A Dependence based Approach, Morgan Kaufmann Publishers, 2002.

Websites

1. https://studentsfocus.com/notes/anna_university/IT/6SEM/IT6612%20-%20CD%20Lab/CS6612%20-%20CD%20LAB%20%20MANUAL.pdf
2. https://swayam.gov.in/nd1_noc20_cs13/preview

3. https://nptel.ac.in/courses/106105190/
4. .http://172.16.25.76/course/view.php?id=1847
5. http://www.vssut.ac.in/lecture_notes/lecture1422914957.pdfhttps://www.iith.ac.in/~ramakrishna/Compilers-Aug14/

Semester – VI

21CGU691 **PROJECT** **8H – 6C**

Instruction Hours / week: L: 0 T: 0 P:8 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours