B.S. Abdur Rahman

Crescent

Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2016

CURRICULUM AND SYLLABI

B.C.A

DATA SCIENCE

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned Institution

- To empower the youth through quality education and to provide professional leadership

- To achieve excellence in all its endeavors to face global challenges

- To provide excellent teaching and research ambience

- To network with global institutions of Excellence, Business, Industry and Research Organizations

- To contribute to the knowledge base through Scientific enquiry, Applied research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER APPLICATIONS

VISION

Aspires to provide quality education in the field of computer applications with state of the art computational facilities and undertake quality research in collaboration with industries and universities to produce committed professionals and academicians to meet the needs of the industries and society.

MISSION

The Department of Computer Applications, endeavors

- To disseminate knowledge through education and training of graduates in the field of computer applications.
- To focus on teaching - learning, research and consultancy to promote excellence in computer applications.
- To foster graduates with opportunities required to explore, create and face challenges of IT related industries.
- To equip the graduates with the necessary skills in communication, team work and leadership qualities to meet the needs of the IT related sector globally.
- To disseminate the outcome of projects and research work undertaken by the department through appropriate measures for the benefit of society and industry.

PROGRAMME EDUCATIONAL OBJECTIVES:

The students of BCA- Data Science Programme would be able to

- Produce graduates who will be competent professionals in IT industry, academics, government, or entrepreneurs.
- Adapt to the fast changing world of Information Technology needs.
- Become effective collaborators and through innovative methodologies, they will be able to address the social, technical and business challenges.
- Be a good team player and in course of time will be able to lead the team to find solutions and improvements in their field of expertise.
- Communicate efficiently and effectively.
- Function in multiple disciplinary teams.
- Understand the need for lifelong learning and IT skill up gradation, through taking up certifications or higher education.
- Understand professional and ethical responsibilities.

PROGRAMME OUTCOMES:

On successful completion of the programme, the graduates will have

- Ability to apply the knowledge of mathematics, science and information technology concepts..
- Have basic knowledge of programming and create first level programs.
- To Fulfill the concept of Statistics and Probability with Statistical Analysis.
- Implement Statistical concept for Data Analysis using tools.
- Knowledge of RDBMS with programming language used for Data Science.
- Applying data analysis on Big Data.
- Have knowledge of Artificial Intelligence with Machine Learning Algorithms.
- Ability to communicate efficiently with team.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

REGULATIONS -2016

FOR
BACHELOR OF COMPUTER APPLICATIONS (B.C.A)/
BACHELOR OF SCIENCE (B.Sc)/
BACHELOR OF BUSINESS ADMINISTRATION (B.B.A)/
BACHELOR OF COMMERCE (B.Com)

DEGREE PROGRAMME (Semester Scheme)

(Candidates to be admitted from the academic year 2016-2017 onwards)

1.0   PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i)   **"Programme"** means Under Graduate Degree Programme (B.C.A/B.Sc/B.Com/B.B.A).

ii)   **"Course"** means a theory or practical subject that is normally studied in a semester.

iii)   **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science & Technology.

iv)   **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology.

v)   **"Dean (Student Affairs)"** means the Dean (Students Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology.

vi)   **"Controller of Examinations"** means the Controller of Examination of B.S. Abdur Rahman Crescent Institute of Science & Technology, who is responsible for conduct of examinations and declaration of results.

2.0   PROGRAMME OFFERED, DURATION AND ELIGIBILITY CRITERIA

2.1   U.G. Programmes Offered

Degree	Mode of Study
B.C.A	Full Time
B.Sc	Full Time
B.B.A	Full Time
B.Com	Full Time

2.2   Duration of the Programme

The duration of the undergraduate program shall be six semesters (three

academic years).

2.3 Eligibility Criteria

2.3.1 Students for admission to the first semester of the under graduate degree programme must have passed the Higher Secondary Certificate examination or any other examination of any authority accepted by this Institution as equivalent thereto.

S.No	Programme	Eligibility Criteria
1	B.C.A	10 +2 (Higher Secondary) with Mathematics or equivalent subject
2	B.Sc Computer Science	10 +2 (Higher Secondary) with Mathematics or equivalent subject
3	B.Sc Bio Technology	10 +2 (Higher Secondary) with Chemistry as one of the subjects.
4	B.B.A (Financial Services)	10 +2 (Higher Secondary) with any stream or equivalent
5	B.Com General	10 +2 (Higher Secondary) with Mathematics, Physics and Chemistry/Physics, Chemistry, Botany and Zoology /Commerce /Statistics as subjects.
6	B.Com (Accounts and Finance)	

2.3.2 Eligibility conditions for admission such as marks obtained, number of in the qualifying examination and physical fitness will be as prescribed by this Institution from time to time.

2.4 Streams of Study

Taking into consideration the rapid developments in technology and to cater the needs of the industry, the following programmes are offered

S.No	Program	Streams of Study
1.	B.C.A	i. specialization in Cloud Technology and Information Security ii. specialization in Mobile Applications and Information Security

		iii.	specialization in Big Data Analytics
2.	**B.Sc**	i.	Computer Science
		ii.	Bio Technology
3.	**B.B.A**	i.	Financial Services
4.	**B.Com**	i.	General
		ii.	Accounts and Finance

3.0 STRUCTURE OF THE PROGRAMME

3.1 The UG Programme consists of the following components as prescribed in the curriculum

- Core Courses
- Allied Courses
- Elective Courses
- Laboratory courses
- Laboratory integrated theory courses
- Value added Courses
- Project Work

3.2 The curricula and syllabi of all UG programmes shall be approved by Board of Studies of the respective department and Academic Council of this Institution.

3.3 Each course is normally assigned certain number of credits :

- One credit for one lecture period per week.
- One credit for one tutorial period per week.
- One credit each for lab sessions/project of two or three periods per week.
- One credit each for value added courses of two or three periods per week.

3.4 The medium of instruction, examinations and project report shall be English, except for courses in languages other than English.

3.5 The minimum number of credits to be earned for the successful completion of the program shall be normally in the range as follows:

S.No	Programme	Credits
1	B.C.A (Cloud Technology and Information Security)	120 - 126

2	B.C.A (Mobile Applications and Information Security)	120 - 126
3	B.C.A (Big Data Science)	120 - 130
4	B.Sc. (Computer Science)	120 – 126
5	B.Sc. (Bio Technology)	145 – 150
6	B.B.A (Financial Services)	120 - 125
7	B.Com	150 – 158
8	B.Com (Accounts and Finance)	150 – 158

3.6 The number of credits registered by a student in non-project semester and project semester shall be normally in the range as follows:

Non Project Semester: 20-28

Project Semester: 19-27

3.7 Elective courses from the curricula are to be chosen with the approval of the Head of the Department/ Dean of School

4.0 DURATION OF THE PROGRAMME

4.1 The minimum and maximum periods for the completion of the UG programmes are three years (6 semesters) and five years (10 semesters) respectively.

4.2 Each semester shall consist of a minimum of 90 working days.

4.3 Semester end examination will normally follow within a week after the last working day of the semester.

5.0 CLASS ADVISOR AND FACULTY ADVISOR

5.1 Class Advisor

A faculty member will be nominated by the HOD/Dean of School as Class Advisor for the class throughout the period of study.

The Class Advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class.

5.2 Faculty Advisor

To help the students in planning their courses of study and for general counseling, the Head of the Department / Dean of School of the students will attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of

study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

6.0 COURSE COMMITTEE

Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean of School / Dean (Academic Affairs) depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

7.0 CLASS COMMITTEE

A class committee comprising faculty members handling the courses, student representatives and a senior faculty member not handling the courses as chairman will be constituted semester-wise by the head of the department.

7.1 The composition of the class committee will be as follows:

- One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department
- Faculty members of all courses of the semester
- Six student representatives (male and female) of each class nominated by the Head of the Department in consultation with the relevant faculty advisors
- All faculty advisors and the class advisors
- Head of the Department - Ex-Officio Member

7.2 The class committee shall meet at least four times during the semester. The first meeting will be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment will be decided for the

first and second assessment. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

7.3 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process.

7.4 The fourth meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

8.0 REGISTRATION AND ENROLMENT

8.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the semester end examination of the ongoing semester. Every student shall submit a completed registration form indicating the list of courses intended to be enrolled during the ensuing semester. Late registration with the approval of the Dean (Academic Affairs) along with a late fee will be permitted up to the last working day of the current semester.

8.2 From the second year onwards, all students shall pay the prescribed fees for the year on or before a specific day at the beginning of the semester confirming the registered courses. Late enrolment along with a late fee will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

8.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

8.4 A student should have registered for all preceding semesters before registering for a particular semester.

9.0 COURSE CHANGE/ WITHDRAWAL

9.1 Change of a Course

A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department/ Dean of School of the student.

9.2 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department/ Dean of School of the student.

10.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. A student can avail the break of study before the start of first assessment of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 4.1).If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only.

11.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

11.1 Every theory course shall have a total of three assessments during a semester as given below:

Type of Assessment	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 6	1.5 hours	25%
Assessment 2	7 to 12	1.5 hours	25%

Semester End Exam	Full course	3 hours	50%

11.2 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

11.3 Appearing for semester - end examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

11.4 Every practical course will have 60% weightage for continuous assessments and 40% for semester end examination. However a student should secure a minimum of 50% of the marks in the semester end practical examination.

11.5 For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory component shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical component shall be through continuous assessment.

11.6 In the case of Industrial training /Internship, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members, constituted by the Head of the Department/ Dean of School. The weightage for report shall be 60% and 40% for Viva Voce examination.

11.7 In the case of project work, a committee of faculty members constituted by the Head of the Department/ Dean of School will carry out three periodic reviews. Based on the project report submitted by the student(s), an oral examination (viva-voce) will be conducted as the semester end examination, for which one external examiner, approved by the Controller of Examinations, will be included. The total weightage for all periodic reviews will be 50%. Of the remaining 50%, 20% will be for the project report and 30% for the Viva Voce examination.

11.8 Assessment of seminars and comprehension will be carried out by a

committee of faculty members constituted by the Head of the Department/ Dean of School.

11.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance will be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall be ignored.

12.0 SUBSTITUTE EXAMINATIONS

12.1 A student who has missed, for genuine reasons, a maximum of one of the two continuous assessments of a course may be permitted to write a substitute examination paying the prescribed substitute examination fees. However, permission to write a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Dean of School for that purpose. However there is no Substitute Examination for Semester End examination.

12.2 A student who misses any continuous assessment test in a course shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of missed assessment test. However the Substitute Examination will be conducted after the last working day of the semester and before Semester End Examination.

13.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

13.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the Institution in approved events etc.) to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. For the courses in which "I" grade is awarded, the student shall register and repeat the course when it is offered next.

13.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75%

attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department/ Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

13.3 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall repeat all the courses of the semester in the subsequent academic year.

13.4 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of Head of the Department / Dean of School.

13.5 A student who is awarded "U" grade in a course will have the option either to write the semester end arrear examination at the end of the subsequent semesters, or to redo the course in the evening when the course is offered by the department. Marks scored in the continuous assessment during the redo classes shall be considered for grading along with the marks scored in the semester-end (redo) examination. If any student obtained "U" grade in the redo course, the marks scored in the continuous assessment test (redo) for that course will be considered as internal mark for further appearance of arrear examination.

13.6 If a student with "U" grade, who prefers to redo the course, fails to earn the minimum 75% attendance while redoing that course, then he / she will not be permitted to write the semester end examination and his / her earlier "U" grade and continuous assessment marks shall continue.

14.0 REDO COURSES

14.1 A student can register for a maximum of two redo courses per semester in the evening after regular college hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters.

14.2 The Head of the Department, with the approval of Dean Academic Affairs, may arrange for the conduct of a few courses during the evening, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

14.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

15.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

15.1 All assessments of a course will be made on absolute marks basis. The Class Committee, without the student members, shall meet within 5 days after the semester-end examination and analyze the marks of students in all assessments of a course and award suitable letter grades. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	0
I	0
AB	0

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from semester-end examination

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester-end examination.

15.2 A student who earns a minimum of five grade points in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

15.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of Schools and the results shall be declared by the Controller of Examinations.

15.4 Within one week from the date of declaration of result, a student can apply for

revaluation of his / her semester-end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to Controller of Examination. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as Convener, the faculty member of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details:

- credits for each course registered for that semester.
- performance in each course by the letter grade obtained.
- total credits earned in that semester.
- Grade Point Average (GPA) of all the courses registered for that semester and the Cumulative Grade Point Average (CGPA) of all the courses taken up to that semester.

If Ci, is the number of credits assigned for the ith course and GPi is the Grade Point in the ith course, GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and "W" grades will be excluded for calculating GPA.

"U", "I", "AB" and **"W"** grades will be excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA.

Classification	CGPA
First Class with	8.50 and above and passing all the courses

Distinction	in first appearance and completing the programme within the Prescribed period of 6 semesters.
First Class	6.50 and above, having completed within a period of 8 semesters.
Second Class	Others

However, to be eligible for First Class with Distinction, a student should not have obtained 'U' or 'I' grade in any course during his/her study and should have completed the U.G. programme within 6 semesters (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within 8 semesters reckoned from his/her commencement of study. For this purpose, the authorized break of study will not be counted. The successful students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

16.0 ELECTIVE CHOICE:

16.1 Apart from the various elective courses listed in the curriculum for each programme, the student can choose a maximum of two electives from any stream of the same program during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

16.2 Online / Self Study Courses

Students are permitted to undergo department approved online/ self study courses not exceeding a total of six credits with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. In case of credits earned through online mode ratified by the respective Board of Studies, the credits may be transferred following the due approval procedures. The students shall undergo self study courses on their own with the mentoring of a member of the faculty. The online/ self study courses can be considered in lieu of elective courses.

17.0 SUPPLEMENTARY EXAMINATION

Final Year students can apply for supplementary examination for a maximum of two courses thus providing an opportunity to complete their degree programme. The students can apply for supplementary examination within three weeks of the declaration of results.

18.0 PERSONALITY AND CHARACTER DEVELOPMENT

18.1 All students shall enroll, on admission, in any of the personality and character development programmes, NCC / NSS / NSO / YRC / Rotaract and undergo practical training.

- **National Cadet Corps (NCC)** will have to undergo specified number of parades.
- **National Service Scheme (NSS)** will have social service activities in and around Chennai.
- **National Sports Organization (NSO)** will have sports, games, drills and physical exercises.
- **Youth Red Cross (YRC)** will have social service activities in and around Chennai.
- **Rotaract** will have social service activities in and around Chennai.

19.0 DISCIPLINE

19.1 Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to affect the prestige of the Institution.

19.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean will be referred to a Discipline and Welfare Committee nominated by the Vice-Chancellor, for taking appropriate action.

20.0 ELIGIBILITY FOR THE AWARD OF DEGREE

20.1 A student shall be declared to be eligible for the award of 3 year Bachelor provided the student has:

i) Successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 10 semesters. from the date of admission, including break of study

ii) no dues to the Institution, Library, Hostels

iii) no disciplinary action pending against him/her.

20.2 The award of the degree must have been approved by the Institution.

21.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.C.A DATA SCIENCE

CURRICULUM & SYLLABUS, REGULATIONS 2016

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1	ENC1182	General English – I	3	0	0	3	
2	MAC1187	Algebra, Calculus and Trigonometry	3	1	0	4	
3	CAC1102	Computer Fundamentals & Organization	3	0	0	3	
4	CAC1103	Programming in C	3	0	0	3	
5	CAC1121	Operating System	3	1	0	4	
6	CAC1122	Programming in C Lab	0	0	4	2	
7	CAC1123	Linux& Shell Programming Lab	0	0	4	2	**21**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1	ENC1283	General English – II	3	0	0	3
2	MAC1288	Probability and Statistics	3	1	0	4
3	CAC1221	Introduction to Data Science	3	1	0	4
4	CAC1203	OOPS with C++	3	0	0	3
5	CAC1204	Data Structures using C	3	0	0	3
6	CAC1222	Programming in C++ Lab	0	0	4	2

7	CAC1223	Data Structures and Algorithms Lab	0	0	4	2	
8	CAC1256	Environmental Studies	2	0	0	2	
9	CAC1224	Communication Skills	3	0	0	-	**23**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC2101	Reasoning and Thinking	3	0	0	3	
2	CAC2121	Database Management Systems	3	0	0	3	
3	CAC2105	Computer Networks	3	0	0	3	
4	CAC2122	Linear Algebra	3	1	0	4	
5	CAC2123	Scientific Programming Using R	3	0	0	3	
6	CAC2124	Database Management Systems Lab	0	0	4	2	
7	CAC2125	Scientific Programming Using R Lab	0	0	4	2	**20**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1	CAC2221	Inferential Statistics	3	0	0	3
2	CAC2222	NoSQL Databases	3	0	0	3
3	CAC2223	Big Data Analytics	3	0	0	3
4	CAC2224	Cloud Computing	3	1	0	4

5	CAC2225	Exploratory Data Analysis	3	1	0	4	
6	CAC2226	Inferential Statistics Lab	0	0	4	2	
7	CAC2227	Big Data Analytics Lab	0	0	4	2	
8	CAC2228	Employability Skills	3	0	0	-	**21**

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC3121	Times Series Analysis	3	0	0	3	
2	CAC3122	Data Analytics using MS Excel and SQL	3	0	2	4	
3	CAC3123	Machine Learning Algorithms	3	0	0	3	
4		Elective – I	3	0	0	3	
5		Elective – II	3	1	0	4	
6	CAC3124	Times Series Analysis Lab	0	0	4	2	
7	CAC3125	Machine Learning Algorithms Lab	0	0	4	2	**21**

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	
1		Elective – III	3	0	0	3	
2	CAC3221	Project and Viva-Voce	0	0	0	16	**19**

TOTAL CREDITS – 125

LIST OF PROGRAMME ELECTIVES

ELECTIVE I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX40	Internet of Things	3	0	0	3
2.	PE	CACX10	Artificial Intelligence	3	0	0	3
3.	PE	CACX16	Mobile Computing	3	0	0	3

ELECTIVE II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX41	Python Programming	3	1	0	4
2.	PE	CACX42	Java Programming	3	1	0	4
3.	PE	CACX43	Data Visualization	3	1	0	4

ELECTIVE III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX44	Data Science Project Management	3	0	0	3
2.	PE	CACX45	Software Engineering	3	0	0	3
3.	PE	CACX46	Agile Methodology	3	0	0	3

ENC1182   **GENERAL ENGLISH - I**   L   T   P   C

3   0   0   3

OBJECTIVES:

- To help the students acquire efficiency in Spoken English through role plays.
- To enable them to make Presentation effectively.
- To develop reading skills among students through extensive readers.
- To orient them in writing letters.
- To train them in appreciating and interpreting English literature.

MODULE I   7

Oral and Written Communication – implications in real life and workplace situations
Essential English Grammar - 1-6 units

MODULE II   8

One–minute Presentations (JAM) on concrete and abstract topics that test their
creative thinking (ii) Prepared presentations and extempore presentations
Short Story ; O Henry - "Robe of Peace" (Extensive Reading)

MODULE III   8

Role-Play – establishing a point of view - convincing someone on social issues
such as
preservation of water, fuel, protection of environment, gender discrimination.
Poetry: William Shakespeare - "All the World's a Stage"

MODULE IV   8

Letter Writing- Letter of Invitation & Permission
Developing story from hints- Short Story : John Galsworthy - "Quality" (Extensive
Reading)

MODULE V   8

Précis Writing- Writing instructions and recommendations
Reading Comprehension: Short Story--Rudyard Kipling – "The Miracle of Puran
Bhagat"(Extensive Reading)

MODULE VI   6

Written correspondence - - e-mail writing

Prose : Education, Employment, Unemployment

TOTAL HOURS – 45

TEXT BOOKS:

1. 'Prism: Spoken and Written Communication, Prose & Poetry', Orient Longman

REFERENCES:

1. Anderson, Kenneth & et.al. "Study Speaking : A Course in Spoken English for
2. Academic Purposes" (Second Edition). Cambridge University Press, UK. 2004.
3. Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing".
4. Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002
5. Hurlock, B. Elizabeth. "Personality Development". Tata McGraw Hill, New York. 2004.
6. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad: Macmillan Indian Ltd, 2006.
7. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford University Press, 2002
8. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge University Press, 2009.
9. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Actively take part in role plays
- Make effective presentation s
- Read and comprehend various texts.
- Write letters without making mistakes.
- Analyse literary texts.

MAC1187	ALGEBRA, CALCULUS AND TRIGONOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To develop the skills of students in applying basic concepts in chosen topics of mathematics that are imperative for effective understanding of application oriented topics.
- To understand the basic concepts of matrices and know the importance of rank of matrix in data science.
- To know the importance of equation in data science models and its transformation.
- To understand the importance of differential calculus in estimation of linear models and to find the optimal values in minima and maxima.
- To know the basic concepts of integral calculus in statistical distribution functions.
- Laying the foundation for learning concepts of Trigonometry and inverse functions.

MODULE I   MATRICES   (9+3)

Symmetric – Skew-Symmetric - Orthogonal and Unitary matrices - Rank of a Matrix -Consistency - Characteristic equation - Eigenvalues and Eigenvectors - properties -Cayley Hamilton's Theorem (proof not needed) - Simple applications.

MODULE II   THEORY OF EQUATIONS   (9+3)

Partial Fractions - Theory of equations- Polynomial Equations with real Coefficients -Irrational roots - Complex roots - Symmetric functions of roots - Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations.

MODULE III   DIFFERENTIAL CALCULUS   (9+3)

Rules of differentiation - Derivative of implicit function - Successive differentiation nth derivatives - Leibnitz theorem (without proof) and applications - maxima and minima of functions of two variables - Partial differentiation - Euler's Theorem.

MODULE IV   INTEGRAL CALCULUS   (9+3)

Integration of rational functions - algebraic expressions involving only one irrational quantity- rational functions of sinx and cosx - Trigonometric substitutions - Bernoulli's formula for integration by parts - reduction formulae - properties of definite integral -Evaluation of double and triple integrals.

MODULE V   TRIGONOMETRY   (9+3)

 De Moivre's theorem and its application - Circular and Hyperbolic functions – Inverse circular and hyperbolic functions - Expansion of trigonometric functions in terms of power and multiples - Separation of real and imaginary parts of logarithmic -trigonometric and inverse trigonometric functions - Summation of series including C+iS method.

TOTAL HOURS – 60

TEXT BOOKS:

1. Narayanan, S. and Manicavachagom Pillay, T.K. (2015) Calculus Vol. I,II &III S.Viswanathan (Printers & publishers) Pvt. Ltd., Chennai.
2. Venkataraman, M.K., "Higher Mathematics for Engineering and Science", Third Edition, The National Publishing Co., Madras, 1986.
3. Kandasamy P, K. Thilagavathi and K. Gunavathy- Allied Mathematics aper-I, First semester, 1/e, S. Chand & Co., New Delhi, 2003

REFERENCES:

1. Stewart J - Single Variable Calculus (4th edition) Brooks / Cole, Cenage Learning 2010.
2. Tom M. Apostol - Calculus, Vol. I (second edition) John Wiley and Sons, Inc., Jan 2007.
3. Burnside W.S. and A.W. Panton - The Theory of Equations, Dublin University Press, 1954.
4. MacDuffee, C.C. - Theory of Equations, John Wiley & Sons Inc., 1954.
5. Ushri Dutta, A.S.Muktibodh and S.D. Mohagaonkar: Algebra and Trigonometry, PHI India, 2006.

OUTCOMES:

On completion of the course the students will be able to

- Understand how Eigen values and vectors are calculated and its importance in data science.

- Classify and solve polynomial equations of different types.

- Differentiate different types of functions.

- Integrate rational and trigonometric functions and to evaluate definite integrals (double and triple).

- Demonstrate the application of Demoivre's theorem and find the sum of series of trigonometric functions.

CAC1102 **COMPUTER FUNDAMENTALS &ORGANIZATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

* To provide the basic knowledge of how a computer works is very important for any fresh networking or operating system professional.
* To provide the functional knowledge of a computers working and its main building parts are paramount.
* To understand the basics of computers of today may come with variety of features but the basic working principles remain the same.
* To explore the fundamentals of organization of a computer and the principles and building units of a computer (its hardware).
* To understand the basics of networking and MS Office.

MODULE I GENERAL FEATURES OF A COMPUTER 9

General features of a computer, Generation of computers, Personal computer, workstation, mainframe computer and super computers. Computer applications – data processing, information processing, commercial, office automation, industry and engineering, healthcare, education, graphics and multimedia.

MODULE II COMPUTER ORGANIZATION 9

Computer organization, central processing unit, computer memory – primary memory and secondary memory, Secondary storage devices – Magnetic and optical media, Input and output units, OMR, OCR, MICR, scanner, mouse, modem.

MODULE III COMPUTER HARDWARE AND SOFTWARE 9

Computer hardware and software, Machine language and high level language, Application software, computer program, operating system, Computer virus, antivirus and computer security, Elements of MS DOS and Windows OS, Computer arithmetic, Binary, octal and hexadecimal number systems, Algorithm and flowcharts, illustrations, elements of a database and its applications, Basic Gates (Demorgans theorems, duality theorem, NOR, NAND, XOR, XNOR gates), Boolean expressions and logic diagrams, Types of Boolean expressions

MODULE IV   MS OFFICE   9

Word processing and electronic spread sheet, An overview of MSWORD, MSEXCEL and MSPOWERPOINT

MODULE V   INTRODUCTION TO NETWORKING   9

Network of computers, Types of networks, LAN, Intranet and Internet, Internet applications, World Wide Web, E-mail, browsing and searching, search engines, multimedia applications

TOTAL HOURS – 45

REFERENCES:

1. Alexis Leon and Mathews Leon (1999) : Fundamentals of information Technology, Leon Techworld Pub.
2. Jain, S K (1999) : Information Technology "O" level made simple, BPB Pub
3. Jain V K (2000) "O" Level Personal Computer software, BPB Pub.
4. Rajaraman, V (1999): Fundamentals of Computers, Prentice Hall India
5. Hamacher, Computer Organization McGrawhill
6. Alexis Leon: Computers for everyone. Vikas, UBS
7. Anil Madaan : Illustrated Computer Encyclopedia. Dreamland Pub
8. Sinha. Computer Fundamentals BPB Pub.

OUTCOMES:

Students are provided learning experiences that enable them to:

* Get in-depth knowledge about the general features of a computer.
* Be introduce them to various features of computer,
* Insight to the different software and hardware components of a computer will take them a step ahead in terms of what they can accomplish from their learning.
* Provides knowledge about fundamentals of organization of a computer.
* Provides knowledge of software in MS-Office.

CAC1103   **PROGRAMMING IN C**   L   T   P   C

                                                   3   0   0   3

OBJECTIVES:

- The object oriented platforms and event driven systems use procedural languages for coding integral command content.
- C is an important procedural language and was developed initially to write the UNIX operating system.
- UNIX operating system, C compiler and all UNIX application programs are written in C.
- C is popular because, it is easy to learn, produces efficient programs, can handle low-level activities, and can be compiled on a variety of platforms.
- This course focuses on all the basic concepts, syntax and constructs of the C language.
- For students, who are new to programming, this unit can be considered as the starting point before taking up any other programming oriented units.

MODULE I   OVERVIEW OF PROGRAMMING   9

Introduction to computer based problem solving, Program design and implementation issues- Flowcharts & Algorithms, Top down design & stepwise refinement, **Programming environment** – Machine language, assembly language, high level languages, Assemblers, Compilers, Interpreters

MODULE II   FUNDAMENTALS OF C PROGRAMMING   9

Overview of C, Data Types, Constants & Variables, Operators & Expressions, **Control constructs**-if then, for, while, **Arrays**- single & multidimensional arrays, **Functions**-fundamentals – general form, function arguments, return value, **Basic I/O**-formatted and Unformatted I/O, **Advanced features**- Type modifiers and storage class specifiers for data types, Bit operators, ? operator, &operator, * operator, Type casting, type conversion.

MODULE III   ADVANCED PROGRAMMING TECHNIQUES   9

Control constructs- Do while, Switch statement, break and continue, exit() function, go to and label, **Scope rules**- Local & global variables, scope rules of functions, **Functions**-parameter passing, call by value and call by reference, calling functions

with arrays, argc and argv, recursion- basic concepts, ex-towers of Hanoi

MODULE IV   DYNAMIC DATA STRUCTURES IN C   9

Pointers- The & and * operator, pointer expression, assignments, arithmetic, comparison, malloc vs calloc, arrays of pointers, pointers to pointers, initializing pointers, pointers to functions, function retuning pointers, **Structures**- Basics, declaring, referencing structure elements, array of structures, passing structures to functions, structure pointers, arrays and structures within structures, **Unions** – Declaration, uses, enumerated data-types, typedef

MODULE V   ADDITIONAL FEATURES   9

File Handling – The file pointer, file accessing functions, fopen, fclose, puc, getc, fprintf, **C Preprocessor-** #define, #include, #undef, Conditional compilation directives, **C standard library and header files**: Header files, string functions, mathematical functions, Date and Time functions

TOTAL HOURS – 45

TEXT BOOKS:

1. Let us C by Yashwant Kanetka, 6th Edition, PBP Publication

REFERENCES:

1. The C programming Language by Richie and Kenninghan, 2004, BPB Publication
2. Programming in ANSI C by Balaguruswamy, 3rd Edition, 2005, Tata McGraw Hill

OUTCOMES:

- Students will learn how to write simple programs using C Language and execute them.
- Student will be able to understand the development of procedural codes is important in several commercial app developments.
- The students will be implementing the concepts explained here to create simple to complex programs.
- Student will get basic knowledge of C to learn, produces efficient programs, can handle low-level activities, and can be compiled on a variety of platforms.
- Understands the concepts of dynamic data structures using C.
- Student will understand the several high level languages and frameworks

CAC1121	OPERATING SYSTEM	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The operating system is the most important program that runs on a computer.
- Every general-purpose computer must have an operating system to run other programs.
- Operating systems perform basic tasks, such as recognizing input from the keyboard.
- Sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
- This course covers the concept of operating system and its applications.

MODULE I   INTRODUCTION TO OPERATING SYSTEM   12

Objectives and Functions of OS, Evolution of OS in the pretext of evolution of UNIX, OS Structures, OS Components, OS Services, System calls, System programs, commands to monitor and perform the operations,Virtual Machines.

MODULE II   PROCESS MANAGEMENT – PROCESSES AND THREADS   12

Processes in Unix environment: Process concept, Process scheduling, Co-operating processes, Inter process Communication Threads in Unix environment: Introduction to Threads, Single and Multi-threaded processes CPU Scheduling in Unix environment: Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-time Scheduling

MODULE III   PROCESS MANAGEMENT – SYNCHRONIZATION AND DEADLOCKS   12

Process Synchronization in Unix: Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic Transactions. Deadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

MODULE IV   STORAGE MANAGEMENT   12

Memory Management in the Unix environment: Logical and physical Address Space,

Swapping, Contiguous Memory Allocation, Paging, Segmentation with Paging. Virtual Memory Management in Unix: Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames, Thrashing.

File-System Interface in UNIX: File concept, Access Methods, Directory structure, File-system Mounting, File sharing, Protection and consistency semantics.   File-System Implementation: File-System structure. Directory Implementation, Allocation Methods, Free-space Management, Efficiency and Performance, Recovery. Disk Management: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation

MODULE V   PROTECTION AND SECURITY   12

Protection: Goals of Protection, Domain of Protection, Security: Security Problem, User Authentication, One – Time Password, Program Threats, System Threats.

TOTAL HOURS – 60

TEXT BOOKS:

1. Operating System Concepts and design by Milan Milonkovic, II Edition, McGraw Hill 1992.
2. Operation System Concepts by Tanenbaum, 2nd Edition, Pearson Education.
3. Operating System by Silberschatz / Galvin / Gagne, 6th Edition,WSE (WILEY Publication)

REFERENCES:

1. Operating System by William Stallings, 4th Edition, Pearson Education.
2. Operating System by H.M.Deitel , 2nd Edition,Pearson Education
3. Operating System by Abraham Silberschatz and peter Baer Galvin, 8th Edition, Pearson Education 1989
4. Operating Systems by Nutt, 3/e Pearson Education 2004

OUTCOMES:

- After learning the fundamental concepts in Operating system including how OS has evolved over the years and different components of OS.
- Students will continue to more significant functions of OS like Process management,

storage and memory management etc.

- This will provide the necessary information for students to extract maximum benefits out of the OS while developing programs, working with applications and etc.
- To enable the students to have a hands on practical exposure to the Linux Red Hat Enterprise and make them prepared for the RHCE Certification.
- Student will be able to understand the security and protection of operating system.
- Students can learn storage management.

CAC1122   **PROGRAMMING IN C LAB**

L	T	P	C
0	0	4	2

OBJECTIVES:

- For students, who are new to programming, this unit can be considered as the starting point before taking up any other programming oriented units.
- The students will be implementing the concepts explained here to create simple to complex programs.

LIST OF PROGRAMS

1. A cow is tied to a pole centered in field using 45 m rope. Write a C program to compute the total area that the cow is capable of grazing.

2. A ladder is laid onto a building such that the distance between the ladder and building is 6.3 m. The length of ladder is 10.2 m as shown below.Write a C program to calculate the area of triangle so formed.
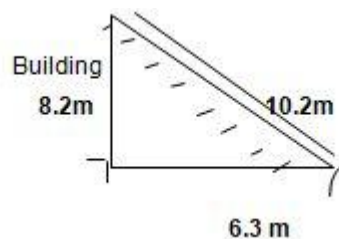
3. Write a C program to find whether a given number is Odd or Even. Also if entered number is even, print half of that number and if odd, print double the number as output.

4. Rahul's birthday falls on 28th February 1994. Write a C program to check if given year is a leap year or not.

5. Heights of two classmates Priya and Lavanya are 163 cm and 171 cm respectively. Write a C program to find the person who is shorter among the two.

6. A patient is suffering from high fever with 104.2 F. Write a C program to find his body temperature in Celsius.

7. Write a C program to find Odd & Even numbers in n series.

8. A user has password 4221899 as his login credential for a banking website. His password is about to expire. He has to change his password and has decided that the new password would be the reverse of the existing one. Write a C program to display the newly changed password.

9. Write a C program to display a series such that the sum of two consecutive

numbers equals the next number in series. Let the first two numbers be 0 and 1.

10. Write a C program to find sum and average of first 99 numbers.

11. Write a C program to multiply consecutive numbers in series beginning from 1 till any n value as input.

12. Write a C program to find the sum of digits in a debit card's cvv number.

13. 5 passengers travelling to Bangalore have booked tickets in bus. The names of those members are Ajay, Pooja, Rohan, Arun and Sukanya and their respective age are 23,21,19,25 and 30.Write a C program to display these data using an array.

14. Rainfall received in few areas in Chennai were recorded as 31 cm, 11.64 cm, 16.87 cm, 28 cm and 23.5 cm. Write a C program to calculate total amount of rainfall and average rainfall received that day.

15. A health survey was conducted to record the weights of students in a class. Six among them had weights above 70 kg and they were recorded as 74 kg, 87kg, 79kg, 71 kg, 85 kg and 93kg. Write a C program to find the greatest weight using an array.

16. Consider an array in following order:

    58, 51, 35, 78, 15, 22 and 85. Write a C program to search the value 35.

17. The heights of ten students were marked as 163cm, 171 cm, 158 cm, 167cm, 175cm, 160cm, 173 cm, 149 cm, 180cm and 154cm.Write a C program to sort the given heights in ascending or descending order.

18. Consider the CAT 1 exam marks of 5 subjects for 5 students. Similarly CAT 2 exam marks as 2nd matrix. Write a C program to find the total marks obtained in CAT1 and CAT2 by those 5 students.

19. Ayisha has 5 five stars and 4 kitkats. Ashwin has 10 five stars and 3 kitkats. Both of them ate 2 five stars and 2 kitkats each. Write a C program to find the remaining chocolates left using matrix.

20. The quantity of stationary sold for 3 days are shown.Write a C program to find the product of the quantity of items mentioned below in the form of matrix.

Day/Item	Pen	Pencil	Eraser
Day 1	10	5	5
Day 2	8	4	2
Day 3	5	10	10
Day/Item	Notebook	Whitener	Marker
Day 1	3	6	5

Day 2	2	1	3
Day 3	5	4	15

21. A faculty entered marks of 6 students for 6 subjects in form of matrix. Later she realized that the order was incorrect(the rows and columns were interchanged). Write a C program to find the correct matrix of marks.

22. Write a C program to find factorial of a given number using Recursion.

23. Consider an array in following order:

    25, 33, 53, 65, 83, 87 and 92. Write a C program to search the value 83.

24. Write a C program to check if a given string is read the same both from the beginning as well as when read backwards.

25. Write a C program to store and display the student mark details for 3 students including name, department,subjects and respective marks using Structure.

26. Write a C program to input details(name, department,salary) for 3 employees into a file created and read the contents from the file to display all the details along with average salary of those employees on output terminal using suitable file handling functions.

    Create a scenario based on real time domain.

TOTAL HOURS :30

OUTCOMES:

- Students will write programs in C Language for lab experiments in this course and execute them.

CAC1123   LINUX & SHELL PROGRAMMING LAB   L   T   P   C

0   0   4   2

OBJECTIVES:

- The students will be implementing the concepts of UNIX experiments.
- Explained here to create simple to complex programs the course provides an overview of the Linux Operating System.

LIST OF PROGRAMS

1. 1. Execute 25 basic commands of UNIX.
2. Basics of functionality and modes of VI Editor.
3. Create a file called vegetables and add the contents as follows
   - Brinjal
   - Carrot
   - Onion
   - Potato
   - Tomato

   Create one more file called Fruits and add the contents as follows
   - Apple
   - Banana
   - Cherry
   - Kiwi
   - Peach
a. Display the contents of the vegetables file on screen
b. Concatenate vegetables and fruits file and display the result
c. Show the difference between fruits and Vegetables
d. Add the content in the Fruits file as Mango, Grape

4. Create a directory called foods
   a) Move **vegetables and fruits to foods directory**
   b) Remove **vegetables** files from **foods**
   c) Comes out from foods
   d) List all the files from this directory
   e) Display all hidden files from the directory

5. Display the detailed result for the below

    a. Get manual help and display the detailed information about bash

    b. Display the time to be taken for executing a file

    c. Change the mode of a fruits file to Read only to all users

    d. Count the number of words in vegetables file.

    e. Count the Number of Characters in Fruits file.

6. Create a file called marklist and add the following data

SNo	Name	Subject	Marks
1.	ABCD	Physics	100
2.	XYZ	Chemistry	90
3.	MNO	Biology	88
4.	EFG	Computer	88

    a. Print the 3rd and 4th column on the screen alone

    b. Print a row which has 'r' character

    c. Print all columns

    d. Search **Computer** from the marklist file

    e. Replace 'i' to 'x' in the file marklist

    f. Remove a marklist from the directory

7. Create a file in vi editor and do the following

    a) Type 1-10 numbers and repeat it for two times using macros

    b) Find the current working directory inside vi editor

    c) Open two files horizontally

    d) Add line numbers

    e) Split the window

    f) Search all the occurrences of the word TEXT

8. Create a file in vi editor and do the following

    a) Insert a line in the beginning and end of line

    b) Yank the last line of the text and paste as first line.

    c) List all the files with detailed information from this directory inside vi editor

    d) Change all the occurrences of the word TEXT to UNIX

    e) Swap first and second paragraph

9. Disk related commands and communication commands in Unix

    a) Find the disk used space in your directory .

    b)Find disk free space in your directory with options.

    c) Send message to all users ,"To shutdown the System"

    d) Block other user from writing in your terminal

    e) Find the disk usage

10. Write a shell program to print all odd numbers between 10-30 .

11. Write a shell program that prompts user for a starting value and counts up from there and execute it.

12. Write a shell program to execute shell program which displays the menu and executes the option selected by user.

Menu

- who
- pwd
- ls –l
- who am i
- ls -a

13. Write a shell program to accept user name and reports if user log has logged in.

14. Create a data file called employee in the format given below:

a. EmpCode   Character

b. EmpName   Character

c. Grade   Character

d. Years of experience   Numeric

e. Basic Pay   Numeric

$vi employee

A001	ARJUN	E1	01	12000.00
A006	Anand	E1	01	12450.00
A010	Rajesh	E2	03	14500.00

A002   Mohan   E2   02   13000.00

A005   John   E2   01   14500.00

A009   Denial Smith E2   04   17500.00

A004   Williams   E1   01   12000.00

Perform the following functions on the file:

a. Sort the file on EmpCode.

b. Sort the file on

    (i) Decreasing order of basic pay

    (ii) Increasing order of years of experience.

c. Display the number of employees whose details are included in the file.

d. Display all records with 'smith' a part of employee name.

e. Display all records with EmpName starting with 'B'.

f. Display the records on Employees whose grade is E2 and have work experience of 2 to 5 years.

g.Store in 'file 1' the names of all employees whose basic pay is between 10000 and 15000.

h.Display records of all employees who are not in grade E2.

15. Create a scenario based on real time domain.

TOTAL HOURS –30

OUTCOMES:
- To use Linux desktop and GNU tool chain with Eclipse IDE.
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.

SEMESTER II

ENC1283   **GENERAL ENGLISH-II**   L   T   P   C

                                                 3   0   0   3

OBJECTIVES:

- To prepare students for Interviews and Group Discussions
- To train them in writing official letters, resume' writing and reports.
- To train them in analysing different genre of literature.

MODULE I   **7**

Filling Money Order Challan and Bank Challan

Short Story :G.K.Chesterton – The Hammer of God (Extensive Reading)

Essential English Grammar – 7-12 units

MODULE II   **8**

Brainstorming – Think, pair and share activity

Poetry **:** Walt Whitman- I Celebrate Myself

MODULE III   **8**

Dialogue Writing- Discussion etiquette -Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter)

Prose**:** Environment

MODULE IV   **8**

Interview skills- SWOT Analysis

Letter Writing- Letter to the Editor- Letter of Application and CV

MODULE V   **8**

Report Writing- feasibility report and survey report

Short Story : Katherine Mansfield—A Cup of Tea (Extensive Reading)

MODULE VI   **6**

Technical reports –Writing a technical report – format and content

TOTAL HOURS – 45

REFERENCES:

1. M. Ashraf Rizvi 'Effective Technical Communication". Tata McGraw – Hill Education, 2005. Gerson, Sharon & Steven M. Gerson, " Technical Writing : Process and Product"
2. Pearson Education, New Delhi, 2004. 6. Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
3. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad:
4. Macmillan Indian Ltd, 2006.
5. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford
6. University Press, 2002.
7. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge
8. University Press, 2009.
9. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Take part in group discussions and interviews with confidence.
- Write official letters, their application letter with CV and reports.
- Analyse various genre of literature.

MAC1288   **PROBABILITY AND STATISTICS**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic concepts of probability in solving application oriented problems
- To provide an understanding on the concepts of statistics

Recap Introduction to Probability (4)

Sample space - events - algebraic operations on events - definition of probability - Conditional probability - addition and multiplication theorems of probability – Baye's theorem.

MODULE I   RANDOM VARIABLES AND DISTRIBUTION (10+3) FUNCTIONS

Discrete and continuous random variables - distribution function and its properties - probability mass function and probability density function - discrete and continuous probability distributions - Binomial, Geometric, Poisson, Uniform, Exponential and Normal distributions.

MODULE II   MOMENTS AND MOMENT GENERATING (8+3) FUNCTIONS

Expectation of a random variable – probability generating function – properties - moment generating function.

MODULE III   TWO DIMENSIONAL RANDOM VARIABLES   (6+3)

Joint, marginal and conditional distribution functions - independence of random variables.

MODULE IV   DESCRIPTIVE STATISTICS   (8+3)

Types of data - primary and secondary data - classification and representation of data -formation of frequency distribution - various measures of central tendency, dispersion - and their merits and demerits - concept of skewness and kurtosis.

MODULE V   CORRELATION AND CURVE FITTING   (9+3)

Correlation coefficient and regression - rank correlation - curve fitting by least square methods - fitting a straight line, parabola, power curve and exponential curves. (no derivation, numerical problems only)

TOTAL HOURS – 60

TEXT BOOKS:

1. Richard Arnold Johnson, Irwin Miller, John E. Freund , Miller & Freund's

2. Probability and Statistics for Engineers, Prentice Hall, 2011.
3. Dr. P. Kandaswamy, Dr. K. Thilagavathy and Dr. K. Gunavathy, Probability and Queuing Theory, Revised edition, S. Chand Publishing, 2013.
4. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill, 2nd edition.

REFERENCES:

1. Goon, A.M., M. K. Gupta and B. Das Gupta Fundamentals of Statistics- Vol. I, World Press Ltd, Kolkata, 2002.
2. Gupta, S.C. and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
3. Hogg, R.V. and A. Craig, Introduction to Mathematical Statistics, McMillan Publishing co., Inc. 1978.
4. Mood A.M., F.A. Graybill and D.C. Boes, Introduction to Theory of Statistics McGraw Hill Book Co., 1974.
5. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Fourth Edition, Elsevier.

OUTCOMES:

On completion of the course the students will be able to
- solve basic problems in probability and fundamentals of statistics.
- solve problems using standard probability distributions.
- find the marginal and conditional distributions of two dimensional random
- variables.
- calculate rank correlation and fitting curves for the given data.
- use method of moments and moment generating functions.

CAC1221   INTRODUCTION TO DATA SCIENCE   L   T   P   C

3   1   0   4

OBJECTIVES:

- To understand the overview and definition of Data Science with its crucial role in current business world.
- To understand the importance of mathematics & Statistics in Data Science.
- To understand the role of machine learning techniques in Data Science and its different types.
- To know the integrated role of computers and its components in Data Science
- To understand the flow and process model of data science project management.

MODULE I   10

Data Science - An Overview

Introduction to Data Science, Definition and description of Data Science, history and development of Data Science, terminologies related with Data Science, basic framework and architecture, difference between Data Science and business analytics, importance of Data Science in today's business world, primary components of Data Science, users of Data Science and its hierarchy, overview of different Data Science techniques, challenges and opportunities in business analytics, different industrial application of Data Science techniques.

MODULE II   15

Mathematics and Statistics in Data Science

Role of mathematics in Data Science, importance of probability and statistics in Data Science, important types of statistical measures in Data Science : Descriptive, Predictive and prescriptive statistics, introduction to statistical inference and its usage in Data Science, application of statistical techniques in Data Science, overview of linear algebra : matrix and vector theory, role of linear algebra in Data Science, exploratory data analysis and visualization techniques, difference between exploratory and descriptive statistics, EDA and visualization as key component of Data Science.

MODULE III   15

Machine Learning in Data Science

Role of machine learning in Data Science, different types of machine learning techniques

and its broad scope in Data Science : Supervised, unsupervised, reinforcement and deep learning, difference between different machine learning techniques, brief introduction to machine learning algorithms, importance of machine learning in today's business, difference between machine learning classification and prediction.

MODULE IV   10

Computers in Data Science

Role of computer science in Data Science, various components of computer science being used for Data Science, role of relation data base systems in Data Science: SQL, NoSQL, role of data warehousing in Data Science, terms related with data warehousing techniques, importance of operating concepts and memory management, various freely available software tools used in Data Science : R, Python, important proprietary software tools, different business intelligence tools and its crucial role in Data Science project presentation.

MODULE V   10

Machine Learning in Data Science

Role of machine learning in Data Science, different types of machine learning techniques and its broad scope in Data Science : Supervised, unsupervised, reinforcement and deep learning, difference between different machine learning techniques, brief introduction to machine learning algorithms, importance of machine learning in today's business, difference between machine learning classification and prediction.

TOTAL HOURS – 60

TEXT BOOKS:

1. Data Smart: Using Data Science to Transform Information into Insight 1st Edition by John W. Foreman. (2015) Wiley Publication.
2. Data Science from Scratch: First Principles with Python 1st Edition by Joel Grus .

REFERENCES:

1. Data Science For Dummies by Lillian Pierson (2015)
2. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking by Foster Provost, Tom Fawcett

OUTCOMES:

- After completing this course, students will be able to appreciate the need of data science in day to day life.
- They will be able to understand the process and components of data science project.
- Student will the Learn importance of probability and statistics in data science
- Student will be able to understand the machine learning in today's business world.
- Understands the various components of computer science being used for data science
- Student will bale to understand the execution flow of a data science project

CAC1203	OOPS WITH C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The main objective is to learn the basic concept and techniques which form the object oriented programming paradigm.
- Object-oriented programming is a new way of thinking about problem using models organizes around real world concept.
- The Fundamental construct is the object which combines both data-structure and behaviour in a single entity which is in contrast to conventional programming in which data-structure and behaviour are loosely connected.

MODULE I   Introduction   9

Evolution of programming methodologies-Procedure oriented versus Object Oriented Programming-characteristics of OOP, Basics of OOP, Merits and Demerits of OOP. **Data Types:** Different data types, operators and expressions in C++, Keywords in C++. **Input and Output:** Comparison of stido.h and iostream.h, cin and cout. **Decision and loop:** Conditional statement - if-else statement, nested if-else statement, switch, break, continue, and goto statements, Looping statements- for loop, while loop, Do-while loop. **Arrays, String and Structures :**   fundamentals-Single dimensional, multi-dimensional arrays, fundamentals of strings, different methods to accept strings, different string manipulations, array of strings, Basics of structures-declaring and defining structure- Accessing structure members, array of structures, Unions difference between structures and Unions, Enumerated data types-declaration and their usage.

MODULE II   9

Class: Definition-defining the class, defining data members and member functions, Access specifier-private, public, protected, objects as function arguments, returning objects from the function, scope resolution operator, and member function defined outside the class, difference between class and structure, array as class member data, Array of objects. **Functions in C++ :** Function definition, function declaration, Built-in functions, user defined functions, calling the function, passing parameter-actual and formal, different methods of calling the function call by value, call by reference using reference as parameter and pointer as parameter, overload

function-different types of arguments-different number of arguments, inline function, default argument, storage classes-automatic, external, static, register. **Constructor and Destructor:** Constructors-constructor with argument, constructor without arguments, constructor with default arguments, Dynamic constructor, constructor overloading, copy constructor, destructors, Manipulating private data members.

MODULE III   9

Operator overloading: Defining operator overloading, overloading unary operator, overloading binary operator, manipulation of string using overloaded operator, rules for overloading operator.Data conversion: conversion between Basic types, conversion between objects & Basic types, conversion between objects of different classes. **Inheritance:** Base Class & derived class, defining derived classes, protected access specifier, public inheritance and private inheritance-member accessibility, constructors and destructors in derived classes, Level of inheritance-single inheritance, multiple inheritance, multi-level inheritance, hierarchical inheritance, hybrid inheritance.

MODULE IV   9

Pointer: Pointer declaration and Access, Pointer to void, pointer and arrays, pointer constant and pointer variable, pointer and functions, pointer, call by pointer arrays, array of pointers to string, printer sort, memory management-new and delete, pointer to object-referencing members using pointers, self-containing class, this pointer, returning values using this pointer. **Virtual function:** Normal member functions accessed with pointers, virtual member function access, late binding, pure virtual function, abstract class, virtual base class. **Friend functions and static function:** Purpose, defining friend functions, friend classes, static function, accessing static function numbering positive objects.

MODULE V   9

Templates and Exception Handling: Introduction to templates, class templates, function templates, Member function templates, Template arguments, Exception handling. **Console IO Operator:**C++ stream and C++ stream classes, unformatted I/O operators, formatted I/O operators-manipulators-user defined manipulators. **Files :** Class for file stream operators, opening and closing a file, file nodes, writing an object to disk, reading an object from disk, binary versus character files, I/O with multiple object, stream class, file pointer-specifying the position, specifying the

object, tellg() function, seekg() function. Command line arguments.

TOTAL HOURS – 45

TEXT BOOKS:

1. E. Balaguruswamy: Object Oriented Programming with C++, Tata McGraw Hill. Publications

2. Strousstrup: The C++ Programming Language, Pearson Edition, 3rd Edition

3. Lafore Robert: Object Oriented Programming in Turbo C++, Galgotia Publications

REFERENCES:

1. Lippman: C++ Primer, 3/e Pearson Education

2. C++ completer reference by Herbert Schildt, Tata McGraw Hill Publications.

3. Let us C++ by Yeshwanth Kanetkar

OUTCOMES:

- Students will learn how to write and execute programs using C++ Language.

- Student will be able to understand Merits and Demerits of OOP.

- Understands the concepts of arrays, strings & structure

- Will get to know the concepts of defining data members and member functions in a class

- Student will be able to understand the concepts of operator overloading

- Student can analyze the pointer declaration & addressing of variables.

CAC1204   DATA STRUCTURES USING C   **L   T   P   C**

3   0   0   3

OBJECTIVES:

* A data structure is a particular way of storing and organizing data in a computer so that it can be used efficiently.
* Different kinds of data structures are suited to different kinds of applications and some are highly specialized to specific tasks.
* This course covers the basic concepts of different data structures which are the basic building blocks of Programming and problem solving.

MODULE I   INTRODUCTION TO DATA STRUCTURES   9

Definition, Classification of data structures: primitive and non primitive, Elementary data organization, Time and space complexity of an algorithm (Examples), String processing.   Dynamic memory allocation and pointers: Definition of dynamic memory allocation, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Meaning of static and dynamic memory allocation, Memory allocation functions: malloc(), calloc(), free() and realloc(). Recursion: Definition, Recursion in C (advantages), Writing Recursive programs – Binomial coefficient, Fibonacci, GCD.

MODULE II   SEARCHING AND SORTING   9

Basic Search Techniques: Sequential search: Iterative and Recursive methods, Binary search: Iterative and Recursive methods, Comparison between sequential and binary search. Sort: General background and definition, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort

MODULE III   STACK AND QUEUE   9

Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks. Queue: Definition, Array representation of queue, Types of queue: Simple queue, Circular queue, Double ended queue (deque) , Priority queue , Operations on all types of Queues

MODULE IV   LINKED LIST   9

Definition, Components of linked list, Representation of linked list, Advantages

and Disadvantages of linked list. Types of linked list: Singly linked list, doubly linked list, Circular linked list, Operations on singly linked list: creation, insertion, deletion, search and display.

MODULE V   TREE GRAPHS AND THEIR APPLICATIONS: 9

Definition : Tree, Binary tree, Complete binary tree, Binary search tree, Heap Tree terminology: Root, Node, Degree of a node and tree, Terminal nodes, Non-terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node. Binary tree: Array representation of tree, Creation of binary tree. Traversal of Binary Tree: Preorder, Inorder and postorder. Graphs, Application of Graphs, Depth First search, Breadth First search.

TOTAL HOURS – 45

REFERENCES:

1. Weiss, Data Structures and Algorithm Analysis in C, II Edition, Pearson Education, 2001
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill
3. Robert Kruse Data Structures and program designing using 'C'
4. Trembley and Sorenson Data Structures
5. E. Balaguruswamy Programming in ANSI C.
6. Bandyopadhyay, Data Structures Using C Pearson Education, 1999
7. Tenenbaum, Data Structures Using C. Pearson Education, 200
8. Kamthane: Introduction to Data Structures in C. Pearson Education 2005.
9. Hanumanthappa M., Practical approach to Data Structures, Laxmi Publications, Fire Wall media 2006
10. Langsam, Ausenstein Maoshe & M. Tanenbaum Aaron   Data Structures using C and C++ Pearson Education

OUTCOMES:

* Students will benefit from the knowledge of Data Structures.
* Understands   the data structure different operating one can perform on these like searching, sorting, stacking.
* This forms a very strong foundation for programming in different languages that the students will take up in subsequent semesters or in any other course.

- Understand the concepts of Stack Queue.
- Student will able to analyze which sorting technique will be used.
- Student will get the knowledge of Tree Graphs and their Applications

CAC1222   **PROGRAMMING with C++ LAB**

L	T	P	C
0	0	4	2

OBJECTIVES:

The aim of the course is to

- Understand and solve logical & mathematical problems through C++ language

- Strengthen knowledge of a procedural programming language.

- Design and develop solutions to intermediate level problems

- Develop their skills in software development using a procedural language

- Get programming skill of object oriented technology with the usage of C++.

LIST OF PROGRAMS

1. Number of vowels and number of characters in a string.

2. Write a function called zeros maller () that is passed with two introduce arguments by reference and set the smaller of the number to zero. Write a man() program to access this function.

3. Demonstration of array of object.

4. Using this pointer to return a value (return by reference).

5. Pointer sort.

6. Demonstration of virtual function.

7. Demonstration of static function.

8. Accessing a particular record in a student's file.

9. Using different methods to write programs to implement function overloading with default arguments for the following problems :

a) To find whether a given number is prime.

b) To find the factorial of a number

10. Write a program to create a database for a bank account contains Name, Account no, Account type, Balance, Including the following a) Constructors b) destructors call) default constructors d) input and output function ; input and output for 10 people using different methods.

11. Create a class to hold information of a husband and another for the wife. Using friend functions give the total salary of the family.

12. Write a program to overload the following operators (any 3)

a) Binary operator '+' to concatenate 2 strings

b) Relational operator '<' to find whether one data is less than the other

c) Unary operator '++' to find the next date of a given date.

13. Create a base class for a stack and implement push and pop operation. Include a derived class to check for stack criteria such as a) stack empty b)stack full c) stack overflow d) stack underflow.

14. Create a database using concepts of files for a student including the following fields : Student- name, Student's Reg No, Student's Attendance (overall % of attendance); and enter data for 10 students and output the same in proper format.

15. Using operator overloading concept implement arithmetic manipulation on two complex numbers.

16. Create a scenario based on real time domain.

TOTAL HOURS –30

OUTCOMES:

After completion of this course, the students would be able to

- Create classes and objects in C++.

- Implement inheritance, polymorphism and object relationship in C++.

- Design methods and procedure.

- Manipulate data through file in C++.

- Trained to write programs to produce the desired result

CAC1223	DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the course is to:

- Understand the implementation of recursive functions and strings.

- Introduce the implementation of linked list and the various operations.

- Implement stack and queue using dynamic memory allocation.

- Introduce the Binary Search Tree implementation using C.

- Learn to implement various sorting and searching algorithms.

LIST OF PROGRAMS

1. Given with two numbers 36 and 60, write recursive function using C to find GCD of two numbers.

2. Write a recursive function using C program to display a series such that the sum of two consecutive numbers equals the next number in series. Let the first two numbers be 0 and 1.

3. Use a recursive function for the towers of Hanoi with three discs.

4. Two strings "Welcome" and "World" are provided. Write a program using pointers to find the length of a string and to concatenate the two strings.

5. String1 is stored with "Greater". Write a program using pointers to copy string1 to string2 and to extract "Great" from string2.

6. Consider an array in following order:

   25, 33, 53, 65, 83, 87 and 92. Write a C program to insert the value 88 and remove 65.

7. Write a C Program using dynamic variables and pointers, to construct a singly linked list consisting of the following information n each node: student id (integer), student name (character string) and semester (integer). The operations to be supported are:

   a. The insertion operation

      i. At the front of a list

      ii. At the back of the list

      iii. At any position in the list

b. Deleting a node based on student id. If the specified node is not present in the list an error message should be displayed. Both the options should be demonstrated.

c. Searching a node based on student id and updating the information content. If the specified node is not present in the list an error message should be displayed. Both situations should be displayed.

d. Displaying all the nodes in the list.

8. The heights of ten students were marked as 163cm, 171 cm, 158 cm, 167cm, 175cm, 160cm, 173 cm, 149 cm, 180cm and 154cm. Find the difference while sorting the given heights in ascending or descending order using

- Insertion sort
- Selection Sort
- Merge Sort

9. Write a C program to implement the following operations in stacks:

- Push

- Pop

- Display

10. Write a C program to implement the following operations in queue:

- o Insert

- o Delete

- o Display

11. Create a binary search tree and traversing it using in order,pre order and post order.

12. Create a scenario based on real time domain.

TOTAL HOURS –30

OUTCOMES:

- At the end of the course, the students will be able to:
- Design and implement programs using recursive functions and strings.
- Implement linear data structures like stack, queue and linked list.
- Develop programs to implement Binary Search Tree.
- Implement searching algorithms.
- Implement and compare various sorting algorithms.
- Sort N numbers using merge sort

CAC1256   **ENVIRONMENTAL STUDIES**   L   T   P   C

                                                        2   0   0   2

OBJECTIVES:

To impart knowledge on

- Various natural resources, availability, utilization and its current scenario.
- Different ecosystems, energy transfer.
- Values, threats and conservation of biodiversity.
- Levels of different pollutants and its impact and the causes and effects of natural disasters

MODULE I   NATURAL RESOURCES   **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, water conservation (rainwater harvesting and watershed management) - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II   ECOSYSTEM   **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

MODULE III   BIODIVERSITY AND ITS CONSERVATION   **8**

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity –bio geographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts -

conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE IV   ENVIRONMENTAL POLLUTION AND   NATURAL   6   DISASTER

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill).

Natural disaster and management: flood, cyclone, drought, landslide, earthquake and tsunami.

Case studies related to current situation.

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.
7. Rajah G, Basic Environmental Studies, Margham Publications, Chennai, 2016.

REFERENCE BOOKS:

1. Masters G.M. and **Wendell P.,** Introduction to Environmental Engineering and Science, **3rd** Edition, Prentice Hall, New Delhi, 2007.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

At the end of the course the student will be able to

- Predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- Identify food chain and web and its role in various ecosystems.
- Assess the impacts on biodiversity and provide solutions to conserve it.
- Analyze the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.

CAC1224	COMMUNICATION SKILLS	L	T	P	C
		3	0	0	0

OBJECTIVES:

- The objective of this course is to make students feel the significance of communicating well and how it can have a profound effect in both our professional and personal lives.
- Students will learn various aspects of managerial writing including report writing.
- Business writing like Quote creation, Business letters, Orders, Complains and etc. are also taught to students.

MODULE I   TECHNICAL VOCABULARY   **9**

Technical Vocabulary, Punctuation, Numerical Expressions, Expanding Acronyms and Abbreviations, Concord, 'If' clauses, Infinitives. Homonyms, Homographs and Homophones, Telephone conversations, Reading Comprehensions, Making of an advertisement.

MODULE II   BASIC SKILLS-READING AND SPEAKING SKILLS   **9**

Reading and interpretation, Intensive reading,. Writing reviews on books and films, Descriptions, Process description, Summarizing, Instructions, Oral presentations. Debate.

MODULE III   BASIC SKILL: TECHNICAL WRITING SKILL   **9**

Letters – formal, informal, Cover Letter and CV, Synonyms and Antonyms, Indefinite Adjectives, Non-verbal communication, Interactive sessions. Role Plays, Critical reading, Listening and Note taking.

MODULE IV   BASIC SKILL: LISTENING AND SPEAKING SKILLS   **9**

Active and Passive Voice, Impersonal Passive, Essay Writing, Comprehension Passage, Editing, Correction of errors, Direct and Indirect, Conversations , Dialogue writing, Discourse Markers. Group activities.

MODULE V   TECHNICAL WRITING AND COMMUNICATION   **9**

Reports – Types, structure, data collection, content, form, Definitions, extended definition, Recommendations, Memos, Checklists. Group Discussions, Listening and

comprehending the conversations.

TOTAL HOURS –45

TEXT BOOKS:

1. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. Department of Humanities and Social Sciences, Anna University, ''English for Engineers and Technologists'' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
3. M.Ashraf Rizvi, "Effective Technical Communication",Tata mcGraw-Hill Publishing Company Limited, New Delhi.2009.

REFERENCES:

1. Sumant. S, 'Technical English', Second Edition, McGraw-Hill Education (India) Pvt. Ltd., 2008.
2. Dr. M. Hariprasad," Communicative English "Third Edition, Neelkamal Publications, PVT. LTD.,2007.
3. Sangeeta Sharma , Binod Mishra, 'Communication Skills for Engineers and Scientists, PHI Learning Private Limited., New Delhi, 2009.

OUTCOMES:

- Students shall overcome their inhibitions and limitations in communication and become effective communicators.
- They will learn to compose letters in English error-free and communicate effectively with their peers, colleagues, managers and so on, via appropriate business communication forms.
- Student will able to understand the Basic skills-reading and speaking skills.
- Student will understand the concept of Basic skill: technical writing skill.
- Student will able understand Basic skill: listening and speaking skills.
- At the end of the semester students will be able to Technical writing and communication.

SEMESTER-III

CAC2101	REASONING AND THINKING	**L T P C**
		3 0 0 3

OBJECTIVES:

- It is the objective of the course to introduce to the students, concepts like Reasoning and thinking.
- which are very important for any individual in every aspect and walk of life
- To assists them in taking the right decisions, approach every problem with diligence and perform action accordingly.

MODULE I   VERBAL ABILITY   9

Synonyms, Antonyms and One word substitutes

MODULE II   BASIC QUANTITATIVE APTITUDE   9

Speed, Time and Distance, Time and Work, Linear Equations, Progressions (Sequences & Series), Permutation and Combination, Probability, Functions, Set Theory, Number Systems, LCM and HCF, Percentages, Collection and Scrutiny of data: Primary data, questionnaire and schedule; secondary data, their major sources including some government publications

MODULE III   LOGICAL REASONING - I   9

Number and Letter Series, Calendars, Clocks, Cubes, Venn Diagrams, Binary Logic, Seating Arrangement, Logical Sequence, Logical Matching, Logical Connectives, Syllogism. Blood Relations; concept of a statistical population and sample from a population; qualitative and quantitative data.

MODULE IV   MEASURES OF CENTRAL TENDENCY   9

Objective of averaging, characteristics of good average, types of average, arithmetic mean of grouped and ungrouped data, correcting incorrect values, weighted arithmetic mean

Median - median of grouped and ungrouped data merit and limitation of median, computation of quartile, decile and percentileMode - calculation of mode of grouped and ungrouped data, merits and limitation of mode, relationship between mean, median and mode. Geometric mean and Harmonic mean.

MODULE V   PRESENTATION OF DATA   9

Construction of tables with one or more factors of classification; Diagrammatic and Graphical representation of non-frequency data; Frequency distribution, cumulative frequency distribution and their graphical representation - histogram, Column Graphs, Bar Graphs, Line Charts, Pie Chart, Data Interpretation – Introduction and approach

TOTAL HOURS =45

TEXT BOOKS:

1. Bajpai, N. Business Statistics, Pearson, 2010
2. Sharma J.K., Business Statistics, Pearson Education India, 2010.
3. Richard I Levin, David S. Rubin: Statistics for Management, Pearson Prentice Hall Education Inc. Ltd, NewDelhi, 5th Ed.

REFERENCES:

1. Anderson; David R, Dennis J. Sweeney and Thomas A. Williams, Quantitative Methods for Business, Prentice-Hall, WestPublishing Company, 1996.
2. CAT Complete course, UPKAR publications

OUTCOMES:

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

- Understand Verbal ability activities and concepts
- Participate in solving questions in aptitude
- Solve logical reasoning questions.

CAC2121   **DATABASE MANAGEMENT SYSTEMS**   **L T P C**

3 0 0 3

OBJECTIVES:

The aim of the course is to

- Provide an introduction to the management of database systems.
- Understand the fundamentals of relational systems including data models, database architectures, and database manipulations.
- Provide knowledge about relational database model.
- Learn the basic concepts of databases in general with an emphasis on relational databases, modeling techniques and writing queries.
- Understand Normalization techniques, Transaction processing, Concurrency Control techniques and Recovery of databases against crashes are also covered.

MODULE I   INTRODUCTION   9

Purpose of Database System -– Views of data – Data Models – Database Languages —– Database System Architecture – Database users and Administrator – Entity– Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases

MODULE II   RELATIONAL MODEL   9

The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals, Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables, Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL. Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause,

MODULE III   SQL VIEWS, INDEX AND TRIGGERS   9

Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User, Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL-

Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases

MODULE IV   DATABASE DESIGN   9

Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

MODULE V   TRANSACTIONS   9

Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery –Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.

TOTAL HOURS =45

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Fifth Edition, Tata McGraw Hill,2006
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson/Addision Wesley.2007
3. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill.2003

REFERENCES:

1. S. Sumathi, S. Esakkirajan, "Fundamentals of Relational Database Management Systems", Springer Science & Business Media.
2. N. P. Singh, C.S. Gupta, "Relational Database Management Systems", Abhishek Publications, 15-May-2014

OUTCOMES:

The student will be able to:

- Write queries, transactions and different modelling techniques in a relational database.
- Normalize data and know its techniques.
- Find the familiarity with relational database model.
- Understand fundamentals of relational systems including data models.

CAC2105 **COMPUTER NETWORKS** **L T P C**
                                     3 0 0 3

OBJECTIVES:

This course provides a comprehensive introduction to

- Basics of networking and networking technology
- Networking and its underlying principles.
- Fundamentals of layered models, devices used in networks and their wireless connectivity.
- The ways to troubleshoot network related issues.
- Protocols, standards and the models associated with networking technology and their troubleshooting mechanisms.

MODULE I   NETWORKING FUNDAMENTALS   9

Basics of Network & Networking, Advantages of Networking, Types of Networks, Network Terms- Host, Workstations, Server, Client, Node, Types of Network Architecture- Peer-to-Peer & Client/Server, Workgroup Vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling- straight through cable, crossover cable, rollover cable, media connectors (Fiber optic, Coaxial, and TP etc.) Introduction of OSI model, Seven layers of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, TCP, UDP, IP, ICMP, ARP/RARP, Comparison between OSI model & TCP/IP model. Overview of Ethernet Addresses

MODULE II   BASICS OF NETWORK DEVICES   9

Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, and modem, Data Link Layer: Ethernet, Ethernet standards, Ethernet Components,Point-to-Point Protocol(PPP),PPP standards, Address Resolution Protocol, Message format, transactions, Wireless Networking: Wireless Technology, Benefits of Wireless Technology, Types of Wireless Networks: Ad-hoc mode, Infrastructure mode, Wireless network Components: Wireless Access Points, Wireless NICs, wireless LAN standards: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, wireless LAN

modulation techniques, wireless security Protocols: WEP,WPA, 802.1X, Installing a wireless LAN

MODULE III   BASICS OF NETWORK, TRANSPORT AND APPLICATION   9
**   LAYERS**

Network Layer: Internet Protocol (IP), IP standards, versions, functions, IPv4 addressing, IPv4 address Classes, IPv4 address types, Subnet Mask, Default Gateway, Public & Private IP Address, methods of assigning IP address, IPv6 address, types, assignment, Data encapsulation, The IPv4 Datagram Format, The IPv6 Datagram Format, Internet Control Message Protocol (ICMP), ICMPv4, ICMPv6, Internet Group Management Protocol (IGMP),Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer: DHCP, DNS, HTTP/HTTPS, FTP, TFTP, SFTP, Telnet, Email: SMTP, POP3/IMAP, NTP

MODULE IV   WAN TECHNOLOGY   9

What Is a WAN?, WAN Switching, WAN Switching techniques Circuit Switching, Packet Switching etc., Connecting to the Internet : PSTN, ISDN, DSL, CATV, Satellite-Based Services, Last Mile Fiber, Cellular Technologies, Connecting LANs : Leased Lines, SONET/SDH, Packet Switching, Remote Access: Dial-up Remote Access, Virtual Private Networking, SSL VPN, Remote Terminal Emulation, Network security: Authentication and Authorization, Tunneling and Encryption Protocols, IPSec, SSL and TLS, Firewall, Other Security Appliances, Security Threats

MODULE V   NETWORK   OPERATING   SYSTEMS   AND   9
**   TROUBLESHOOTING NETWORK**

Network Operating Systems: Microsoft Operating Systems, Novell NetWare, UNIX and Linux Operating Systems, Macintosh Networking, Trouble Shooting Networks: Command-Line interface Tools, Network and Internet Troubleshooting, Basic Network Troubleshooting : Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.

TOTAL HOURS =45

TEXT BOOKS:

1. CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011
2. CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013.

REFERENCES :

1. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008

2. CCNA Exploration Course Booklet : Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010

OUTCOMES:

The student will be able to:

- Develop knowledge and skills required to take up vendor certifications in the networking domain.
- Understand how communication works in data networks
- Learn the role of protocols in networking.
- Analyze the services and features of the various layers of data networks

CAC2122   LINEAR ALGEBRA

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand the basic concepts of vector spaces and matrices
- To understand the inverse of matrix and its application in data science
- To understand the system of linear equation and its representation in business studies
- To understand the importance of Eigen values and Eigen Vectors in dimension reduction techniques.
- To understand the basic concepts in application of tree in data science.

MODULE I   **9**

Introduction to Linear Algebra, Field Theory: Characteristic of a field, Subfield and prime field, Extension of fields, Finite and infinite extensions, Algebraic element,

MODULE II   **9**

Minimal polynomial of an algebraic element, Algebraic and transcendental extensions, Splitting fields, Multiple roots, Separable and inseparable extensions, Finite fields, Galois theory, Mono-morphisms and their linear independence, Normal extensions, Fundamental theorem of Galois theory.

MODULE III   **9**

Vector Spaces: Vector spaces, Subspaces, Quotient spaces, Linear dependence, Basis, Dimension, Algebra of linear transformations, Matrix representation of linear transformations, Change of basis.

MODULE IV   **9**

Canonical Forms: Linear transformations and their characteristic roots and vectors, Minimal polynomial of a linear transformation, Geometric and algebraic multiplicity, Singular and non-singular transformations,

MODULE V   **9**

Minimal polynomial of a vector relative to a linear transformation, Triangular form, Jordan canonical form. Applications of Linear Algebra in data science.

TEXT BOOKS:

1. Linear Algebra concepts and methods – Martin Anthony, Michele Harvey, Cambridge University Press

2. Singh, Surjeet and ZameeruddinQazi, Modern Algebra, Vikas Publishing House, (2006).

3. Hoffmann, K. and Kunze R., Linear algebra, PHI, (2011).

REFERENCES:

1. Bhattacharya, P.B., Jain, S.K. and Nagpaul, S.R. Basic Abstract Algebra, Cambridge University Press (1997).

2. Luthar, I.S., and Passi, I.B.S., Algebra (Vol. 4), Narosa Publishing House (2004).

OUTCOMES:

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

- Put a matrix into reduced row echelon form using row operations
- Recognize consistent and inconsistent systems of equations by the row echelon form of the augmented matrix
- Understand the importance of Eigen values and Eigen vectors in data dimension reduction techniques.
- Understand the application of cosine projection in producing the non-correlated variables.
- Apply graph theory in data mining techniques.
- Understand tree structures and its importance in data science.

CAC2123   SCIENTIFIC PROGRAMMING USING R

L	T	P	C
3	0	0	3

OBJECTIVES:

The student will be able to:

- Understand the R programming environment and data important R Statistical Packages.
- Know functions writing in R and important points in Comments and commands.
- Understand the important programming concepts of R, class and objects.
- Work with basic R commands, packages, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code.

MODULE I   9

Introduction to scientific programming, R basics, code editors for R, finding help, control structures, conditional executions, loops.

MODULE II   9

Functions in R, useful utilities, debugging utility, regular expressions, interpreting character string as expression, time-date-sleep, calling external software with system commands, running R commands.

MODULE III   9

Object oriented programming in R, define class and objects in R, assign generics and methods.

MODULE IV   9

Packages in R, installation process of various packages in R, data science packages in R, Building R packages.

MODULE V **9**

Comparison of R with other scientific programming software, implementation of various industry use cases of scientific programming using R.

TEXT BOOKS:

1. Mark Gardener, Beginning R: The Statistical Programming Language (2013).
2. Roger Peng R Programming for Data Science (2016)

REFERENCES:

3. Grolemund, Garrett, Hands-On Programming with R (2014)
4. Garrett Wickham, Garrett Grolemund, R for Data Science (2017)

OUTCOMES:

Upon completion of the course, students will be able to

- Know how to install R packages and invoking the same for data analysis.
- Program in R and how to use R for effective data analysis.
- Know the important statistical packages for data analytics.
- Know the data management like importing different data types and exporting the same into different file format.
- Understand the environment and describe generic programming language concepts as they are implemented in a high-level statistical language.
- Implement various concepts learnt in earlier courses like statistics and probability, linear algebra etc.

CAC2124   DATABASE MANAGEMENT SYSTEMS LAB   **L T P C**

                                                    0 0 4 2

OBJECTIVES:

The Students will be able to:

- Provide practical experience to students and reinforce the theory concepts.

LIST OF PROGRAMS:

1. Create User in Oracle Database and grant and revoke the privileges
   and use of commit save point rollback command.

2. Create the following:
- Synonym sequences and Index
- Create alter and update views.

3. Create PL/SQL program using cursors, control structure, exception
   handling

4. Create following:
- Simple Triggers
- Package using procedures and functions.

5. Create the table for
- COMPANY database
- STUDENT database and Insert five records for each attribute.

6. Illustrate the use of SELECT statement

7. Conditional retrieval - WHERE clause

8. Query sorted - ORDER BY clause

9. Perform following:
- UNION, INTERSECTION and MINUS operations on tables.
- UPDATE, ALTER, DELETE, DROP operations on tables

10. Query multiple tables using JOIN operation.

11. Grouping the result of query - GROUP BY clause and HAVING clause

12. Query multiple tables using NATURAL and OUTER JOIN operation.

13. Create a scenario based on real time domain

OUTCOMES:

- Students will work on the tasks provided to them in the form of experiments and write programs to produce the desired result.

CAC2125   SCIENTIFIC PROGRAMMING USING R Lab

L	T	P	C
0	0	4	2

OBJECTIVES:

The Aim of the course is to:

- Provide students a hands-on exposure to scientific programming using R.
- Provide wider knowledge to know about data structures in R and its types.
- Know about the statistical modeling with real time data.
- Know the customized graphical techniques in R using inbuilt graph packages.

LIST OF PROGRAMS:

1. Install and configure R, set working directory.
2. Implement basic R operations (data input, missing values, importing data into R)
3. Use R as a calculator
4. Explore various functionalities of dataframes
5. Explore various functionalities of plots
6. Formal data exploration in R
7. Data summary in R
8. Sampling distribution and central limit theorem in R
9. Linear regression model in R
10. Data visualization using ggplots in R.
11. Create a scenario based on real time domain

Case Study - 1
Scientific Programming using R Lab

The air pollution is one of the main causes of serious respiratory problem in the world especially difficulty in breathing in asthmatic patients. Several cities are on the radar of WHO (World Health Organization), which are about to touch the dangerous level. Sadly, India is one of the countries with maximum number of most polluted cities in the world.

Especially, on the onset of Diwali, the air quality index of Chennai soars to new heights. This year the air quality index has already crossed last year's post Diwali index.

To know the intricacies of the problem, we decided to do an analytical study for the factors that contribute most to air pollution in Chennai.

In this article, we share a case study on "Identifying Patterns in Chennai's Air Pollution", in which we closely studied the air quality data for Chennai, identified patterns, factors that lead to rise in air pollution across three key locations in Chennai.

On this occasion of Diwali, we want to sensitize the readers towards celebrating environmentally safe Diwali this year.

The rate at which urban air pollution has grown across India is alarming. A vast majority of cities are caught in the toxic web as air quality fails to meet health-based standards. Almost all cities are reeling under severe particulate pollution while newer pollutants like oxides of nitrogen and air toxics have begun to add to the public health challenge.

According to WHO, India ranks among the world's most polluted countries. Out of the 20 most polluted cities in the world, 13 are in India. In which, Chennai is the one among the most polluted city in India today.

Exposure to particulate matter for a long time can lead to respiratory and cardiovascular diseases such as asthma, bronchitis, lung cancer and heart attack. Last year, the Global Burden of Disease study pinned outdoor air pollution as the fifth largest killer in India, after high blood pressure, indoor air pollution, tobacco smoking, and poor nutrition. In 2010, about 620,000 early deaths in India occurred from air pollution-related diseases. The Central Pollution Control Board (CPCB) sponsored the study that links the pollutants, pm 10 (particulate matter smaller than 10 microns), the cause of these diseases. The central regulatory authority recently regulated stricter norms for a number of air toxins and pollutants but omitted revision of the standard for pm 10.

We feel, if we closely study the Air Quality Data, we should be able to identify patterns (spike in air pollution levels) and identify correlating factors on key levels of Air Pollution across Chennai. Also as part of the exercise, we wanted to study the impact of Government sponsored Initiatives like 'Odd-Even' Pilot Project Phase II. The Phase I of the 'Odd- Even' experiment was a huge success in terms of people compliance and reduction of traffic congestion, it had very little impact on the Air Pollution levels during the Campaign period.

It is also important to understand the behaviour of meteorological parameters in the planetary boundary layer because, atmosphere is the medium in which air pollutants are transported away from the source, which is governed by the meteorological parameters such as atmospheric wind speed, wind direction, and temperature.

Air pollutants are being let out into the atmosphere from a variety of sources, and the concentration of pollutants in the ambient air depends not only on the quantities that are emitted but also the ability of the atmosphere, either to absorb or disperse these pollutants.

There were conflicting reports in media on the actual cause of air pollution in Chennai. Some sections claimed vehicles as the main source of pollution, while others held road dust & construction debris responsible. But the root cause of the problem is Industrial pollution.

Through this study, we hope to develop some insights that can help organizations (State / Central Pollution Control Boards & NGOs) to advocate more stringent policies to control air pollution.

- Study Air Pollution Data for various locations in Chennai to identify patterns of spike in Air Pollution levels w.r.t to various monitored parameters
- Identify the Meteorological factors that correlate with the air pollution levels for the respective locations using R Functions
- Explore the possibility of developing a Predictive Model for predicting the levels for key pollutants like PM 5 using suitable R predictive model.
- Explore the factors which most impact on air pollution PM 5 using R PCA analysis and Factor Analysis.

Case Study - 2
Scientific Programming using R Lab

High concentrations of certain harmful algae in rivers constitute a serious ecological problem with a strong impact not only on river life forms, but also on water quality. Being able to monitor and perform an early forecast of algae blooms is essential to improving the quality of rivers.

With the goal of addressing this prediction problem, several water samples were collected in different European rivers at different times during a period of approximately 1 year. For each water sample, different chemical properties were measured as well as the frequency of occurrence of seven harmful algae. Some other characteristics of the water collection process were also stored, such as the season of the year, the river size, and the river speed.

One of the main motivations behind this application lies in the fact that chemical monitoring is cheap and easily automated, while the biological analysis of the samples to identify the algae that are present in the water involves microscopic examination, requires trained manpower, and is therefore both expensive and slow. As such, obtaining models that are able to accurately predict the algae frequencies based on chemical properties would facilitate the creation of cheap and automated systems for monitoring harmful algae blooms.

Another objective of this study is to provide a better understanding of the factors influencing the algae frequencies. Namely, we want to understand how these frequencies are related to certain chemical attributes of water samples as well as other characteristics of the samples (like season of the year, type of river, etc.).

The data available for this problem was collected in the context of the ERUDIT1 research Network and used in the COIL 1999 international data analysis competition. It is available from several sources, such as in the UCI Machine Learning Repository of data sets.2 There are two main datasets for this problem. The first consists of data for 200 water samples. To be more precise, each observation in the available datasets is in effect an aggregation of several water samples collected from the same river over a period of 3 months, during the same season of the year. Each

observation contains information on 11 variables. Three of these variables are nominal and describe the season of the year when the water samples to be aggregated were collected, as well as the size and speed of the river in question. The eight remaining variables are values of different chemical parameters measured in the water samples forming the aggregation.

Exercise:

1. Load the Data into R
2. Visualize and summarize data and interpret
3. Find Data normality assumptions
4. Remove the Observations with Unknown Values
5. Fill in the Unknowns with the Most Frequent Values
6. Fill in the Unknown Values by Exploring Correlations
7. Fill in the Unknown Values by Exploring Similarities between Cases

OUTCOMES:

After completing this lab, students will be able to:

- Work on R, use its features in the field of data science.
- Understand the statistical model building and post testing.
- Understand the graphical techniques in R.

SEMESTER-IV

CAC2221	INFERENTIAL STATISTICS	L T P C
		3 0 0 3

OBJECTIVES:

- To understand the basic concepts of statistical inference and different estimation methods.
- To understand testing of hypothesis with important terminologies related with testing of hypothesis.
- To know the difference between large and small sample test.
- To know about the non-parametric testing procedures.

MODULE I 9

Introduction to Statistical Inference, Estimation of Parameters, Point estimation, Properties of a good estimate, Methods of estimation: Maximum Likelihood method, Interval estimation: Confidence Interval for mean, variance and proportion.

MODULE II 9

Testing of hypothesis: Introduction, Type I and Type II error, Null hypothesis and Alternative hypothesis, Simple and Composite hypothesis, Critical Region of the test, Significance level of the test, Power of the test, p value, Procedure for a statistical test.

MODULE III 9

Large Sample test: Test for specified mean, test for equality of means, test for a specified proportion, and test for equality of proportions (Derivations not required).

MODULE IV 9

Small sample Test: Test for specified mean, test for equality of means, Paired t test, test for specified variance, and test for equality of variances (Derivations not required).

MODULE V 9

Chi Square Test: Goodness of fit, test for independence, test of homogeneity,

Analysis of Variance: Introduction, one way classification, two-way classification. (Derivations not required).

TEXT BOOKS:

1. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan, Chand & Sons.

2. S.P. Gupta: Statistical Methods, Sultan, Chand & Sons.

3. Rao C R (1985) Linear Statistical Inference and its Applications (2nd edition), Wiley Eastern Limited.

REFERENCES:

1. Miller and Freund: Probability and Statistics for Engineers, Pearson Education.

2. B.L. Agarwal: Basic Statistics, New Age International (P) Ltd.

3. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers.

OUTCOMES:

- After completing this course, students will be able to:

- Implement the concepts of inferential statistics in real world scenarios.

- They will be able to apply hypothesis testing

- Implement various statistical tools to test the homogeneity and independence.

- Student will able to understand the Testing of hypothesis.

- Student will able to analyze test for equality of variances.

CAC2222   **NOSQL DATABASES**   **L   T   P   C**

                                                             3   0   0   3

OBJECTIVES:

The course is aimed at:

- Provide students an exposure to unstructured data.
- Work with query unstructured database.

MODULE I: INTRODUCING NOSQL   **9**

The value of Relational Databases, Disadvantages of Relational Databases, A Brief History of NoSQL, Features of NoSQL : Features of NoSQL, ACID vs. BASE, Managing Different Data Types

MODULE II: DATA MODELS   **9**

Aggregates, key-value and document data models, Column-Family Stores, relationships, graph databases, schema-less databases, materialized views. Distribution models: Single Server, sharding, master-slave replication, peer-peer replication, sharding and replication

MODULE III: UPDATE AND READ CONSISTENCY   **9**

Update Consistency, Read Consistency. Relaxing Consistency: Relaxing Consistency, Relaxing Durability

MODULE IV: NOSQLDATABASES   **9**

Key-Value Databases, Document Databases, Column-Family Stores

MODULE V: GRAPH DATABASES   **9**

Graph Databases, Beyond NoSQL.

TEXT BOOKS:

1. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence",Copyright © 2013 Pearson Education, Inc. 2012.
2. NoSQL For Dummies®, 2015 by John Wiley & Sons, Inc
3. Professional NoSQL, Shashank Tiwari, Wrox
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

REFERENCES:

1. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
2. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
3. "MongoDB: The Definitive Guide" by Kristina Chodorow

OUTCOMES:

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

- Identify the use of unstructured data.
- Know the knowledge of features of NO SQl Data Base.
- Know the Key-Value Databases, Document Databases.
- Learn various concepts of Graph Databases   .
- Analyze the advantage & disadvantages of Relational database .

CAC2223	**BIG DATA ANALYTICS**	L T P C
		3 0 0 3

OBJECTIVES:

This course aimed to:

- Introduce the concepts of big data analytics to the students.
- Introduces the big data framework, its characteristics and use cases associated with it.
- A concise introduction to Hadoop framework will prepare students to handle industry scenarios of big data analytics.

MODULE I

Introduction to Big Data, Characteristics and its Use Case   **9**

Introduction – Why Big data - What is big data – Facts about Big Data - importance of Big Data Evaluation of Big Data – Market Trends – Sources of Data Explosion – Types of Data – Case Study for Netflix and the house of card. Need of Big Data – Big Data and its sources – Characteristics of Big Data – Difference between Traditional IT Approach and Big Data Technology – Capabilities of Big Data – Handling Limitations of Big Data - Technologies Supporting Big Data - Big Data Use Cases.

MODULE II

Introduction to Hadoop   **9**

Introduction – Why Hadoop – What is Hadoop – History and Milestone of Hadoop – Core Components of Hadoop – Difference between Regular File System and HDFS – Common Hadoop Shell Commands – Hadoop Configuration.

MODULE III

Hadoop Distributed File System (HDFS)   **9**

Concepts and Architecture - Data Flow (File Read, File Write) - Fault Tolerance - Java Base API - Different Daemons in Hadoop cluster (NameNode, Secondary NameNode, Job Tracker, Task Tracker and DataNode) - Loading a dataset into the HDFS.

MODULE IV

Introduction to YARN and MapReduce   **9**

What is YARN – YARN Infrastructure - Introduction of MapReduce – Analogy of MapReduce – MapReduce Architecture - Example of MapReduce –Sorting, Shuffling – Reducing – Combiner – Partitioner – Creating MapReduce program by using Eclipse.

MODULE V

Introduction to Big Data Streaming   **9**

Real time Big Data Streaming, Big data streaming framework, data streaming process, tools for big data streaming, industry use cases for big data streaming.

TEXT BOOKS:

1. Seema Acharya (Author), Subhashini Chellappan, Big Data and Analytics (2015). Wiley Publication.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data (2015), EMC Education Services

REFERENCES:

1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization (2016), DT Editorial Services
2. Tom White, Hadoop: The Definitive Guide, 4th Edition (2015)

OUTCOMES:

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

- Understand the characteristics of big data.
- Explore Hadoop framework and its components.
- Use HDFS and Map Reduce to analyze various industry use cases of big data analytics.
- Understand the YARN Infrastructure.
- Learning different Sorting, Shuffling.

CAC2224	CLOUD COMPUTING	L T P C
		3 1 0 4

OBJECTIVES:

- Cloud computing is a colloquial expression used to describe a variety of different computing concepts that involve a large number of computers involves a large number of computers that are connected through a real-time communication network.

- In science, cloud computing is a synonym for distributed computing over a network and means the ability to run a program on many connected computers at the same time.

- This course covers basic concepts of cloud types, services and security etc.

MODULE I: Introduction   9

Introduction to Cloud Computing, History and Evolution of Cloud Computing, Types of clouds, Private Public and hybrid clouds, Cloud Computing architecture, Cloud computing infrastructure, Merits of Cloud computing, , Cloud computing delivery models and services (IaaS, PaaS, SaaS), obstacles for cloud technology, Cloud vulnerabilities, Cloud challenges, Practical applications of cloud computing.

MODULE II: Cloud Computing Companies and Migrating to Cloud   9

Web-based business services, Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies

MODULE III: Cloud Cost Management and Selection of Cloud Provider   9

Assessing the Cloud: software Evaluation, System Testing, Seasonal or peak loading, Cost cutting and cost-benefit analysis, selecting the right scalable application. Considerations for selecting cloud solution. Understanding Best Practices used in selection of Cloud service and providers, Clouding the Standards

and Best Practices Issue: Interoperability, Portability, Integration, Security, Standards Organizations and Groups associated with Cloud Computing, Commercial and Business Consideration

MODULE IV: Governance in the Cloud   9

Industry Standards Organizations and Groups associated with Cloud Computing, Need for IT governance in cloud computing, Cloud Governance Solution: Access Controls, Financial Controls, Key Management and Encryption, Logging and Auditing, API integration. Legal Issues: Data Privacy and Security Issues, Cloud Contracting models, Jurisdictional Issues Raised by Virtualization and Data Location, Legal issues in Commercial and Business Considerations

MODULE V: Ten cloud do an do nots   9

Don't be reactive, do consider the cloud a financial issue, don't go alone, do think about your architecture, don't neglect governance, don't forget about business purpose, do make security the centerpiece of your strategy, don't apply the cloud to everything, don't forget about Service Management, do start with a pilot project.

TEXT BOOKS:

1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski,, John Wiley and Sons Publications, 2011

REFERENCES:

1. Brief Guide to Cloud Computing, Christopher Barnett, Constable & Robinson Limited, 2010
2. Handbook on Cloud Computing, Borivoje Furht, Armando Escalante, Springer, 2010

OUTCOMES:

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

- Learn the underlying principles of Cloud Technology and various types of cloud computing architecture and types.

- Evaluate between different cloud solutions offered by various providers based on their merits and demerits.

- Understand the Cloud Cost Management and Selection of Cloud Provider.

- Understand the IT governance in cloud computing.

- Track the Ten cloud do an do nots.:

LIST OF PROGRAMS: 15

Study the basic cloud architecture and represent it using a case study

1. Enlist Major difference between SAAS PAAS & Iaas also submit a research done on various companies in cloud business and the corresponding services provided by them , tag them under SAAS , Paas & Iaas.

2. Study and present a report on Jolly cloud.

3. Present a report on obstacles and vulnerabilities in cloud computing on generic level

4. Present a report on Amazon cloud services.

5. Present a report on Microsoft cloud services.

6. Present a report on cost management on cloud

7. Enlist and explain legal issues involved in the cloud with the lelp of a case study

8. Explain the process of migrating to cloud with a case study.

9. Present a report on google cloud and cloud services

10. Create a scenario based on real time domain

CAC2225   **EXPLORATORY DATA ANALYSIS**   **L   T   P   C**
                                                                       3   1   0   4

OBJECTIVES:

This course is aimed to:

- Understand difference between EDA and summary statistics in context of interpretation.
- Understand the importance of data pre-processing for Exploratory Data Analysis.
- Understand the significance of missing value imputations in better EDA interpretations.
- Understand the importance measure of central tendency in describing the quick view of data set.
- Understand the importance of measure of dispersion and its interpretation in spread ness of data.

MODULE I   **9**

Introduction to Exploratory Data Analysis, Difference between classic data analysis and exploratory data analysis, difference between summary analysis and data exploratory analysis.

MODULE II   **9**

Basic EDA assumptions, importance of underlying assumptions, techniques for testing assumptions, interpretation of 4-Plot, consequences of non-randomness, non-fixed parameters like location and variation parameters, consequences related to distributional assumptions.

MODULE III   **9**

EDA techniques, analysis questions, graphical techniques, auto correlation plot for random data, moderate correlation, strong and autoregressive correlation, sinusoidal correlation, Various Plot.

MODULE IV   9

Graphical techniques for EDA, Quantitative techniques, ANOVA, Bartlett's test, probability distributions, family of probability distribution, location and scale parameters, estimation of parameters, various distributions.

MODULE V   9

EDA case studies – Random distribution, Random walk, standard resistor, Heat flow meter.

LIST OF PROGRAMS:

1. Explore and implement interpretation of 4-Plot,
2. Explore and comment on consequences of non-randomness, non-fixed parameters like location and variation parameters, consequences related to distributional assumptions.
3. Explore and implement various parameters of summary analysis in a given business scenario.
4. Explore and implement EDA techniques of analysis questions in a given business scenario
5. Explore and implement EDA graphical techniques in a given business scenario
6. Explore and implement EDA technique of auto correlation plot for random data in a given business scenario
7. Explore and implement EDA technique of moderate correlation in a given business scenario
8. Explore and implement EDA technique of strong and autoregressive correlation in a given business scenario
9. Explore and implement EDA technique of sinusoidal correlation in a given business scenario
10. Explore and implement ANOVA in a given business scenario.
11. Create a scenario based on real time domain

TEXT BOOKS:

1. Exploratory Data Analysis by John W. Tukey (1977) – 2016 Reprint.
2. Exploratory Data Analysis with R by Roger Peng (2016).

REFERENCES:

1. Think Stats: Exploratory Data Analysis (2nd edition) by Allen B. Downey (2014)

OUTCOMES:

After completing this course, students will be able to:

- Do exploratory data analysis on a given dataset, they will be able to implement various probability distributions,
- Do autocorrelation and ANOVA.
- Understand the EDA techniques & different kinds of techniques for testing.
- Understands the EDA case studies.

CAC2226	**INFERENTIAL STATISTICS LAB**	**L T P C**
		0 0 4 2

OBJECTIVES:

This lab is aimed at:

- Provide students a hands-on exposure to the concepts of inferential statistics.
- To calculate the parameters using different estimation techniques.
- To form null and alternative hypothesis based on problem situation.
- To use ChiSquare test for goodness fit.
- To calculate Z and t test for large and small sample testing procedure.

LIST OF PROGRAMS:

1. Estimation of Parameters, Point estimation for a given dataset using R.
2. Implement Maximum Likelihood method using R.
3. Find Confidence Interval for mean, variance and proportion for a given dataset using R.
4. Implement Null hypothesis and Alternative hypothesis using R.
5. Implement Simple and Composite hypothesis using R.
6. Find Critical Region of the test, Significance level of the test using R.
7. Perform Test for specified mean, test for equality of means for a given dataset using R.
8. Perform test for a specified proportion, test for equality of proportions for a given dataset using R.
9. Perform Test for specified mean, test for equality of means for a given dataset using R.
10. Implement Chi Square Test to check the goodness of the test.

Case study – 1

Inferential Statistics.

Field Experiment – Inference on Sorghum Variety

An experiment was conducted in RBD to study the comparative performance of fodder sorghum under rainfed conditions of different tropical region of Tamil Nadu under Department of Agriculture. The rearranged data are given below.

    a. Estimate the linear model for the better variety.

b. Fit One way and two-way ANOVA.

c. Analyse the post ANOVA test to find the higher yielding variety.

Green matter yield of sorghum, Kg/plot.						
Variety	Replication				Total	Mean
	I	II	III	IV		
African tall	22.9	25.9	39.1	33.9	121.8	30.4
Co-11	29.5	30.4	35.3	29.6	124.8	31.2
FS-1	28.8	24.4	32.1	28.6	113.9	28.5
K-7	47.0	40.9	42.8	32.1	162.8	40.7
Co-24	28.9	20.4	21.1	31.8	102.2	25.6
Total	157.1	142.0	170.4	156.0	625.5	31.3

Analyse the difference between one way and two-way ANOVA and suggest which one of them is suitable for estimating linear model.

Case study – 2

Independence of Attributes among different Race.

1. 100 individuals of a particular race were tested with an intelligence test and classified into two classes. Another group of 120 individuals belong to another race were administered the same intelligence test and classified into the same two classes. The following are the observed frequencies of the two races:

Race	Intelligence		
	Intelligent	Non-intelligent	Total
Race I	42	58	100
Race II	55	65	120
Total	97	123	220

Test whether the intelligence is anything to do with the race.

2. From the following table, showing the number of plants having certain characters. Test the hypothesis that the following colour is independent of shape of the leaf.

Colour of the flower	Shape of the leaf	
	Flat	Curved
Orange	115	32
Violet	29	14

3. A health status survey in a few villages revealed that the normal serum protein value of children in that locality is 7.0 g/100ml. A group of 16 children who received high protein food for a period of six months had serum protein values shown below. Can we consider that the mean serum protein level of those who were fed on high protein diet is different from that of the general population?

S.No. (Child No.)	1	2	3	4	5	6	7	8
Protein level (g%)	7.10	7.70	8.20	7.56	7.05	7.08	7.21	7.25

S.No. (Child No.)	9	10	11	12	13	14	15	16
Protein level (g%)	7.36	6.59	6.85	7.90	7.27	6.56	7.93	8.56

OUTCOMES:

- After completing this lab, students will be able to work on inferential statistics using R, use its features in the field of data science.
- Parametric and non-parametric statistical testing procedure.
- Chisquare test for goodness of fit for statistical model.

CAC2227	**BIG DATA ANALYTICS LAB**	L T P C
		0 0 3 2

OBJECTIVES:

- This lab is aimed at providing students a hands-on exposure to big data analytics.

LIST OF PROGRAMS:

1. Install and configure Hadoop, set working directory and various processes.
2. Implement basic commands in Hadoop to manipulate big data.
3. Set up Hadoop cluster configuration.
4. Implement HDFS and explore its characteristics
5. Explore the properties of YARN
6. Import data from MySQL into HDFS
7. Import data from MS Excel into HDFS
8. Implement reducer in Hadoop
9. Implement partitioner in Hadoop
10. Implement nested MapReduce
11. Create a scenario based on real time domain

Case study1:

Experiment 1:

Due to the advent of new technologies, devices, and communication means like social networking sites, the amount of data produced by mankind is growing rapidly every year. The amount of data produced by us from the beginning of time till 2003 was 5 billion gigabytes. If you pile up the data in the form of disks it may fill an entire football field. The same amount was created in every two days in 2011, and in every ten minutes in 2013. This rate is still growing enormously. Though all this information produced is meaningful and can be useful when processed, it is being neglected. By 2020, 1.7 megabytes of data will be created every second, for every person on earth. There are different uses of Big Data, but not only limited to, Industry influencers, academicians, and other prominent stakeholders certainly agree that big data has become a big game changer in most, if not all, types of modern industries over the last few years. As big data continues to permeate our day-to-day lives, there has

been a significant shift of focus from the hype surrounding it to finding real value in its use.

Considering Big Data in general, explain different use cases for below mentioned domain and comment how companies are converting Big Data into profit:

- Healthcare
- Education
- Agriculture
- Space Technology

Experiment 2:

Prepare infrastructure for setting up single node Hadoop cluster.

Experiment 3:

Install all the software to set up single node Hadoop cluster.

Experiment 4:

Configuration of single node Hadoop cluster and testing by creating directory at HDFS location

Experiment 5:

You need to find the location of below Hadoop configuration file and understand the purpose of different attributes mentioned in below xml files.
hdfs-site.xml
core-site.xml
yarn-site.xml

Experiment 6:

You need to perform 20 basics Hadoop commands on single node Hadoop cluster.
(Faculty will share commands)

Experiment 7:

Install IDE to code and compile map reduce framework.

Experiment 8:

You need to program Mapper Class, Reducer Class and Driver Class for map reduce word count Job.

Experiment 9:

You need to find out word count job for the given input file provided by faculty.

Experiment 10:

You need to trouble shoot log file generated in experiment Number 09 and note all the steps involved in job execution

Experiment 11:

You need execute word count job based on 0 reducer, 2 reducer, Default reducer & 4 reducer and observe different outputs.

Case Study 2:

Consider a scenario, you are working for a startup company. Your cluster size is 10 Node. Number of data node in your cluster is 09. The size of each data node of your cluster is 2 TB. Currently you are working on 5 Tb of Data with Replication factor 03. Recently you got a new project from your client. You are expecting 20Tb of data to be processed in your cluster.

Based on above scenario, you need to explain below:

1. How many data node you are going to add in your cluster?
2. What will be your new cluster size?
3. What will be your new data size considering Replication factor?
4. What will be your new data size considering only original data (without replication)?
5. What will be your total number of task tracker in your cluster?

OUTCOMES:

After completing this lab, students will be able to:

- Work on big data analytics; use its features in the field of data science.

CAC2228 **EMPLOYABILITY SKILLS** **L T P C**

3 - - -

OBJECTIVES:

- To be qualified for employment and to work in a corporate sector demands not only the technical knowledge and experience but interpersonal skills like speaking skills.

- Professional etiquettes and so on. In this course, students will be taught how to develop these skills and apply them in our everyday interactions with people, both in our personal and professional lives.

MODULE I: Speaking skills **9**

Group Discussions; Importance of Group Discussions; Difference between Group Discussion, Panel Discussion and Debate;   Format of GD as used in national level recruitment boards, Rules, ambience and normal practices, Dos   and Don'ts in Group Discussions, Traits Evaluated in GDs

MODULE II: Etiquette and Mannerism **9**

Introduction; Professional etiquette – Etiquette at meetings, Dining, Involuntary Awkward Actions; Technology Etiquette – Phone, Email, Social Media, Video Conferencing, Web interview

MODULE III: Professional Presentations **9**

Nature of Oral Presentation; Planning a Presentation, Preparing the Presentation; Delivering the Presentation

TEXT BOOKS:

1. Objective English: 3 rd Edition, Edgar Thorpe and Showick Thorpe, Pearson Publishers, 2010 print.
2. Presentation skills. The essential guide for students, Patsy Mc Carthy & Caroline Hatcher, Sage publications, 2002.

REFERENCES:

1. Soft Skills – An integrated approach to Maximise Personality, Gajendra Singh Chauhan & Sangeeta Sharma, Wiley Publications

OUTCOMES:

At the end of this program, students will able to:

- Participate in various group discussions.
- Participate in debates and get familiar with patterns and interactive methods.
- Get knowledge and presentation skills.
- Understand the Traits Evaluated in GDs.
- Learn different ways of Delivering the Presentation.

 * **Note: This is a value added Course**

SEMESTER-V

CAC3121	**TIME SERIES ANALYSIS**	**L T P C**
		3 0 0 3

OBJECTIVES:

- To understand the basic concepts of time series analysis.

- To understand the elementary time series models and model evaluation techniques.

- To understand the integration process of non-stationary data set.

- To understand the importance of ARMA and ARIMA models for forecasting.

- To understand the basic concepts and estimation procedure for VAR models.

- To understand the method to select the appropriate number of order of variables.

- To understand the ARCH and GARCH models.

MODULE I   9

Introduction to Time Series: Definition, Examples, Components of time series, Trend, Seasonal, Cyclic and Irregular Variations, Determination of trend: Method of moving average, method of least squares, Determination of seasonality: Ratio to trend method, Ratio to moving average method, Exponential Smoothing: Simple exponential Smoothing, Holt Winter's Smoothing Procedure.

MODULE II   9

Stationarity, Auto covariance, Autocorrelation functions and its properties, Partial Autocorrelation function, Test for stationarity, Test for randomness, Spectral density Function.

MODULE III   9

Models of Time series: Autoregressive (AR) models, Moving average (MA) models, Properties such as stationarity, invertibility, ACF, PACF, Spectral density function.

MODULE IV   9

Box-Jenkins analysis of time series: Model identification using ACF and PACF, Estimation of parameters of AR, MA and ARMA models by method of MLE and

method of least squares, fitting of the models, residual analysis and diagnostic checking. Autoregressive integrated moving average (ARIMA) models: Definition and elementary properties.

MODULE V   **9**

Non Linear Time Series Models, ARCH and GARCH Models: definition and basic properties, Multivariate Time Series Models: Introduction, Stationary Multivariate Time Series, Vector Autoregressive Models, Vector ARMA Models, Co-integration.

TEXT BOOKS:

1. C. Chatfield: The Analysis of Time Series - An Introduction Chapman and Hall.
2. G.E.P. Box, G.M. Jenkins and G.C. Reinsel: Time Series Analysis, Forecasting and Control, John Wiley & Sons Publications.
3. P.J. Brockwell .and R.A. Davis: Time Series: Theory and Methods, Springer-Verlag.

REFERENCES:

1. Chris Brooks: Introductory Econometrics for Finance, Cambridge University Press.
2. S.P. Gupta: Statistical Methods, Sultan, Chand & Sons.

OUTCOMES:

- Understand the different elementary models related to time series analysis.
- Apply different model evaluation technique to identify better model to forecast.
- Understand the importance of stationarity in building time series models.
- Understand the use of Granger Causality and Johensen Cointegration method.
- Apply VAR model to the dynamic behaviour of financial time series conditions.
- Select the order of Vector Auto Regression model for better forecast of time series data.
- Build the model using ARCH and GARCH technique for non-constant variance data.

CAC3122   DATA ANALYSIS USING MS EXCEL AND SQL

L	T	P	C
3	1	3	4

OBJECTIVES:

- To understand the general purpose of MS Excel and its built in functions for data analysis.
- To understand the importance of ROC curve and its use in finding the fitness of classification model.
- To know the basics of macros in MS Excel.
- To understand the working knowledge in MS Excel for linear regression analysis.
- To understand the importance of SQL in Data Analytics.
- To know the importance of SQL in Data mining models.

MODULE I   **9**

Introduction to data analytics, MS Excel as tool for data analytics, basic data analytics operations in MS Excel like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak.

MODULE II   **9**

Binary classification in MS Excel, AUC (Area under the receiver operating characteristic (ROC) curve, information measures using entropy, linear regression, basics of macros and VBA in excel.

MODULE III   **9**

Data analytics using SQL, , basic data analytics operations in SQL like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak.

MODULE IV   **9**

Data mining models in SQL, association rules in SQL, linear regression in SQL, AUC and RoC in SQL. Unstructured data analysis in SQL

MODULE V   **9**

Advance topics of data analytics using excel like power pivot table, power query for

data, importing data using excel. Industry use cases from data science like market basket analysis.

LIST OF PROGRAMS:

1. Implement Binary classification in MS Excel,
2. Implement AUC (Area under the receiver operating characteristic (ROC) curve in Excel
3. Explore information measures using entropy in Excel
4. Implement linear regression in Excel
5. Explore and implement basic macros in Excel
6. Explore and implement various options of VBA in excel.
7. Implement basic data analytics operations in SQL like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak.
8. Implement association rules in SQL
9. Implement linear regression in SQL
10. Implement AUC and RoC in SQL

TEXT BOOKS:

1. Data Analysis Using SQL and Excel, 2nd Edition by Gordon S. Linoff (2015), Wiley publication.
2. Microsoft Business Intelligence Tools for Excel Analysts 1st Edition by Michael Alexander, Jared Decker and Bernard Wehbe.

REFERENCES:

3. Learning SQL: Master SQL Fundamentals 2nd Edition by Alan Beaulieu
4. Head First SQL: Your Brain on SQL -- A Learner's Guide by Lynn Beighley (2007)

OUTCOMES:

- After completing this course, students will be able to do data analytics using MS Excel and SQL.

- In this course, you will learn how to perform data analysis using Excel's most popular features. You will learn how to create pivot tables from a range with rows and columns in Excel.

- Pivots are used in many different industries by millions of users who share the goal of reporting the performance of companies and organizations.

- In addition, Excel formulas can be used to aggregate data to create meaningful reports.

- To complement, pivot charts and slicers can be used together to visualize data and create easy to use dashboards.

CAC3123 **MACHINE LEARNING ALGORITHMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic concepts of statistical learning methods and models.
- To understand the importance of supervised learning in multivariate data sets.
- To understand the estimation procedure for multiple regression coefficients
- To understand the assumptions in estimating regression coefficients using OLS method.
- To understand the importance of supervised learning in classifying class labels for prediction.
- To understand the different algorithms related to classification techniques.
- To understand the concepts of hypothesis testing in model coefficients.

MODULE I 9

Introduction to Machine Learning

Introduction to machine learning, types of learning, Learning Input-Output Functions, Designing a learning system, perspectives and issues in machine learning. Basic algorithms methods, Inferring Rudimentary Rules, Simple Probabilistic Modelling, Divide and Conquer: Constructing Decision Trees, Covering Algorithms: Constructing Rules, Mining Association Rules, Linear Models, Instance-based Learning, Clustering, Multi-Instance Learning.

MODULE II 9

Supervised Learning Algorithms

Supervised Machine Learning Algorithms, working of supervised machine learning algorithm, Naive Bayes algorithm, decision tree, Support Vector Machines, KNN, Random Forest algorithm.

MODULE III 9

Unsupervised Learning Algorithms

Unsupervised Machine Learning Algorithms, working of unsupervised machine learning algorithm, clustering, neural networks, Blind Signal Separation Techniques like Principal Component Analysis, Singular Value Decomposition.

MODULE IV   9

Reinforcement Learning Algorithms

Reinforcement Machine Learning Algorithms, working of reinforcement machine learning algorithm, Finite Markov Decision Processes, Dynamic Programming, Monte Carlo Methods,

MODULE V   9

Machine Learning Use-cases

Machine learning in business, Use cases of machine learning implementation in various industry domains: Banking, Finance, Retail, Healthcare, Manufacturing, E-commerce, Human Resource.

TEXT BOOKS:

1. Machine Learning by Tom M. Mitchell. 2014 Reprint. McGraw-Hill Science
2. Data Mining: Practical Machine Learning Tools and Techniques by Ian H Witten, Eibe Frank, Mark A Hall, Christopher J Pal. Third Edition. Morgan Kaufmann Series in Data Management Systems
3. Reinforcement Learning: An Introduction by Richard S Sutton and Andrew G. Barto. (2016). MIT Press.

REFERENCES:

1. Understanding Machine Learning: From Theory To Algorithms by Shai Shalev-Shwartz (2015).
2. Simpler: Using Machine Learning Algorithms in R by Darrin Thomas (2017)

OUTCOMES:

- Understand the difference between continuous class label and discrete class label classification methods.
- Predict the continuous class variable using linear regression analysis.
- Predict the binary class variable using decision tree and random forest.

- Understand the importance of Logistic regression and its application in business.

- Understand the important concepts of neural networks and its prediction techniques.

- Apply the assessment method to find the better fit model for classification techniques.

CAC3221	PROJECT AND VIVA VOCE	L	T	P	C
		0	0	0	16

The students will undertake a project as part of their final semester. The students can do independent projects or can take up projects in groups of two or more depending on the complexity of the project. The maximum group size will be four and in case of team projects there should be a clear delineation of the responsibilities and work done by each project member. The projects must be approved by the mentor assigned to the student. The mentors will counsel the students for choosing the topic for the projects and together they will come up with the objectives and the process of the project. From there, the student takes over and works on the project.

If the student chooses to undertake an industry project, then the topic should be informed to the mentor, and the student should appear for intermediate valuations. Prior to undertaking this project the students undergo a bridge course.

Bridge Course:

The bridge course ensures that all the students have the correct prerequisite knowledge before their industry interface. The purpose of a bridge course is to prepare for a healthy interaction with industry and to meet their expectations. It would be difficult to establish standards without appropriate backgrounds and therefore to bridge this gap, students are put through a week mandatory classroom participation where faculty and other experts will give adequate inputs in application based subjects, IT and soft skills.

The Project:

Each student will be allotted a Faculty Guide and an Industry Guide during the internship/project work. Students need to maintain a Project Diary and update the project progress, work reports in the project diary. Every student must submit a detailed project report as per the provided template. In the case of team projects, a single copy of these items must be submitted but each team member will be required to submit an individual report detailing their own contribution to the project.

Each student/group should be allotted a supervisor and periodic internal review shall be conducted which is evaluated by panel of examiners.

Project Evaluation Guidelines:

The Project evaluator(s) verify and validate the information presented in the project report.

The break-up of marks would be as follows:

1. Internal Evaluation
2. External Assessment
3. Viva Voce

Internal Evaluation:

Internal Evaluator of project needs to evaluate Internal Project work based on the following criteria:

- Project Scope , Objectives and Deliverables
- Research Work, Understanding of concepts
- Output of Results and Proper Documentation
- Interim Reports and Presentations– Twice during the course of the project

External Evaluation:

The Project evaluator(s) perform the External Assessment based on the following criteria.

- Understanding of the Project Concept
- Delivery Skill
- The Final Project Report
- Originality and Novelty

The Final Project Report Details:

- The report should have an excel sheet that documents the work of every project member

Viva Voce

- Handling questions
- Clarity and Communication Skill

Marking Scheme:

1. **Internal Evaluation:** 35% of Total Marks
2. **External Evaluation:** 50% of Total Marks
3. **Viva Voce:** 15 % of Total Marks

For e.g., If the total mark for the project is 100, then

❖ Internal Evaluation = 35 marks

The break-up of marks is shown below:-

- Interim Evaluation 1: 10 marks
- Interim Evaluation 2: 10 marks
- Understanding of concepts: 5 marks
- Programming technique: 5 marks
- Execution of code : 5 marks

❖ External Evaluation = 50 marks

The break-up of marks is shown below:-

- Project Report: 15 marks
- Explanation of project working: 10 marks
- Execution of code: 10 marks – (if done in industry, a stand-alone module can be reprogrammed and submitted. Error rectification etc. can be included by the evaluator)
- Participation in coding: 15 marks

❖ Viva Voce = 15 marks

The break-up of marks is shown below: -

- Questions related to project: 10 marks
- Questions related to technology: 5 marks

The Project evaluator(s) verifies and validates the information presented in the project report.

ELECTIVE - I

CACX40	**INTERNET OF THINGS**	L T P C
		3 0 0 3

OBJECTIVES:

- To introduce the concept of "Internet of Things" to the students.

- To understand the basic ecosystems and landscape in IoT.

- To understand the real time use cases in IoT

- To know the different domains, where IoT plays a crucial role.

MODULE I   9

Introduction to IoT: What is IoT, IoT architecture, Characteristics of IOT systems, Prevalent IoT architectures, IoT applications, Overview of different technologies involved for IoT realization.

MODULE II   9

History of IoT: The transition from mainframes and personal computing, Planet lab and origins of distributed computing; Robotics, AI and Cyber Computing Infrastructure; M2M communications; P2P networks; Universal identification and RFID; Autonomic computing, Pervasive computing, Ubiquitous computing; Wireless Sensor Networks; The emergence of IoT.

MODULE III   9

IOT state of the art: The IoT ecosystem and landscape; IOT business models and its usage in various domains; Technology Enablers for IOT – Mobility, Analytics, Cloud and Social Media; IOT platforms; Security; Test methodologies; Regulations and Risks.

MODULE IV   9

IoT Characteristics and use cases: Consumer and enterprise use cases

MODULE V   9

IoT DOMAINS: Smart Home, Smart Buildings, smart cities, IoT in telecommunications, smart manufacturing, IoT in environment monitoring, smart vehicles, IoT in healthcare, smart farming, IoT in enterprises, smart transportation, smart energy, smart retail and logistics

TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga "Internet of things, A hands-on-approach" 2014
2. Jean-Philippe Vasseur & Adam Dunkels "Interconnecting smart objects with IP", Morgan Kaufmann Publishers, 2010

REFERENCES:

1. Cuno Pfister, "Getting Started with the Internet of Things" , Maker Media Inc, 2011
2. Adrian Mcewen and Hakim, "Designing the Internet of Things", Wiley publication, 2013

OUTCOMES:

- After the completion of this course, students will be able to explore IoT as the framework to link things across the globe.
- They will be able to talk about various business use cases that may be implemented in IoT.
- IoT provides the scale of data that machines require in order to learn.
- IoT will accelerate dematerialization by enabling us to work smarter.
- Student will be knowing the Consumer and enterprise use cases.
- Student can able to Apply effective techniques to create IoT based projects

CACX10   **ARTIFICIAL INTELLIGENCE**   **L T P C**

                                                 3 0 0 3

OBJECTIVES:

- To understand the importance and basic concepts of Artificial Intelligence.
- To know the important artificial intelligence algorithms in analysis.
- To understand the importance of knowledge representation in Artificial intelligence.
- To know the basic concepts of machine learning in Artificial intelligence.

MODULE I   **9**

Overview: foundations, scope, problems, and approaches of AI. Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents, Artificial Intelligence programming techniques

MODULE II   **9**

Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

MODULE III   **9**

Knowledge Representation and Reasoning: ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV   **9**

Planning: planning as search, partial order planning, construction and use of planning graphs, Representing and Reasoning with Uncertain Knowledge: probability, connection to logic, independence, Bayes rule, bayesian networks, probabilistic inference, sample applications.

MODULE V   **9**

Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications. Machine Learning and

Knowledge Acquisition: learning from memorization, examples, explanation, and exploration. Learning nearest neighbor, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, 3rd Edition, by Stuart Russell and Peter Norvig.
2. Luger, G. F., & Stubblefield, W. A., Artificial Intelligence - Structures and Strategies for Complex Problem Solving. New York, NY: Addison Wesley, 5th edition (2005).

REFERENCES:

1. Nilsson, N. J., Principles of Artificial Intelligence. Palo Alto, CA: Tioga (1981).
2. Rich, E., & Knight, K., Artificial Intelligence. New York: McGraw-Hill (1991).

OUTCOMES:

- After completing this course, students will be able to explore artificial intelligence in day to day life.
- Student will be able to identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Student will be able to formalize a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms Design and perform an empirical evaluation of different algorithms on a problem formalization
- Student can state the conclusions that the evaluation supports.
- Student will know about the virtual assistant is an exciting development in the field.

CACX16	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Usage of mobile devices have increased exponentially over the past decade. Most of the people have more than one mobile devices.

- The introduction of Smart Phones have created a new revolution in the telecommunication industry.

MODULE I: Mobile Network Architecture   9

Wireless Communication Principles, Network Evolution, Radio Communication, Analog and Digital Communication, Computer Network, OSI Model, Mobile Network OSI layer functions, Mobile Network Protocol Layers, Telephony Networks, PSTN, Telecommunication Networks, Fixed Networks, Mobile Networks, Cellular Network Concepts, Cellular Networks, Cells and Base Stations, Frequency and Interface in Cells, Mobile Network Architecture, Wireless Network Generations, GSM, GPRS.

MODULE II: Mobile Device Architecture   9

Mobile Phone Evolution, Mobile Handset Characteristics, Bluetooth , Display, Keypad, Camera, Mobile Handset Categories, Handset Components, Handset Design, Handset hardware architecture, Elements inside a Mobile Handset, Hardware Architecture Evolution, Hardware architectural trends, CPU and Memory, Internal storage, Handset Power Requirements, Power Management, Introduction and Definition to the SIM, Functions and usage of the SIM, Phones without SIMs, Key Handset software components, Device Drivers.

MODULE III: Mobile Application Development   9

Mobile Application Development Paradigm, Mobile Programming Tools, Mobile Application Evolution, Thin Client, Fat Client, Future of Mobile App Development, Mobile Client Server App Architecture, Mobile App Programming in different languages, Mobile Programming best practices, Pros and Cons of Mobile Web App, SIM based Mobile App Development, SIM as a Platform, SIM as Service

Differentiator, Evolution of Mobile Services, Types of Mobile Services, App Server, Mobile Context of AS, AS Deployment Architecture, App Server Layers.

MODULE IV: Mobile Web Application   9

World Wide Web, Web Application, Web Application Architecture, Web Server, Web Server Features, Web Application Server, Mobile Internet Access, Mobile Web browser Evolution, Mobile Web Development Approaches, Dynamic Content, RSS, Feed, Mobile Advertising Motivation, Dynamic Mobile Advertising, Web Service Architecture, Users on the Go, Best Development Practices.

MODULE V: Mobile Operating System   9

Introduction to Mobile Operating Systems and why they are needed, Open Platforms, Mobile OS Features, Symbian, BlackBerry, Android, iOS, Windows, Tizen, Ubuntu, etc.

TEXT BOOKS:

1. Wireless and Mobile Network Architectures by Yi-Bang Lin and Imrich Chlamtac, Wiley-India, 2008
2. Mobile Networks Architecture by Andre Perez, Wiley, March 2012
3. Mobile Computing – Technology, Application & Service Creation by Asoke. K Talukder, Roopa R. Yavagal, Asoke K. Talukder, Tata McGraw-Hill, 2005
4. GSM - Architecture, Protocols and Services by Jörg Eberspächer, Hans-JoergV ögel, Christian Bettstetter, Christian Hartmann John Wiley & Sons, Dec-2008
5. Mobile Handset Design by Sajal K. Das, John Wiley and Sons, 2010
6. Smart Phone and Next Generation Mobile Computing by Pei Zheng and Lionel M. Ni., Morgan Kaufmann, 2006.

REFERENCES:

1. Professional Mobile Application Development by Jeff McWherter, Scott Gowell, 2012
2. Mobile Computing Principles: Designing and Developing Mobile Applications by Reza B'Far, Cambridge University, 2005
3. Mobile Applications: Architecture, Design, and Development by Valentino Lee, Heather Schneider and Robbie Schell, Pearson Education, 2004
4. Mobile Web Development by Nirav Mehta, Packt Publishing, 2008
5. Next Generation Wireless Applications: Creating Mobile Applications in a Web 2.0 and Mobile 2.0 World by Paul Golding, John Wiley & Sons, 2008
6. Head First Mobile Web by Lyza Danger Gardner, Jason Grigsby, 2011

OUTCOMES:

- Students will learn the basics of mobile networks.
- They will be able to understand the different concepts needed for the proper functioning of a mobile device.
- They will be able to identify different types of applications, the importance of mobile operating system and features of the same.
- The student can able to understand the rise in demand of mobile phones have led telecommunication companies to delve into newer technologies and standards.
- They will able to understand the basics of mobile network, device and their architecture.
- Student can able to know the course explains about the importance, features, functions and types of mobile operating systems.

ELECTIVE-II

CACX41	**PYTHON PROGRAMMING**	**L T P C**
		3 1 0 4

OBJECTIVES:

- To understand the basic concepts of python programming with values and varibles.
- To know the basic arithmetic operators used in Python Programming.
- To understand why Python is a useful scripting language for developers
- To understand the important functions in python programming
- To know the data structures and its usage in python programming.

MODULE I 9

Introduction to Python Programming, development tools, values and variables, integer values, variables and assignment, identifiers, floating point types, control codes with strings, user input, Eval function, print function

MODULE II 9

Expression and arithmetic, operator precedence and associativity, comments and errors, syntax errors, run time errors, logic errors, arithmetic operators

MODULE III 9

Conditional execution, Boolean expressions, simple if statement, if/else, compound Boolean expressions, nested conditions, decision statements, conditional expressions. Iterations, while statement, definite vs indefinite loops, nested loops, abnormal loop termination

MODULE IV 9

Functions, standard mathematics functions, time function, random function, importing function, writing own functions, parameter passing, custom function vs standard functions. Global variables, default variables, recursion, reusable functions, functions as data.

MODULE V   **9**

Lists, List assignment, list bounds, slicing, list and functions, prime generation with list, sorting, flexible sorting, search, linear search, binary search, list permutation, random permutation, objects, string objects, list objects, custom types - geometric, handling exceptions.

LIST OF PROGRAMS

Part A

1. Write a Python program to check whether two strings are equal or not.

2. Write a Python program to display reverse string.

3. Write a Python program to find the sum of digits of a given number.

4. Write a Python program to display a multiplication table.

5. Write a Python program to display all prime numbers between 1 to 1t000.

6. Write a Python program to insert element in existing array.

7. Write a Python program to sort existing array.

8. Write a Python program to create object for Tree Set and Stack and use all methods.

9. Write a Python program to check all math class functions.

   1. Write a program to execute any Windows 95 application (Like notepad, calculator etc)
   2. Write a program to find out total memory, free memory and free memory after executing garbage Collector (gc).

TEXT BOOKS:

   1. LEARNING TO PROGRAM WITH PYTHON by Richard L. Halterman.(2011)
   2. Guttag, John. Introduction to Computation and Programming Using Python. Spring 2013 edition. MIT Press, 2013.

REFERENCES:

1. Programming Python, 4th Edition by Mark Lutz (2010) O'Reilly Media
2. Python Cookbook, 3rd Edition: Recipes for Mastering Python 3, by David Beazley and Brian K. Jones, on O'Reilly Atlas (2013)

OUTCOMES:

- After completing this course, students will be able to apply various features and components of Python programming in the field of data science.

- Student will learn how to design and program Python applications.

- Student will learn how to use lists, tuples, and dictionaries in Python programs.

- Student will learn how to identify Python object types.

- Student will learn how to use indexing and slicing to access data in Python programs.

- Student will define the structure and components of a Python program.

- Student will learn how to write loops and decision statements in Python

Elective – II

CACX42	JAVA PROGRAMMING	L T P C
		3 1 0 4

OBJECTIVES:

- Object oriented programming is the most proven technique for developing reliable programs.

- It helps in increased productivity, reusability of code, decrease in the development time, and reduces cost of production to an extent. The cost of maintaining such systems have also considerably decreased.

- There are many languages which used the object oriented concepts and techniques. Some of them are C++, Java, Smalltalk, Objective-C, etc. Java is a purely object oriented language.

- Systems/applications created using java programming language reduces the need for developing and maintain complex and space consuming applications.

MODULE I: Introduction 9

History, Overview of Java, Object Oriented Programming, A simple Program, Two control statements - if statement, for loop, using Blocks of codes, Lexical issues - White space, identifiers, Literals, comments, separators, Java Key words. Data types: Integers, Floating point, characters, Boolean, A closer look at Literals, Variables, Type conversion and casting, Automatic type promotion in Expressions Arrays. **Operators:** Arithmetic operators, The Bit wise operators, Relational Operators, Boolean Logical operators, Assignment Operator, Operator Precedence. Control Statements: Selection Statements - if, Switch: Iteration Statements - While, Do-while, for Nested loops, Jump statements.

MODULE II: Classes: 9

Class Fundamentals, Declaring objects, Assigning object reference variables, Methods, constructors, "this" keyword, finalize ( ) method A stack class, Over loading methods, using objects as parameters, Argument passing, Returning objects, Recursion, Access control, Introducing final, understanding static,

Introducing Nested and Inner classes, Using command line arguments. Inheritance: Inheritance basics, Using super, method overriding, Dynamic method Dispatch, using abstract classes, using final with Inheritance.

MODULE III: Packages. 9

Definition, Access protection importing packages, Interfaces: Definition implementing interfaces. Exception Handling: Fundamental, Exception types, Using try and catch, Multiple catch clauses, Nested try Statements, throw, throws, finally, Java's Built - in exception, using Exceptions.

MODULE IV: Multithreaded Programming. 9

The Java thread model, The main thread, Creating a thread, Creating multiple thread, Creating a thread, Creating multiple threads, Using isalive() and Join(), Thread - Priorities, Synchronization, Inter thread communication, suspending, resuming and stopping threads, using multi threading. 1/0 basics, Reading control input, writing control output, Reading and Writing files, Applet Fundamentals, the AWT package,AWT Event handling concepts The transient and volatile modifiers, using instance of using assert.

MODULE V: JAVA Database Connectivity (JDBC) 9

Database connectivity: JDBC architecture, JDBC Drivers, the JDBC API: loading a driver, connecting to a database, Creating and executing JDBC statements, Handling SQL exceptions, Accessing result sets: Types of result sets, Methods of result set interface. An example JDBC application to query a database

TEXT BOOKS:

1. The complete reference Java –2: V Edition By Herbert Schildt Pub. TMH.

REFERENCES:

1. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.

OUTCOMES:

- Students will learn how to write Programs using Java
- Student will learn Java has a lot of advantages of being simple, robust, platform independent, etc. Nowadays java is also found in the mobile phones.
- Student will focuses on the concepts of object oriented programming language and the different constructs for creating applications in java.
- Student will able to learn the object oriented concepts which helps in the field of programming, management of data, etc.
- Student will get help of Java programming which helps to explore object oriented nature of the language and the multi-platform versatility offered by it.

LIST OF PROGRAMS: 15

1. Write a program to check whether two strings are equal or not.

2. Write a program to display reverse string.

3. Write a program to find the sum of digits of a given number.

4. Write a program to display a multiplication table.

5. Write a program to display all prime numbers between 1 to 1t000.

6. Write a program to insert element in existing array.

7. Write a program to sort existing array.

8. Write a program to create object for Tree Set and Stack and use all methods.

9. Write a program to check all math class functions.

   1. Write a program to execute any Windows 95 application (Like notepad, calculator etc)
   2. Write a program to find out total memory, free memory and free memory after executing garbage Collector (gc).

3. Write a program to copy a file to another file using Java to package classes. Get the file names at run time and if the target file is existed then ask confirmation to overwrite and take necessary actions.

4. Write a program to get file name at runtime and display number f lines and words in that file.

5. Write a program to list files in the current working directory depending upon a given pattern.

6. Create a textfileld that allows only numeric value and in specified length.

7. Create a Frame with 2 labels, at runtime display x and y command-ordinate of mouse pointer in the labels.

CACX43　　　　　　**DATA VISUALIZATION**　　　　**L　T　P　C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3　1　0　4

OBJECTIVES:

- To know the importance of data visualization in data science reports.
- To understand uni, bi and multidimensional data visualization techniques.
- To know the important libraries in data visualization tools.
- To know important visualization tools like tableau.
- To understand the importance of use cases of data visualization.

MODULE I　　　　　　　　　　　　　　　　　　　　　　　　　**9**

Introduction to data visualization, importance of data visualization in data science, seven stages of visualizing data -- acquire, parse, filter, mine, represent, refine, and interact.

MODULE II　　　　　　　　　　　　　　　　　　　　　　　　**9**

Classifying data visualization – explanatory, exploratory and hybrid, three perspectives of data visualization - the designer, the reader, and the data—shape what you create.

MODULE III　　　　　　　　　　　　　　　　　　　　　　　**9**

Data visualization using R, data visualization libraries, features of libraries, ggplot library for data visualization.

MODULE IV　　　　　　　　　　　　　　　　　　　　　　　**9**

Data visualization using Tableau, features of Tableau public version, configuration of Tableau, various libraries of Tableau.

MODULE V　　　　　　　　　　　　　　　　　　　　　　　　**9**

Visualization best practices, data science use cases for data visualization.

TEXT BOOKS:

1. Data Points: Visualization That Means Something by Nathan Yau . John Wiley & Sons (2013)

2. Beautiful Visualization: Looking at Data through the Eyes of Experts by Julie Steele and Noah Iliinsky .

REFERENCES:

1. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic (2014)
2. ggplot2: Elegant Graphics for Data Analysis by Hadley Wickham (2009)
3. Designing Data Visualizations: Representing Informational Relationships by Noah Iliinsky, Julie Steele (2011)

OUTCOMES:

- After completing this course, students will be able to visualize data through seven stages of data analysis process.
- They will be able to do explanatory, exploratory and hybrid types of data visualization.
- Student will understand various stages of visualizing data
- Student will able analyze features of libraries, ggplot library for data visualization.
- Student will learn the data science use cases for data visualization

Elective-III

CACX44	DATA SCIENCE PROJECT	L T P C
		3 0 0 3

OBJECTIVES:

- To understand and learn various project management life cycles.
- To understand the difference between ETL and Data Science model.
- To know the important software for data science analysis.
- To know the importance of data visualization techniques in analytics reports.

MODULE I

Introduction to project management, various project management life cycles, SDLC, waterfall model, various aspects of managing a data science project.

MODULE II

Comparison of ETL project Vs Data Science, modeling data science project. Managing structured, unstructured and semi-structured data for data science project.

MODULE III

Analytics tools for data science project, comparing open source and proprietary tools.

MODULE IV

Choosing a proper data visualization tool for data science project. Working with open source tools for data visualization.

MODULE V

Various stake holders of data science project, preparing project report for CXO level people. Report presentation and closure activities of a data science project.

TEXT BOOKS:

1. Real life scenarios
2. Industry inputs from SMEs

OUTCOMES:

- After completing this course, students will be able to apply various tools and techniques to execute a data science project.
- Student will able to do project on various project management life cycles, SDLC.
- Student will be able to learn semi-structured data for data science project
- Student can able to do Analytics tools for data science project
- Student will able to do open source tools for data visualization.

CACX45   **SOFTWARE ENGINEERING**   **L   T   P   C**
                                                  3   0   0   3

OBJECTIVES:

- Software engineering incorporates various accepted methodologies to design software. This subject gives a detailed description of the entire process of developing a software project and also the issues associated after development.

- This course covers the introductory concepts of software engineering and its design.

MODULE I: Software Product and Process   **9**

Introduction – S/W Engineering Paradigm – Verification – Validation – Life Cycle Models – System Engineering – Computer Based System – Business Process Engineering, Overview – Product Engineering Overview.

MODULE II: Software Requirements   **9**

Functional and Non-Functional – Software Document – Requirement Engineering Process – Feasibility Studies – Software Prototyping – Prototyping in the Software Process – Data – Functional and Behavioral Models – Structured Analysis and Data Dictionary.

MODULE III: Analysis, Design Concepts and Principles   **9**

Systems Engineering - Analysis Concepts - Design Process And Concepts – Modular Design – Design Heuristic – Architectural Design – Data Design – User Interface Design – Real Time Software Design – System Design – Real Time Executives – Data Acquisition System – Monitoring And Control System.

MODULE IV: Testing   **9**

Taxonomy Of Software Testing – Types Of S/W Test – Black Box Testing – Testing Boundary Conditions – Structural Testing – Test Coverage Criteria Based On Data Flow Mechanisms – Regression Testing – Unit Testing –

Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques

MODULE V: Software Project Management   9

Measures And Measurements – ZIPF's Law – Software Cost Estimation – Function Point Models – COCOMO Model – Delphi Method – Scheduling – Earned Value Analysis – Error Tracking – Software Configuration Management – Program Evolution Dynamics – Software Maintenance – Project Planning – Project Scheduling– Risk Management – CASE Tools

TEXT BOOKS:

1. Ian Sommerville, "Software engineering", Seventh Edition, Pearson Education Asia, 2007

REFERENCES:

2. Roger S. Pressman, "Software Engineering – A practitioner's Approach", Sixth Edition, McGraw-Hill International Edition, 2005

OUTCOMES:

- Learners will develop knowledge about Software Development Life Cycle, which is very essential for any Software Developer to design and develop any application or software.

- This course also includes modules on Software testing which forms an essential part of SDLC

- Students are ability to apply knowledge of mathematics, science, and engineering

- Students are ability to design and conduct experiments, as well as to analyze and interpret data.

- Students are ability to function on multi-disciplinary teams.

- Students are ability to analyze, design, verify, validate, implement, apply, and maintain software system.

CACX46   **AGILE METHODOLOGY**   **L   T   P   C**
                                                           3   0   0   3

OBJECTIVES:

- To understand the important basic concepts of agile methodology.
- To know the importance of agile values and principles.
- To understand the foundations of agile delivery methods and XP and AM.
- To know the agile project development phases and identifying scope of agile project.

MODULE I

Introduction to Disciplined Agile Delivery, Context Counts--The Agile Scaling Model, Disciplined Agile Delivery (DAD) Process Framework, People First approach, Learning Oriented approach, A Hybrid Process Framework, Goal-Driven Delivery Lifecycle, Enterprise Aware

MODULE II

Introduction to Agile and Lean, Toward a Disciplined Agile Manifesto, Disciplined Agile Values, Disciplined Agile Principles, Lean Principles.

MODULE III

Foundations of Disciplined Agile Delivery, the Terminology Tar Pit, Scrum, Extreme Programming (XP), Agile Modeling (AM), Agile Data, Lean Software Development.

MODULE IV

People first approach, Roles, Rights, and Responsibilities, The Rights of Everyone, The Responsibilities of Everyone, The DAD Roles, Forming Disciplined Agile Delivery Teams.

MODULE V

Initiating a Disciplined Agile Delivery Project, the Inception Phase, Identifying a Project Vision, Identifying the Initial Scope, Identifying an Initial Technical Strategy, Initial Release Planning, Forming the Work Environment.

TEXT BOOKS:

1. S.W. Ambler, M. Lines, Disciplined Agile Delivery: A Practitioner's Guide to Agile Software Delivery in the Enterprise, IBM Press, 2012.

2. K. Beck, Test Driven Development: By Example, Addison-Wesley, 2002.

3. K. Beck, C. Andres, Extreme Programming Explained: Embrace Change, 2nd Edition, Addison-Wesley, 2004.

REFERENCES:

1. M. Cohn, Succeeding with Agile: Software Development Using Scrum, Addison-Wesley, 2010.

2. K.S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley, 2012.

OUTCOMES:

- After completing this course, students will be able to apply various features and components of agile methodology in the field of data science.

- Student will able to understand the most impactful change has come from defining new roles within the R&D department.

- Student will able analyze the teams rely less on up-front requirements and documentation than on face-to-face conversations.

- Student can identify the agile development accelerates the delivery of initial business value.

- Student can go through a process of continuous planning and feedback, is able to ensure that value is continuing to be maximized throughout the development process.