



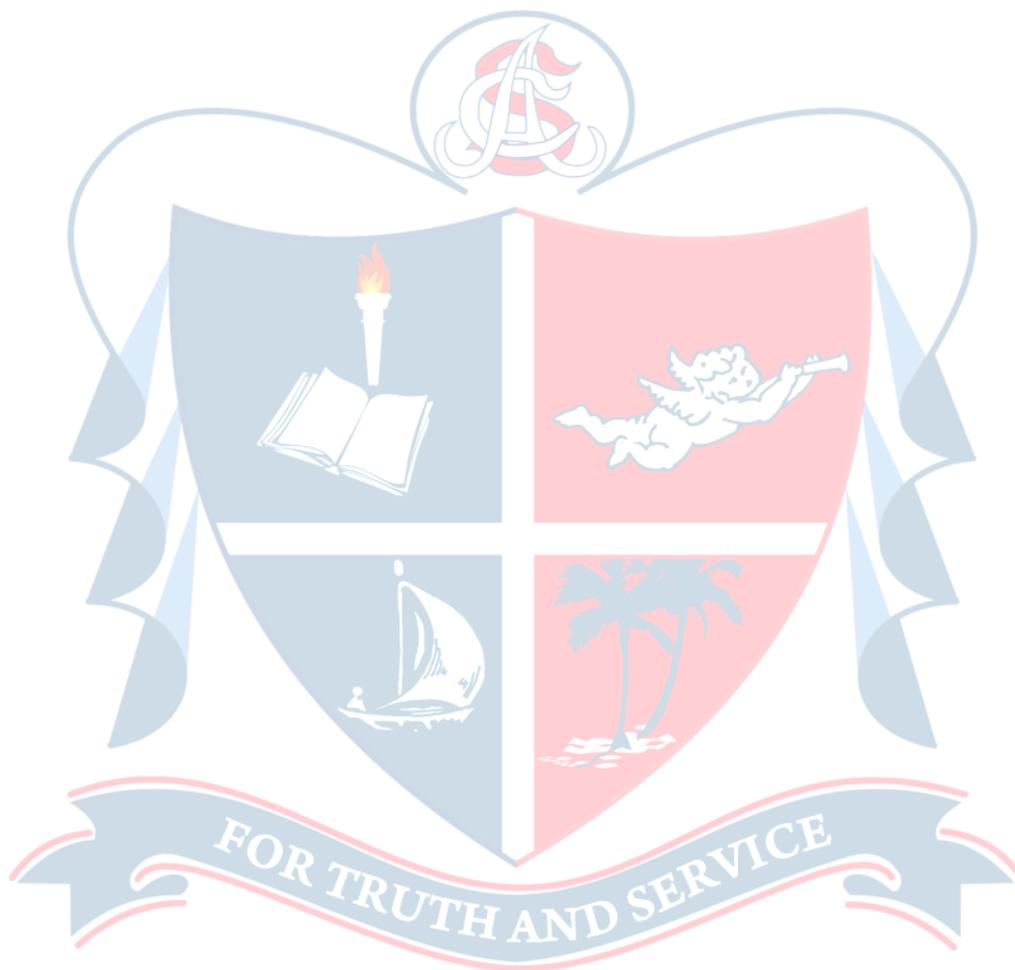
**ST. ALBERT'S COLLEGE (AUTONOMOUS)  
ERNAKULAM**

**Affiliated to Mahatma Gandhi University, Kottayam, Kerala**

**SYLLABUS FOR UNDERGRADUATE  
PROGRAMMES**

**BACHELOR OF SCIENCE (HONOURS) IN  
COMPUTER SCIENCE**

**SACA – UGP  
(WITH EFFECT FROM 2024 ADMISSION)**



## Syllabus of BSc Computer Science

Prepared by the Board of Studies on 4<sup>th</sup> March 2024

**Ms.Amrutha N**

Chairman, Board of Studies

Approved by the Academic Council on 14<sup>th</sup> March 2024

**Dr. Bijoy V.M., Principal**

Chairman, Academic Council

Approved by the Governing Council on 27<sup>th</sup> March 2024

**Fr. Dr. Antony Thoppil**

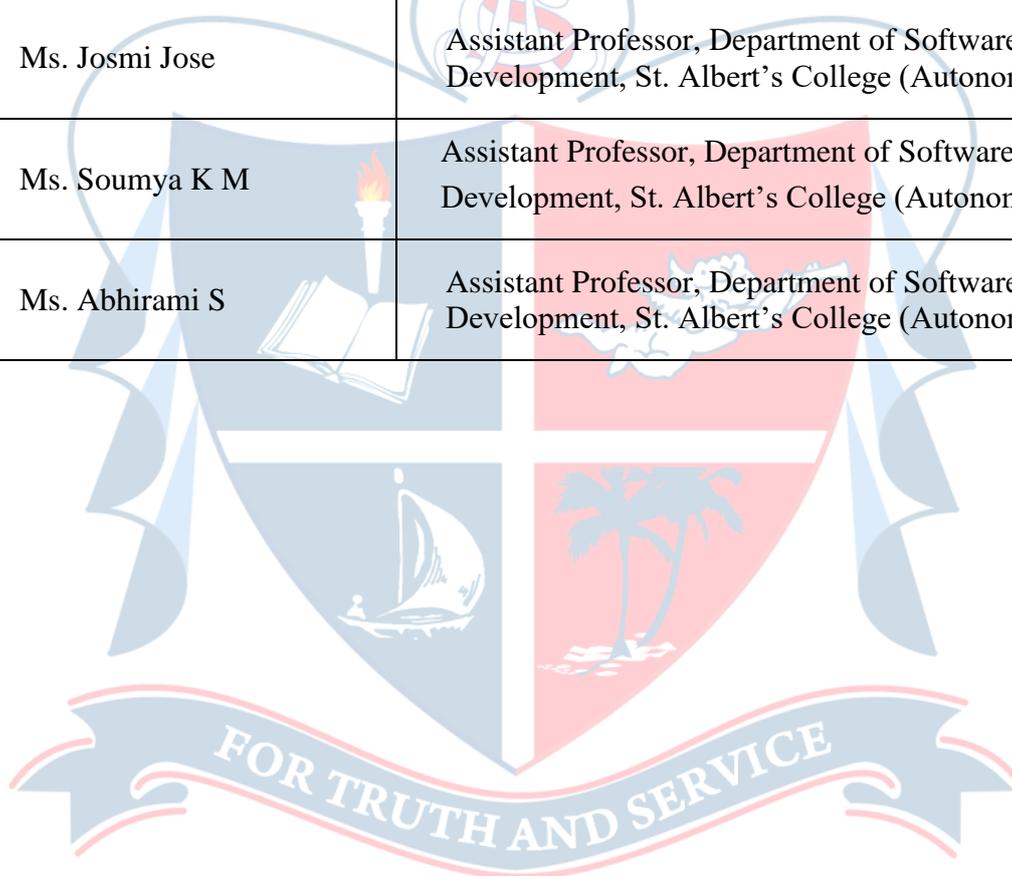
Chairman, Governing Council



### Board of Studies

No.	Name	Designation
1	Ms. Amrutha N	Chairman and Head of the Department of Computer Science, St. Albert's College(Autonomous), Ernakulam.
2	Dr. Bindya M. Varghese	Dean, Computer Science, Rajagiri School of Computer Science, Cochin.
3	Dr. Sherly K.K	Associate Professor, Department of Information Technology, Rajagiri School of Engineering and Technology, Cochin
4	Dr. Kurian M J	Assistant Professor, Head of Department of Computer Application, BPC College, Piravom
5	Mr. Shiju Thomas M Y	Assistant Professor, Rajagiri School of Computer Science, Cochin
6	Mr. Joseph Deril K S	Associate Professor, Department of Computer Application, MES College Marampally
7	Mr. Cijin K Paul	Assistant Professor, Department of Computer Science, UC College Aluva
8	Mr. Nishanth Ravindran	MD & CEO, Technovia Info Solutions Pvt Ltd
9	Dr. Haritha Rajeev	Assistant Professor, Department of Computer Science, St. Albert's College (Autonomous)
10	Ms. Vineetha Sankar P	Assistant Professor, Department of Computer Science, St. Albert's College (Autonomous)
11	Mr. Nithin Sebastian	Assistant Professor, Department of Computer Science, St. Albert's College (Autonomous)
12	Ms. Ashly Mathew	Assistant Professor, Department of Computer Science, St. Albert's College (Autonomous)

13	Ms. Lenet Steephen	Assistant Professor, Department of Computer Science, St. Albert's College (Autonomous)
14	Ms. Anju Antony	Assistant Professor, Department of Computer Science, St. Albert's College (Autonomous)
15	Ms. Asha Thomas	Assistant Professor, Department of Software Development, St. Albert's College (Autonomous)
16	Ms. Anitha M V	Assistant Professor, Department of Software Development, St. Albert's College (Autonomous)
17	Ms. Josmi Jose	Assistant Professor, Department of Software Development, St. Albert's College (Autonomous)
18	Ms. Soumya K M	Assistant Professor, Department of Software Development, St. Albert's College (Autonomous)
19	Ms. Abhirami S	Assistant Professor, Department of Software Development, St. Albert's College (Autonomous)



## Table of Contents

Preface	8
SACA UGP Regulations	9
Syllabus Index	45
Detailed Syllabus: Semester I	54
Detailed Syllabus: Semester II	70
Detailed Syllabus: Semester III	84
Detailed Syllabus: Semester IV	125
Detailed Syllabus: Semester V	165
Detailed Syllabus: Semester VI	201
Detailed Syllabus: Semester VII	249
Detailed Syllabus: Semester VIII	281

## Preface

In view of the National Educational Policy, the Higher Education Council has taken initiative to revamp, reconstruct, and release a new curriculum opening the doors of multidisciplinary education, imparting the opportunity for the student community to choose the subject for their undergraduate programme with their own free will. This curriculum has been designed with a strong commitment to academic excellence, innovation, and relevance to the evolving landscape of technology and computing.

As the world experiences rapid advancements in artificial intelligence, data science, cybersecurity, and software development, the field of computer science is at the forefront of shaping the future. In this context, the FYUGP in Computer Science provides students with a robust foundation, combining theoretical knowledge with hands-on experience. Our curriculum is structured to foster critical thinking, problem-solving, and computational skills that are essential for tackling real-world challenges.

The Board of Studies, composed of distinguished academicians and industry experts, has worked collaboratively to ensure that the program is dynamic, inclusive, and aligned with global standards. Our goal is to empower students with the necessary tools to thrive in their academic and professional journeys while fostering ethical considerations and a deep understanding of the societal impact of technology. We are confident that this program will inspire and equip our students to contribute meaningfully to the fast-changing world of computer science, preparing them for both higher education and the industry.

At this juncture we are adopting the major components of MG University Syllabus and integrating the signature courses developed by Computer Science Board of Studies of St. Albert's College (Autonomous). We extend our gratitude to all experienced academicians, industrial experts and faculty members who have contributed to the development of this curriculum.

**Ms. Amrutha N**

**Chairman, BoS Computer Science**

# **THE ST. ALBERTS COLLEGE (AUTONOMOUS) UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024**

## **SACA-UGP (Honours)**

### **PREAMBLE**

The University Grants Commission (UGC) has issued the Curriculum and Credit Framework for Undergraduate Programmes 2023 (CCFUP) which would provide a flexible choice-based credit system, multidisciplinary approach, multiple entry and exit options, and establish three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG Degree (Honours), and 4-year UG Degree (Honours with Research).

The Kerala Higher Education Reforms Commission has recommended a comprehensive reform in the undergraduate curriculum for the 2023-24 academic year, adopting 4-year undergraduate programmes to bring Kerala's undergraduate education at par with well acclaimed universities across the globe.

The Kerala State Curriculum Committee for Higher Education has been constituted and have proposed a model Kerala State Higher Education Curriculum Framework (KSHECF) for Undergraduate Education. Further, an Executive Committee and various sub committees were constituted for the implementation of the Regulations. Further, MGU has framed the Rules and Regulations based on this namely: **THE MAHATMA GANDHI UNIVERSITY UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024 {MGU-UGP (Honours)}** under the New Curriculum and Credit Framework, 2024. Being an Autonomous college affiliated to MG University, St. Albert's College is adopting all the major components of MGU UGP (Honours) 2024 in the title SACA-UGP (Honours) to our UG curriculum from the academic year (2024-25) onwards.

### **1. Short Title and Commencement**

- i. The Regulations will be called as **“THE ST. ALBERT’S COLLEGE (AUTONOMOUS) UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024 {SACA-UGP (Honours)}”** under the New Curriculum and Credit Framework 2024.
- ii. These Regulations will come into effect from the academic year 2024-2025 and will have prospective effect.

### **2. Scope, Application**

- i. These Regulations shall apply to all undergraduate programmes (except B. Voc.)

of ST. ALBERT'S COLLEGE (AUTONOMOUS) for the Admissions commencing in the academic year 2024-2025.

- ii. Every programme conducted under the SACA-UGP shall be monitored by the SACA-UGP Academic Committee (Academic Council).

### 3. Definitions

Unless context otherwise required,

- i. FYUGP means Four Year Undergraduate Programme.
- ii. Academic Year: Two consecutive (one odd and one even) semester followed by a vacation in one academic year.
- iii. Academic Coordinator/Nodal Officer: Academic Coordinator/Nodal Officer is a faculty nominated by the College Council to co-ordinate the effective conduct of the FYUGP including Continuous Comprehensive Assessment (CCA) undertaken by various departments within the College. She/ he/ they shall be the convenor for the College level Academic Committee.
- iv. Academic Week: A unit of five working days in which the distribution of work is organized, with five contact hours of one-hour duration on each day.
- v. Academic Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week in a semester. It is defined both in terms of student efforts and teacher's efforts. A course which includes one hour of lecture or tutorial or minimum 2 hours of lab work/ practical work/ field work per week is given one credit hour. Accordingly, one credit is equivalent to one hour of lecture or tutorial or two hours of lab work/ practical work/ field work/ practicum and learner engagement in terms of course related activities (such as seminar preparation, submitting assignments, group discussion, recognized club-related activities etc.) per week. Generally, a one credit course in a semester should be designed for 15 hours lecture/ tutorials or 30 hours of practical/ fieldwork/ practicum and 30 hours learner engagement.
- vi. Academic Bank of Credits (ABC): An academic service mechanism as a digital/ virtual entity established and managed by Government of India to facilitate the learner to become its academic account holders and facilitating seamless learner mobility, between or within degree-granting Higher Education Institutions (HEIs) through a formal system of credit recognition, credit accumulation, credit transfers and credit redemption to promote distributed and flexible process of teaching and learning. This will facilitate the learner to choose their own learning path to attain a Degree/ Diploma/ Certificate, working on the principle of multiple entry and exit, keeping to the doctrine of anytime, anywhere, and any level of learning.

- vii. Credit Accumulation: The facility created by ABC in the Academic Credit Bank Account (ABA) opened by the learner across the country in order to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs.
- viii. Credit Recognition: The credits earned through eligible/ partnering HEIs and transferred directly to the ABC by the HEIs concerned.
- ix. Credit Redemption: The process of commuting the accrued credits in the ABC of the learner for the purpose of fulfilling the credits requirements for the award of various degrees. Total credits necessary to fulfil the criteria to get a degree shall be debited and deleted from the account concerned upon collecting a degree by the learner.
- x. Credit Transfer: The mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed credits to individuals registered with ABA in adherence to the UGC credit norms for the course(s) registered by the learner in any HEIs within India.
- xi. Credit Cap: Maximum number of credits that a student can take per semester, which is restricted to 30.
- xii. Continuous Comprehensive Assessment (CCA): The mechanism of evaluating the learner by the course faculty at the institutional level.
- xiii. End Semester Evaluation (ESE): The mechanism of evaluating the learner at the end of each semester.
- xiv. Audit Course: A course that the learner can register without earning credits and is not mandatory for completing the SACA-UGP. The student has the option not to take part in the CCA and ESE of the Audit Course. If the student has 75% attendance in an Audit Course, he/ she/ they are eligible for a pass in that course, without any credit (zero-credit).
- xv. Courses: Refer to the papers which are taught and evaluated within a programme, which include lectures, tutorials, laboratory work, studio activity, fieldwork, project work, vocational training, viva, seminars, term papers, presentations, assignments, self-study, group discussion, internship, etc., or a combination of some of these elements.
- xvi. Choice Based Credit System (CBCS) means the system wherein students have the option to select courses from the prescribed list of courses.
- xvii. College-level Academic Committee: Is a committee constituted for the FYUGP at the College level comprising the Principal as the Chairperson, the Academic Co-

- ordinator/ Nodal Officer as its convenor.
- xviii. Academic Co-ordinator/ Nodal Officer: A senior faculty member nominated by the College Council.
- xix. Course Faculty: A faculty member nominated by the Head of the Department shall be in charge of offering a particular course in a particular semester of FYUGP.
- xx. Department means any teaching department in a college offering a course of study approved by the Governing body and statutory bodies of the College.
- xxi. Senior Faculty Advisor (SFA) is a faculty nominated by a Department Council to coordinate all the necessary work related to FYUGP undertaken in that department, including the Continuous Comprehensive Assessment.
- xxii. Department Council means the body of all teachers of a department in a college.
- xxiii. Faculty Advisor (FA) means a teacher from the parent department nominated by the Department Council to advise students in academic matters.
- xxiv. Graduate Attributes means the qualities and characteristics to be obtained by the graduates of a programme of study at the College, which include the learning outcomes related to the disciplinary areas in the chosen field of learning and generic learning outcomes. The graduate attributes for its programmes will be specified.
- xxv. Programme means the entire duration of the educational process including the evaluation leading to the award of a degree.
- xxvi. Programme Pathway: Combination of courses that can be chosen by a student that give options to pursue interesting and unconventional combinations of courses drawn from different disciplinary areas, like the sciences and the social sciences/ humanities. The pathways could be in terms of major- minor options with different complementary/allied disciplines.
- xxvii. Regulatory Body means University Grants Commission (UGC), All India Council for Technical Education (AICTE), National Council for Teacher Education (NCTE), Medical Council of India (MCI), Pharmacy Council of India (PCI), Indian Council for Agricultural Research (ICAR), Bar Council of India, Council of Architecture, National Assessment and Accreditation Council (NAAC) and National Board of Accreditation (NBA) etc.
- xxviii. Signature Courses: Signature courses are the specialized Discipline Specific Elective courses or skill enhancement/value addition courses offered by the regular/ ad hoc/visiting/ emeritus/ adjunct faculty member of a particular

Department with the prior recommendation of the BoS and the approval of Academic Council of the College.

- xxix. Letter Grade or simply 'Grade' in a course is a letter symbol (O, A+, A, B+, B, C, P, F, and Ab). Grade shall mean the prescribed alphabetical grade awarded to a student based on their performance in various examinations. The Letter grade that corresponds to a range of CGPA.
- xxx. Grade Point: Each letter grade is assigned a 'Grade point' (G) which is an integer indicating the numerical equivalent of the broad level of performance of a student in each course. Grade Point means point given to a letter grade on 10-pointscale.
- xxxi. Semester Grade Point Average (SGPA) is the value obtained by dividing the sum of credit points obtained by a student in the various courses taken in a semester by the total number of credits in that semester. SGPA shall be rounded off to two decimal places. SGPA determines the overall performance of a student at the end of a semester.
- xxxii. Credit Point (P) of a course is the value obtained by multiplying the grade point (G) by the credit (C) of the course:  $P = G \times C$
- xxxiii. Cumulative Grade Point Average (CGPA) is the value obtained by dividing the sum of credit points in all the semesters earned by the student for the entire programme by the total number of credits in the entire programme and shall be rounded off to two decimal places
- xxxiv. Grade Card means the printed record of students' performance, awarded to them.
- xxxv. Words and expressions used and not defined in this regulation but defined in the M. G. University Act and Statutes, and College handbook shall have the meaning assigned to them in the Act and Statutes and handbook

#### 4. Features and Objectives of SACA-UGP 2024

The features and objectives of the SACA-UGP 2024 shall be:

- i. The features, meaning, and purpose of FYUGP shall be as stipulated by the UGC and as adapted by the Kerala State Higher Education Curriculum Framework (KSHECF) and MGU-UGP (Honours) for undergraduate education.
- ii. The practice of lateral entry of students to various semesters exists, but an exit with a Degree shall be awarded only upon successful completion of 133 credits as per the conditions stipulated in this regulation.
- iii. FYUGP shall have three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG

Degree (Honours), and (c) 4-year UG Degree (Honours with Research).

- iv. Students who choose to exit after 3 years shall be awarded UG Degree in their respective Discipline/ Disciplines after the successful completion of the required minimum Courses with 133 credits.
- v. A 4-year UG Degree (Honours) in the Discipline/ Disciplines shall be awarded to those who complete the SACA-UGP with a specific number of Courses with 177 credits including 12 credits from a capstone level graduate project/dissertation. Those students who are not doing capstone project shall do three courses at the level 400 or above or three vocational training courses or internships for 12 credits.
- vi. Students who acquire minimum 75% in their graduation (upto 6<sup>th</sup> semester) are eligible for Honours with Research Programme. However, if necessary, College may conduct screening test for the honours with research programme in accordance with University and College Regulations time to time.
- vii. 4-year UG Degree (Honours with Research): Students who aspire to pursue research as a career may opt for 4-year UG Degree Honours with Research stream under FYUGP with a specific number of Courses with 177 credits including 12 credits from a research project in their major discipline.
- viii. The recognized research departments or departments with at least two faculty members having PhD shall offer the Honours with Research programme. Minimum 2 students (mentees) should be allotted to a faculty member (Mentor).
- ix. Students who have chosen the honours with research stream shall do their entire fourth year under the mentorship of a mentor.
- x. The mentor shall prescribe suitable advanced level/capstone level courses for a minimum of 20 credits to be taken within the institutions along with the courses on research methodology, research ethics, and research topic-specific courses for a minimum of 12 credits which may be obtained either within the institution or from other recognized institutions, including online and blended modes. Students shall also be allowed to pursue these three courses of 12 credits from suitable interdisciplinary/ transdisciplinary/ multidisciplinary/ vocational areas of their choice.
- xi. Students who have opted for the honours with research should successfully complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to successfully defend the research project to obtain 12 credits under a faculty member of the University/ College/Recognized Research Institute. The research shall be in the Major/ allied discipline.

- xii. The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.
- xiii. The proposed FYUGP curriculum comprises three broad parts: a) Foundation Components, b) Discipline Specific Pathway components (Major/ Minor), and c) Discipline Specific Capstone Components.
- xiv. The Foundation component of the FYUGP shall consist of a Set of General Foundation Courses and a Set of Discipline Specific Foundation Courses.
- xv. General Foundation Courses shall be grouped into 4 major baskets as Ability Enhancement Courses (AEC), Skill Enhancement Courses (SEC), Value Addition Courses (VAC), and Multi-Disciplinary Courses (MDC).
- xvi. Ability Enhancement Courses shall be designed specifically to achieve competency in English, other languages as per the student's choice with special emphasis on language and communication skills.
- xvii. English or other language courses shall be designed to enable the students to acquire and demonstrate the core linguistic skills, including critical reading, academic and expository writing skills as well as the cultural and intellectual heritage of the language chosen. Separate courses will be designed for Science, Humanities and Commerce streams.
- xviii. Multi-Disciplinary Courses (MDC) shall be so designed as to enable the students to broaden their intellectual experience by understanding the conceptual foundations of Science, Social Sciences, Humanities, and Liberal Arts. Students shall not be eligible to take the MDC in the same discipline that they have studied during their Plus Two. Third semester MDC can be Kerala specific content. Each BoS can prepare basket of courses under MDC.
- xix. Skill Enhancement Courses (SEC) shall be designed to enhance 21<sup>st</sup> century workplace skills such as creativity, critical thinking, communication, and collaboration.
- xx. Discipline Specific Courses shall include Discipline Specific Pathway Courses, both Major and Minor streams, enabling students to gain basic knowledge in the chosen discipline.
- xxi. Discipline Specific Foundation Courses shall focus on foundational theories, concepts, perspectives, principles, methods, and critical thinking essential for taking up advanced/ Capstone Courses. Practical courses shall be included in discipline specific foundation courses.
- xxii. The curriculum of the SEC should be designed in a manner that at the end of year-

1, year-2, year-3, and year-4 students are able to meet the level descriptors for levels 5, 6, 7, and 8 of the UGC Guidelines on National Skills Qualifications Framework (NSQF).

- xxiii. Value Addition Courses (VAC) shall be so designed as to empower the students with personality development, perspective building, and self-awareness.
- xxiv. Discipline Specific Pathway Components (Major/Minor) shall provide the students with an opportunity to pursue in-depth study of a particular subject or discipline and develop competency in that chosen area, which includes Discipline Specific Core (DSC) courses and Discipline Specific Elective (DSE) courses as Major and Minor courses.
- xxv. Major components consist of three types: Discipline Specific Core or the Discipline Specific Elective Courses, and the research/laboratory/fieldwork.
- xxvi. Minor Courses can be selected from any discipline. A student who completes 12 credits in a particular stream will be eligible for a minor.
- xxvii. Students who complete a sufficient number of Courses in a discipline or an interdisciplinary area of study other than their chosen Major shall qualify for a Minor in that discipline or in a chosen interdisciplinary area of study.
- xxviii. Major Components shall be the main focus of study. By selecting a Major, the student shall be provided with an opportunity to pursue an in-depth study of a particular discipline.
- xxix. Each Board of Studies (BoS) shall identify specific Courses or baskets of Courses towards Minor Course credits. Students shall have the option to choose Courses from disciplinary/ interdisciplinary minors and skill-based courses related to a chosen programme.
- xxx. Students can opt for a change of Major at the end of the second semester to any Minor discipline studied among the foundation level courses. Students can also opt for a change of Major at the end of the second semester to any MDC.
- xxxi. Students should opt their 5<sup>th</sup> and 6<sup>th</sup> semester VAC and SEC from their Major disciplines only.
- xxxii. Course cum Credits Certificate: After the successful completion of a semester, this certificate is essential as proof for re-entry to another institution. This will help the learner for preserving the credits in the Academic Bank of Credits.
- xxxiii. The Advanced Level/ Capstone Level Courses shall be designed in such a manner as to enable students to demonstrate their cumulative knowledge in their main field

of study, which shall include advanced thematic specialization or internships or community engagement or services, vocational or professional training, or other kinds of work experience.

- xxxiv. Advanced/ Capstone level Major Specialization shall include Courses focused on a specific area of study attached to a specific Major, which could be an Elective Course. They shall include research methodology as well.
- xxxv. The student has the option to register for and attend a course without taking part in the CCA and ESE of that course. Such a course is called the Audit Course. If the student has 75% attendance in an Audit Course, he/she/they is eligible for a pass in that course, without any credit (zero-credit). The Audit Course will be recorded in the final grade card of the student.
- xxxvi. All students shall undergo Summer Internship or Apprenticeship in a Firm, Industry or Organization; or Training in labs with faculty and researchers or other Higher Education Institutions (HEIs) or Research Institutions. A separate guideline for Internship Programmes will be published.
- xxxvii. Students will be provided the opportunities for internships with local industries, business organizations, agriculture, health and allied sectors, Local Government institutions (such as panchayats, municipalities), State Planning Board, State Councils/Boards, Research Institutions, Research Labs, Library, elected representatives to the parliament/state assembly/panchayath, media organizations, artists, crafts persons etc. These opportunities will enable the students to actively engage with the practical aspects of their learning and improve their employability.
- xxxviii. The College will assist in providing opportunities for field-based learning/minor Projects enabling them to understand the different socio-economic and development-related issues in rural and urban settings. The College will assist in providing the students with opportunities for Community engagement and services, exposing them to socio-economic issues to facilitate theoretical learning in real-life contexts.
- xxxix. Additional Credits will be awarded for those who actively participate in Social Activities, which may include participation in National Service Scheme (NSS), Sports and Games, Arts, participation in University/ college union related activities (for respective elected/nominated members), National Cadet Corps (NCC), adult education/literacy initiatives, mentoring school students, and engaging in similar social service organizations that deemed appropriate to the College.
- xl. Grace marks shall be awarded to a student for meritorious achievements in co-curricular activities (in Sports/ Arts/ NSS/ NCC etc.). Such a benefit is applicable in the same academic year spreading over two semesters, in which the said

meritorious achievements are earned. The Academic Council will decide from time to time the eligibility and other rules of awarding the grace marks.

- xli. Options will be made available for students to earn credit by completing quality-assured remote learning modes, including Online programmes offered on the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) or other Online Educational Platforms approved by the competent body from time to time.
- xlii. Students shall be entitled to gain credits from courses offered by other recognized institutions directly as well as through distance learning.
- xliii. For the effective operation of the FYUGP, a system of flexible academic transaction timings shall be implemented for the students and teachers.
- xliv. Specialization: Student will have the option to achieve specialization within their Major by securing 12 credits from a disciplinary/interdisciplinary area. By choosing atleast 3 courses from discipline specific elective basket under a chosen field (preferably one from 200 level course and two 300 level courses) student will be awarded specialization in that particular area of study. Each student will have the option to achieve two specializations at a time from the institution.

## **5. Eligibility for Admission and Reservation of Seats**

- i. The eligibility for admissions and reservation of seats for various FYUG Degree Programmes shall be in accordance with the norms/ rules made by the Government/University/College from time to time.
- ii. No student shall be eligible for admission to FYUG Degree Programmes in any of the disciplines unless he/she/they have successfully completed the examination conducted by a Board/University at the Plus Two level of schooling or its equivalent.
- iii. Students shall be admitted and enrolled in the respective programmes solely based on the availability of the academic and physical facilities within the institution. The College shall provide all students with a brochure detailing the Courses offered by the various departments under the various Programmes and the number of seats sanctioned for each Programme.
- iv. During the time of admission each student may be provided with a unique higher education student ID which may be linked with the Aadhar number of the students so that his ID can be transferred if required to other higher education institutions as well.

- v. The students at the end of second semester may be permitted to change their major programme of study to any course/ institution/ university across the state. Based on the availability of seats and other facilities, the students may be permitted to opt any discipline which he/she/they had studied during the first two semesters as Discipline Specific Foundation courses/ Multidisciplinary Foundation courses. If ranking is required, it will be in the order of the highest-grade points secured in the discipline to which the switching of Major is sought.
- vi. Students shall be allowed to change their major programmes, if required, to a maximum of 10% of the sanctioned strength of that particular programmes depending upon the academic and infrastructural facilities available in the Institution.
- vii. Depending upon the availability of academic and infrastructural facilities, the Institution may also admit a certain number of students who are registered for particular programmes in each semester by transfer method, if required, from other Institutions subject to conditions as may be issued by the University.
- viii. A student who has already successfully completed a First-Degree Programme and is desirous of and academically capable of pursuing another First-Degree Programme may also be admitted with the prior approval of the University as per the conditions regarding programme requirements specified by the University.
- ix. A Student can also be admitted for an additional major/ second major/ additional minor and on completion of the required credits he/she/they can be awarded a second major/ additional major/ minor. He/she/they may be exempted from minor pathway and general foundation course requirement.
- x. The HEIs can also enrol students in certain courses as per their choice depending upon the availability of infrastructure and other academic facilities from other recognized HEIs who are already registered for a particular programme there either through regular/online/distance mode irrespective of the nature of programme (Govt/ Aided/ Self- finance/ Autonomous). On successful completion of the course the credits may be transferred through the Academic Bank of Credit (ABC), against the unique higher education ID provided by the College at the time of admission.

## 6. Academic Monitoring and student Support

The academic monitoring and student support shall be in the following manner, namely

- i. College should appoint a Senior Faculty member as Academic Co-ordinator/Nodal officer for the smooth conduct of FYUGP.
- ii. Advisory System: There shall be one Senior Faculty Advisor (SFA) for each

department and one Faculty Advisor (FA) for 20 to 30 students of the class to provide advice in all relevant matters. The Head of the Department, in consultation with the SFA, shall assign FA for each student.

- iii. The documents regarding all academic activities of students in a class shall be kept under the custody of the FA/SFA.
- iv. All requests/ applications from a student or parent to higher offices are to be forwarded/recommended by FA/SFA.
- v. Students shall first approach their FA/ SFA for all kinds of advice, clarifications, and permissions on academic matters.
- vi. It is the official responsibility of the institution to provide the required guidance, clarifications, and advice to the students and parents strictly based on the prevailing academic regulations.
- vii. The SFA shall arrange separate or combined meetings with FA, faculty members, parents, and students as and when required and discuss the academic progress of students.
- viii. The FA/SFA shall also offer guidance and help to solve the issues on academic and non-academic matters, including personal issues of the students.
- ix. Regular advisory meetings shall be convened immediately after the commencement of the semester and immediately after announcing the marks of the Continuous Comprehensive Assessment (CCA).
- x. The CCA related results shall be uploaded on the College portal only after displaying the same on the department notice board/other official digital platforms of the college at least for two working days.
  - i. Any concern raised by the students regarding CCA shall be looked into in the combined meetings of advisors, HoD, course faculty, and the students concerned.
  - ii. If the concerns are not resolved at the advisor's level, the same can be referred to the properly constituted department-level grievance redressal committees
  - iii. The HOD shall ensure the proper redressal of the concerns raised by the students regarding CCA.
  - iv. If the students raise further concerns about the issue, the Principal shall refer the issue to the College-level grievance committee with proper

documents and minutes of all the committees.

- x. The FA/SFA shall be the custodian of the minutes and action taken reports of the advisory meetings. The SFA shall get the minutes and action taken reports of advisory meetings approved by the Head of Department and the Principal. It shall be the duty of the HoD and the Principal to produce them before the Governing body of the College as and when required.
- xi. The Principal shall inform/forward all regulations, guidelines, communications, announcements, etc. issued by the University regarding student academic and other matters to the HODs/ SFA for information and timely action.
- xii. It shall be the official responsibility of the Principal to extend the required administrative and financial support to the HODs, SFAs and FAs to arrange necessary orientation programmes for students regarding student counselling, the prevailing College norms, regulations, guidelines and procedures on all academic and other College related matters.
- xiii. An integrated educational planning and administration software will be made available by the College to manage the academic information of all students. Which include student admissions and registration, managing student personal and academic information, course registrations, attendance management, all process related to assessments including regular & online examinations, grading, publishing of results, supplementary examinations, LMS, stakeholders' feedback, etc.
- xiv. Faculty, staff, students, and parents shall be allowed to access this software system over a highly secure authenticated mechanism from within the campus and outside the campus.

## 7. Course Registration

- i. Each department shall publish well in advance the relevant details of courses offered, such as the name, academic level, expected outcomes, time slot, and course faculty members.
- ii. Students shall be allowed to visit and interact with respective faculty members during the first week of each semester, to gather more information about the courses and the availability of seats.
- iii. Based on consultations and advice from the faculty adviser, each student shall complete course registration within one week from the commencement of each semester.
- iv. The number of credits that a student can take in a semester is governed by the

provisions in these Regulations, subject to a minimum of 16 and a maximum of 30 Credits.

- v. A student can opt out of a Course or Courses registered, subject to the minimum Credit/ Course requirement, if he/she/they feel that he/she/they has registered for more Courses than he/she/they can handle, within 30 days from the commencement of the semester. An option can be given to the student to convert this course as audit course if he/she/they wishes to do so.
- vi. The college shall publish a list of the students registered for each course including audit course, if any, along with the chosen Programmes, repeat/reappearance courses, if any, and shall forward the same to the university.
- vii. The higher education institutions shall admit candidates not only for programmes, but also for courses.

## 8. Re-admission and Scheme Migration

- i. Students who opt out before the completion of the third year shall be provided with a 'Course cum Credits Certificate' after the successful completion of a semester as proof for re-entry to another institution.
- ii. Students who have successfully completed a particular programme pathway maybe permitted to take an additional minor or second major.
- iii. Those students who are opting for a second major are eligible for getting certain credit transfer/ credit exemption from their previous minor programs of study, subject to the prior recommendation of the BoS that, those credits are relevant for the present major programme of study.

## 9. Duration of Programmes, Credits Requirements and Options

- i. Students will be offered the opportunity to take breaks during the programme and resume after the break, but the total duration for completing the FYUG programme shall not exceed 7 years.
- ii. Students who wish to complete the undergraduate programmes faster may do so by completing different courses equivalent to the required number of credits and fulfilling all other requirements in N-1 semesters, where N is the number of semesters in the FYUGP.
- iii. Provided further that the students may complete the undergraduate programme in slower pace, they may pursue the three years or six semester programme in 4 to 5

years (8 to 10 semesters), and four years, or eight semester programme in 5 to 6 years (10 to 12 semesters) without obtaining readmission.

- iv. For students who crossed 6 semesters at a slower pace, the requirement of 16 credits per semester from the institutions where they enrolled may be relaxed.

## 10. Credit Structure

The proposed number of credits per course and the credit distribution of them for the FYUG Programmes are given below-

- i. An academic year shall consist of 200 working days; one semester consists of 90 working days; and an academic year consists of two semesters.
- ii. Ten working days in a semester shall be used for extracurricular activities. One semester consists of 18 weeks with 5 working days per week. In each semester, 15 days (3 weeks) should be kept aside for End Semester Evaluation (ESE) and CCA.
- iii. The maximum number of available weeks for curriculum transactions should be fixed at 15 in each semester. A minimum of 5 teaching or tutorial hours could be made available for a day in a 5-day week.
- iv. A course that includes one hour of lecture/ tutorial or two hours of lab work/practical work/fieldwork/practicum per week is given one credit hour.
- v. One credit in a semester should be designed for 15 hours of lectures/ tutorials or 30 hours of lab work/ practical work/ field work/ practicum and 30 hours of learner engagement in terms of course-related activities such as seminar preparation, assignment submission, etc.
- vi. A one-credit seminar or internship or studio activities or field work/ projects or community engagement and service will have two-hour engagements per week (30 hours of engagement per semester).
- vii. A course can have a combination of Lecture (L)/ Tutorial (T)/ Practicum or Practical (P)/ & Others (O) credits.
- viii. Minimum credit for one Course should be 2 (Two), and the maximum credit should be 4 (Four).
- ix. All Discipline Specific Major/Minor Courses shall be of 4 (Four) credits.
- x. For all Discipline Specific Major/Minor Courses, there may be practical/practicum.
- xi. All Courses under the Multi-Disciplinary, Ability Enhancement, Value Addition

and Skill Enhancement categories are of 3 credits. Practical/Practicum credits can also be included in this category.

- xii. Summer Internship, Apprenticeship, Community Outreach activities, etc. may require sixty hours (or as appropriate) of engagement for acquiring one credit.
- xiii. A student shall be able to opt for a certain number of extra credits over and above the requirements for the award of a degree.
- xiv. Maximum number of credits that a student can earn per semester shall be restricted to 30. Hence, a student shall have the option of acquiring credits to a maximum of 180 credits for a 3-year (6-semester) UG programmes and 240 credits for a 4-year (8-semester) programmes.
- xv. Each faculty member shall offer a maximum of 16 credits per semester. However, those who are offering both practical and theory courses shall offer a maximum of 12-16 credits per semester.
- xvi. For a four-credit theory course, 60 hours of lecture/ tutorial class shall be assured as a mandatory requirement for the completion of that course.

#### 11. Course Structure of the SACA-UGP Programmes

The SACA-UGP consists of the following categories of courses and the minimum credit requirements for pathway option-one shall be as follows:

Sl. No.	Categorization of Courses for all Programmes	Minimum Number of Credit Required	
		3-yearUG	4-yearUG
1	Major	68	88
2	Minor	24	24+12*
3	Multi-Disciplinary Courses (MDC)	9	9
4	Skill Enhancement Courses (SEC)	9	9
5	Ability Enhancement Courses (AEC)	12	12
6	Value Addition Courses (VAC)	9	9
7	Summer Internship, field-based learning etc.	2	2
8	Research Project/Dissertation		12**
	<b>Total Credits</b>	<b>133</b>	<b>177</b>

\*The students can acquire advanced/capstone level courses with 12 credits from their DSC/ DSE/ Minor courses depending upon their pathway choice. The Minor courses

can be of level 300 or above.

\*\* The students pursuing the 4-year honours with research have to complete a capstone project with 12 credits and for the 4-year honours degree students have to complete a project with 12 credits. Those honours students who are not doing capstone project shall do three courses at the level 400 or above or three vocational training courses or internships for 12 credits.

- i. 20% syllabus of each course will be prepared by the teacher as 'Teacher Specific Content' and will be evaluated under CCA.
- ii. In case of MDC, SEC, VAC courses coming under 3<sup>rd</sup> & 4<sup>th</sup> semester, college should make necessary arrangements to give adequate preference to courses designed by language departments. MDC in the 3<sup>rd</sup> semester can be Kerala Specific Content.

## 12. Academic Levels of Pathway Courses

Semester	Difficulty level	Nature of Course
1&2	100-199	Foundation level or introductory courses
3&4	200-299	Intermediate level courses
5&6	300-399	Higher level courses
7&8	400-499	Advanced/Capstone level courses

## 13. Signature Courses

- i. With a prior recommendation of BoS and the approval of academic council, each faculty member can design and offer at least one signature course in every semester, which may be offered as DSE/SEC/VAC.
- ii. College may publish a list of their signature courses in DSE/ SEC/ VAC offered by their faculty members with a prior recommendation of BoS and the approval of Academic Council.
- iii. College may empanel distinguished individuals who have excelled in their field of specialization like science and technology, industry, commerce, social research, media, literature, fine arts, civil services etc. as adjunct faculty as per the UGC guidelines with the approval of the University/College. With a prior recommendation of BoS and the approval of academic council, the adjunct faculty can offer SEC/VAC as signature course.

- iv. Adhoc/ Guest faculty/ Visiting faculty/ Visiting Scholars can also offer DSE/SEC/ VAC as signature courses with a prior recommendation of BoS and the approval of academic council.
- v. The faculty concerned may design the particular course and it should be forwarded to the BoS after the approval of department council.
- vi. The examinations and evaluation of the signature courses designed by the faculty shall be conducted by the faculty themselves and an external expert faculty chosen by the college from a panel of experts submitted by the faculty and recommend by the BoS concerned.

#### 14. Programme Pathways and Curriculum Structure

Students who have joined for any programme under these regulations shall have the option to choose the following pathways for their UG degree and Honours programme.

- i. **Degree with single Major:** A student pursuing the FYUG programme in a specific discipline shall be awarded a Major degree if he secures at least 50% of the total credits in the specific discipline required for the award of the Degree in that Discipline.  
Example: Physics Major/Economics Major/Commerce Major
- ii. **Degree Major with Minor:** If a student pursuing the FYUG Programme is awarded a Major Degree in a particular discipline, he/she/they are eligible to be awarded a Minor in another discipline of his choice, if he earns a minimum of 32 credits (approximately 25% of credit required for the three-year programme) from 8 pathway courses in that discipline.  
Example: Physics Major with Chemistry Minor/ Chemistry Major with English Minor/ Commerce Major with Economics Minor/ English Major with Functional English Minor/Hindi Major with Malayalam Minor etc.
- iii. **Major with Multiple Disciplines of Study:** This pathway is recommended for students who wish to develop core competencies in multiple disciplines of study. In this case, the credits for the minor pathway shall be distributed among the constituent disciplines/ subjects. If a student pursuing FYUG Degree Programme is awarded a major Degree in a particular discipline, he/she/they are eligible to get mentioned his core competencies in other disciplines of his choice if he has earned 12 credits from the pathway courses of that discipline.  
Example: Physics Major with Minors in Chemistry and Mathematics, Economics Major with Minors in History and English, Commerce Major with Minors in Economics and Statistics.

iv. **Interdisciplinary Major:** For these programme pathways, the credits for the major and minor pathways shall be distributed among the constituent disciplines/subjects to attain core competence in the inter disciplinary programme.

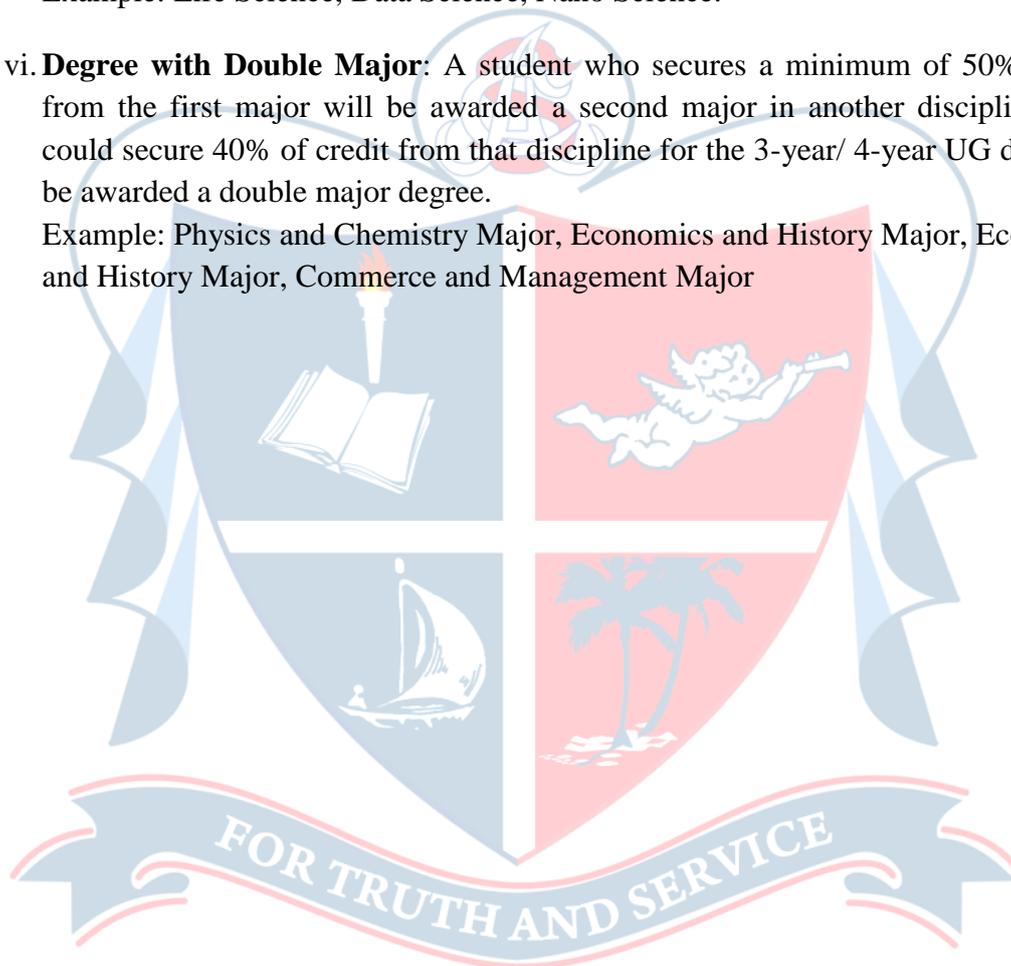
Example: Econometrics Major, Global Studies Major, Biostatistics Major.

v. **Multi-Disciplinary Major:** For multidisciplinary major pathways, the credits for the major and minor pathways will be distributed among the broad disciplines such as Life Sciences, Physical Sciences, Mathematical and Computer Sciences, Data Analysis, Social Sciences, Humanities, etc.

Example: Life Science, Data Science, Nano Science.

vi. **Degree with Double Major:** A student who secures a minimum of 50% credits from the first major will be awarded a second major in another discipline if he could secure 40% of credit from that discipline for the 3-year/ 4-year UG degree to be awarded a double major degree.

Example: Physics and Chemistry Major, Economics and History Major, Economics and History Major, Commerce and Management Major



**Pathway Option1-Degree Major or Major with Multiple Disciplines of Study**

Course Components	No. of Courses											Total	
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8		Total
DSCA (4 Credit/ Course)	1(P)	1(P)	3 (2P)	3 (2P)			5	4	17	7 Out of 17 can be opted as DSE	3	2	22
DSCB&C (4 Credit/ Course)	2(P)	2(P)	1(P) (BorC)	1(P) (CorB)					6		3		9
Multidisciplinary Courses (MDC) (3 Credit/ Course)	1(P)	1(P)	1*						3	*Cannot opt from DSC			3
Ability Enhancement Courses (AEC) (3 Credit/ Course)	1 (English) 1 (OL)	1 (English) 1 (OL)							4				4
Skill Enhancement Courses (SEC) (3 Credit/ Course)				1*			1**	1**	3	*Cannot opt from DSCA **From DSCA only			3
Value Addition Courses (VAC) (3 Credit/ Course)			1*	1*				1**	3	*Cannot opt from DSCA **From DSCA only			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours												12 (1 DSC /DSE for Honours)	
<b>Total Courses</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>			<b>6</b>	<b>6</b>	<b>36</b>		<b>6</b>	<b>2+1</b>	
<b>Total Credits</b>	<b>21</b>	<b>21</b>	<b>22</b>	<b>22</b>		<b>2</b>	<b>23</b>	<b>22</b>		<b>Total Credits 133</b>	<b>24</b>	<b>20</b>	<b>Total Credits 177</b>
<b>Total Hours per Week</b>	<b>25</b>	<b>25</b>	<b>25</b>	<b>25</b>			<b>25</b>	<b>25</b>		<b>Exit option available</b>	<b>25</b>	<b>25</b>	

**Pathway Option 2 – Major with Minor**

Course Components	No. of Courses												
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8	Total	
<b>DSCA</b> (4Credit/ Course)	1(P)	1(P)	3 (2P)	3 (2P)			4	3	15	7 Out of 15 can be opted as DSE	3	2	22
<b>DSCB</b> (4Credit/ Course)	2(P)	2(P)	1(P)	1(P)			1	1	8	1 Out of 8 can be opted as DSE	3		11
<b>Multidisciplinary Courses (MDC)</b> (3Credit/ Course)	1(P)	1(P)	1*						3	*Cannot opt from DSC			3
<b>Ability Enhancement Courses (AEC)</b> (3Credit/ Course)	1 (English) 1 (OL)	1 (English) 1 (OL)							4				4
<b>Skill Enhancement Courses (SEC)</b> (3Credit/ Course)				1*			1**	1**	3	*Cannot opt from DSCA **From DSCA only			3
<b>Value Addition Courses (VAC)</b> (3 Credit/ Course)			1*	1*				1**	3	*Cannot opt from DSCA **From DSCA only			3
<b>Project/ Dissertation</b> 12 credits for Honours with Research & 8 for Honours												12 (1DSC/ DSE for Honours)	
<b>Total Courses</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>			<b>6</b>	<b>6</b>	<b>36</b>		<b>6</b>	<b>2+1</b>	
<b>Total Credits</b>	<b>21</b>	<b>21</b>	<b>22</b>	<b>22</b>		<b>2</b>	<b>23</b>	<b>22</b>		<b>Total Credits 133</b>	<b>24</b>	<b>20</b>	<b>Total Credits 177</b>
<b>Total Hours per Week</b>	<b>25</b>	<b>25</b>	<b>25</b>	<b>25</b>			<b>25</b>	<b>25</b>		<b>Exit option available</b>	<b>25</b>	<b>25</b>	

**Pathway Option 3 – Double Major**

Course Components	No. of Courses											Total	
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8		Total
<b>DSC A</b> (4 Credit/ Course)	1(P)	1(P)	2(2P)	2(1P)			4	3	13	7 Out of 13 can be opted as DSE	3	2	18
<b>DSC B</b> (4 Credit/ Course)	2(P)	2(P)	2(1P)	2(2P)			1	1	10	2 Out of 10 can be opted as DSE	3		13
<b>Multidisciplinary Courses (MDC)</b> (3 Credit/ Course)	1(P)	1(P)	1*						3	*Cannot opt from DSC			3
<b>Ability Enhancement Courses (AEC)</b> (3 Credit/ Course)	1 (English) 1 (OL)	1 (English) 1 (OL)							4				4
<b>Skill Enhancement Courses (SEC)</b> (3 Credit/ Course)				1			1	1	3				3
<b>Value addition Courses (VAC)</b> (3 Credit/ Course)			1	1				1	3				3
<b>Project/Dissertation</b> 12 credits for Honours with Research & 8 for Honours												12 (1 DSC/DSE for Honours)	
<b>Total Courses</b>	6	6	6	6			6	6	36		6	2+1	
<b>Total Credits</b>	21	21	22	22		2	23	22		Total Credits 133	24	20	Total Credits 177
<b>Total Hours per Week</b>	25	25	25	25		25	25		Exit option available	25	25		

### 15. Guidelines for Acquiring Credit from Other Institutions/Online/Distance Mode

- i. A student shall register to a minimum of 16 credit per semester from the college/ department where he/ she/ they is officially admitted for a particular programme. However, students enrolled for a particular programme in one institution can simultaneously enrol for additional credits from other HEIs within the University or outside the University subject to a maximum of 30 credits per semester including the 16 institutional credits.
- ii. The College shall publish a list of courses that are open for admission for students from other institutions well in advance before the commencement of each semester.
- iii. Each BoS shall prepare and publish a list of online courses at different levels before the commencement of each semester offered in various online educational platforms recognized by the academic council of the College, which can be opted by the students for acquiring additional credits.
- iv. Each BoS shall prepare and publish a list of allied/relevant pathway courses before the commencement of each semester offered by other Board of Studies that can be considered as pathway courses for major/minor for their disciplines at different levels.
- v. At the end of each, the semester College will include the credit acquired by the student through online courses in their semester grade cards subject to a maximum of 30 credits.

### 16 Attendance

- i. A student shall be permitted to register for the end-semester evaluation of a specific course to acquire the credits only if he/ she has completed 75% of the prescribed classroom activities in physical, online, or blended modes, including any other activities as specified by the faculty coordinator of that particular course.
- ii. A student is eligible for attendance as per the existing university and government orders which includes participation in a meeting, or events organized by the college or the university, a regularly scheduled curricular or extracurricular activity prescribed by the college or the university. Due to unavoidable or other legitimate circumstances such as illness, injury, family emergency, care-related responsibilities, bad or severe weather conditions, academic or career-related interviews, students are eligible for authorized absence. Apart from this, all other eligible leave such as maternity leave, and menstrual leave shall also be treated as authorized absences.
- iii. The condonation facility can be availed as per the College norms.

## 17. Workload

- i. The workload of a faculty who offers only lecture courses during an academic year shall be 32 credits.
- ii. The workload of a faculty offering both practical courses and theory courses may be between 24-32 credits per academic year.
- iii. An academic year shall consist of two semesters.
- iv. To protect the existing language workload, college should make necessary arrangements to give adequate preference to those courses designed by language departments coming under MDC, SEC and VAC of 3<sup>rd</sup> & 4<sup>th</sup> semester.
- v. Programme wise workload calculation will be as per the FYUGP workload ordinance 2024.
- vi. The teachers given the administrative responsibilities in the department and college level may give a relaxation in their workload as specified in the UGC regulations 2018.

## 18. Credit Transfer and Credit Accumulation

- i. College will establish a digital storage (DIGILOCKER) of academic credits for the credit accumulation and transfer in line with ABC.
- ii. The validity of credits earned shall be for a maximum period of seven (7) years or as specified in the university/UGC regulations.
- iii. The students shall be required to earn at least 50% of the credits from the College.
- iv. Students shall be required to earn the required number of credits as per any of the pathway structure specified in this regulation for the award of the degree

## 19. Outcome Based Approach

The curriculum will be designed based on Outcome Based Education (OBE) practices. The Graduate Attributes (GA) and Programme Outcomes (PO) are provided in appendix-1. The OBE based syllabus template is provided in appendix-2.

## 20. Assessment and Evaluation

- i. The assessment shall be a combination of Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE).
- ii. 30% weightage shall be given for CCA. The remaining 70% weight shall be for the ESE.
- iii. Teacher Specific Content will be evaluated under CCA.
- iv. CCA will have two subcomponents: Formative Assessment (FA) and Summative Assessment (SA). Each of these components will have equal weightage and must be conducted by the course faculty/course coordinator offering the course.
- v. FA refers to a wide variety of methods that teachers use to conduct in-process evaluations of student comprehension, learning needs, and academic progress during a lesson, unit, module or course. FA is to encourage students to build on their strengths rather than fixate or dwell on their deficits. FA can help to clarify and calibrate learning expectations of students. FA will help students become more aware of their learning needs, strengths, and interests so they can take greater responsibility for their educational growth. FA will be the prerogative of the course faculty/course coordinator based on specific requirement of the student.
- vi. Suggested methods of FA are as follows: (any one or in combination could be followed as decided by the course faculty/course coordinator)
  - a. Practical assignment
  - b. Observation of practical skills
  - c. Viva voce
  - d. Quiz
  - e. Interview
  - f. Oral presentations
  - g. Computerized adaptive testing
  - h. In-class discussions
  - i. Group tutorial work
  - j. Reflection writing assignments
  - k. Home assignments
  - l. Self and peer Assessments
  - m. Any other method as may be required for specific course/student by the Course faculty/course coordinator
- vii. Summative Assessments (SA) are used to evaluate student learning, skill

acquisition, and academic achievement at the conclusion of a defined instructional period- typically at the end of a project, unit, module, course or semester. SA may be class tests, assignments, or project, used to determine whether students have learned what they were expected to learn. It will be based on evidence, collected using single or multiple ways of assessment. The systematically collected evidence should be kept in record by course faculty/course coordinator and the marks should be displayed on the college notice board/ other official digital platforms of the college before the end semester examinations

- viii. The method of SA will be as follows: (any one as decided by the course faculty/course coordinator)
- a. Written test
  - b. Open book test
  - c. Laboratory report
  - d. Problem based assignments
  - e. Individual project report
  - f. Case study report
  - g. Team project report
  - h. Literature survey
  - i. Standardized test
  - j. Any other pedagogic approach specifically designed for a particular course by the course faculty/course coordinator.
- ix. A student may repeat SA only if there are any compulsive reasons due to which the student could not attend the assessment
- x. The prerogative of arranging a CCA lies with the course faculty/course coordinator with the approval of SACA-UGP Academic Committee based on justified reasons
- xi. The course faculty/ course coordinator shall be responsible for evaluating all the components of CCA. However, the university may involve any other person (External or Internal) for evaluation of any or all the components as decided by the Vice-Chancellor/Pro-Vice Chancellor from time to time in case any grievances are raised.
- xii. Written tests shall be precisely designed using a variety of tools and processes (e.g., constructed responses, open-ended items, multiple-choice), and the students should be informed about the evaluation modalities before the commencement of the course.

- xiii. The course faculty may provide options for students to improve their performance through continuous assessment mechanism.
- xiv. There shall be theory and practical examinations at the end of each semester.
- xv. Regarding evaluation, one credit may be evaluated for 25 marks in a semester; thus, a 4-credit course will be evaluated for 100 marks; and 2-credit courses for 50 marks. However, for tabulation purpose course with 1-credit will be evaluated for 50 marks and will be converted to 25 marks
- xvi. Odd semester examinations will be conducted by the institution and will be evaluated at the institution level. However, even semester examinations will be conducted and evaluated by internal and external faculty.
- xvii. Individual Learning Plans (ILPs) and/ or specific assessment arrangements may be put in place for differently abled students. Suitable evaluation strategies including technology assisted examinations/alternate examination strategies will be designed and implemented for differently abled students.
- xviii. Distribution of CCA & ESE will be as given below

<b>Credit</b>	<b>CCA</b>	<b>ESE</b>
4	30	70
3	25	50
2	15	35

## 21. Practical Examination

- i. The end semester practical examination will be conducted and evaluated by the institution.
- ii. There shall be a CCA of practical courses conducted by the course faculty course coordinator.
- iii. The scheme of evaluation of practical courses will be as given below:

<b>Components for the Evaluation of Practical Courses</b>	<b>Weightage</b>
CCA of practical/practicum.	30%
ESE conducted under the supervision of internal examiner	70%

- iv. Those who have completed the CCA alone will be permitted to appear for the ESE.
- v. For grievance redressal purposes, the university shall have the right to call for all the records of CCA.
- vi. Duration of Examination  
Questions shall be set as per the defined Outcome. The question setter shall ensure that there will be Time and Mode (T & M) flexibility for all External Examinations. BoS can recommend the T&M from the following list.

Mode	Time (in Hours)	
	Minimum	Maximum
Written Examination	1	2
Multiple Choice	1	1.5
Open Book	1	2
Any Other Mode	1	2

## 22. Evaluation of Project/Dissertation

The evaluation of project work shall be CCA with 30% and ESE 70%. The scheme of evaluation of the Project is given below

Components of Evaluation of Internship	Weightage	Marks for Internship 2 Credits / 50Marks
CCA	30%	15
ESE	70%	35

The department council may decide any mode for the completion of the Internship. If in case evaluation is not specified in any of the selected internship programme, institution can adopt a proper evaluation method as per the weightage specified in the table above.

## 23. Letter Grades and Grade Points

A Mark system is followed for evaluating each question. For each course in the semester, letter grades and grade points are introduced in a 10-point indirect grading system as per the guidelines given below,

- i. The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester. The SGPA is based on

the grades of the current term, while the Cumulative Grade Point Average (CGPA) is based on the grades in all courses taken after joining the programme of study.

- ii. Based on the marks obtained, the weighted grade point will be mentioned in the student's grade cards.

Letter Grade	Grade Point	Percentage of Marks (Both Internal & External Marks put together)	Class
O (Outstanding)	10	95% and above	First Class with Distinction
A+ (Excellent)	9	Above 85% and below 95%	
A (Very good)	8	Above 75% and below 85%	
B+ (Good)	7	Above 65% and below 75%	First Class
B (Above average)	6	Above 55% and below 65%	
C (Average)	5	Above 45% and below 55%	Second Class
P(Pass)	4	Above 35% and below 45% Aggregate (external and internal put together) with a minimum of 30% in external	Third Class
F(Fail)	0	Below an aggregate of 35% or Below 30% in external evaluation	Fail
Ab (Absent)	0		Fail



- iii. When students take audit courses, they may be given pass (P) or fail (F) grade without any credits

#### 24. Computation of SGPA and CGPA

The following method is recommended to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

- i. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum

of the number of credits of all the courses undertaken by a student in the semester, i.e.

$$SGPA(S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

Where  $S_i$  is the SGPA in the  $i^{\text{th}}$  semester,  $C_i$  is the number of credits of the  $i^{\text{th}}$  course and  $G_i$  is the grade point scored by the student in the  $i^{\text{th}}$  course.

$$SGPA = \frac{\text{Sum of the credit points of all the courses in a semesters}}{\text{Total Credits in that semester}}$$

### Illustration–Computation of SGPA

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit Grade)
I	DSC A	4	A	8	4x8=32
I	DSC B	4	B+	7	4x7=28
I	DSC C	4	B	6	4x6=24
I	MDC	3	B	6	3x6=18
I	AEC 1	3	O	10	3x10=30
I	AEC 2	3	C	5	3x5=15
	Total	21			147
			SGPA		147/21=7

- ii. The CGPA is also calculated in the same manner considering all the courses undertaken by a student over all the semesters of a programme i.e.

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where  $S_i$  is the SGPA in the  $i^{\text{th}}$  semester,  $C_i$  is the total number of credits in the  $i^{\text{th}}$  semester.

*CGPA*

$$= \frac{\text{Sum of the credits of all the courses in six/eight semesters}}{\text{Total Credits in Six(133)/Eight(177) semesters}}$$

- iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

## **25. Committees to be Constituted for the Implementation and Monitoring of SACA-UGP**

- i. There shall be a college level SACA-UGP Academic Co-ordinator/Nodal Officer, academic committee and SACA-UGP department committee in each department.
- ii. The tenure of the college level committees will be 4 years.

### **SACA-UGP Academic Committee**

- i. The Principal (Chairman)
- ii. Academic Co-ordinator/Nodal Officer (Convenor)
- iii. All the Heads of Departments in the college
- iv. Four teachers of the college representing different discipline nominated by the college council by rotation
- v. Not less than four experts/academicians from outside the college representing areas such as Industry, Commerce, Education, Sciences etc., to be nominated by the college council preferably from the alumni of the college
- vi. Three nominees of the affiliating University (not less than the designation of associate professor in a college/university department)

### **Functions of SACA-UGP Academic Committee**

- i. Scrutinize, approve, and recommend to the University all the proposals submitted by the department committee with regard to the SACA-UGP such as, academic pathway, allowed syllabi enrichment/updation, details of elective courses, Online courses, blended teaching, courses offering to the students of other HEIs, panel of examiners, summative and formative evaluation tools proposed by the concerned course faculty, new courses and syllabus proposed by the faculty members as signature courses etc. The Academic Committee can differ on any proposal, and it shall have the right to return the matter for reconsideration to the concerned Department committee or reject it, after giving sufficient reasons to do so.
- ii. Scrutiny of all documents related to Teacher Specific Content.
- iii. Recommend to the College Governing Body for starting innovative

programmes using the flexibility and holistic nature of the SACA-UGP curriculum framework

### **SACA-UGP Department Committee**

- i. Head of the Department concerned (Chairman)
- ii. The entire faculties of the Department
- iii. Two subject experts from outside the college to be nominated by the MGU-UGP Academic Committee
- iv. One representative from industry/ corporate sector/ allied area relating to placement
- v. One meritorious alumnus of the department to be nominated by the department council
- vi. The department council of the SACA-UGP, may with the approval of the principal of the college, co-opt:
  - (a) Experts from outside the college whenever special courses of studies are to be formulated.
  - (b) Other faculty members of the same Faculty within the college

### **Functions of SACA-UGP Department Committee**

- i. Prepare teacher specific content of syllabi for various courses keeping in view the objectives of the SACA-UGP and submit the same for the approval of the academic committee.
- ii. Scrutinize the signature course content and its evaluation techniques.
- iii. Suggest methodologies for innovative teaching and evaluation techniques.
- iv. Suggest panel of examiners to the academic committee.
- v. Coordinate research, teaching, extension and other academic activities in the department/college.

## **26. Proposed Options for Higher Studies for the Students of SACA-UGP**

The following higher studies options at the level of post-graduation/research was described by UGC in the national higher education qualification framework;

- i. The two-year master programme will continue (with an option of having the

second year devoted entirely to research) for those who have completed a 3-year UG programme under the SACA-UGP regulations.

- ii. For students who have completed a 4-year honours degree could complete their master programme within one year by acquiring the required credits as per the Post Graduate curriculum framework requirement.
- iii. For enrolling in a PhD programme the candidate should have acquired a master degree or a 4-year honours degree with research.

## **28. Power to Remove Difficulties**

If any difficulty arises in giving effect to the provisions of these Regulations, the Principal may by order make such provisions not inconsistent with the Act, Statutes, Ordinances or other Regulations, which appears to him to be necessary or expedient for removing the difficulty. Every order made under this rule shall be subject to ratification by the Governing body.

## **29. Modifications to the Regulations**

Notwithstanding anything contained in these Regulations, any amendments or modifications issued or notified by the University Grants Commission or the State Government, from time to time, shall be deemed to have been incorporated into these Regulations and shall constitute an integral part thereof.

## **Appendix-1**

### **Graduate Attributes (GA) of St. Albert's College (Autonomous)**

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that, higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected. The expected learning outcomes are used as reference points that would help formulate graduate attributes, qualification descriptors, programme outcomes and course outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. The graduate attributes of St. Albert's College (Autonomous) are:

#### **GA1: Critical thinking and Analytical reasoning**

Capability to analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories to develop knowledge and understanding; critical sensibility to lived experiences, with self-awareness and

reflexivity of both self and society.

### **GA2: Scientific reasoning and Problem solving**

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

### **GA3: Multidisciplinary / interdisciplinary / trans disciplinary Approach**

Acquire interdisciplinary / multidisciplinary / transdisciplinary knowledge base as a consequence of the learning they engage with their programme of study; develop a collaborative – multidisciplinary / interdisciplinary / transdisciplinary-approach to formulate constructive arguments and rational analysis for achieving common goals and objectives.

### **GA4: Intra and Interpersonal skills**

Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team; lead the team to guide people to the right destination, in a smooth and efficient way.

### **GA5: Digital literacy**

Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

### **GA6: Global citizenship**

Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

### **GA7: Social Competency**

Ability to contemplate on the impact of research findings on conventional practices, and a clear understanding of responsibility towards societal needs, and reaching the targets for attaining inclusive and sustainable development.

### **GA8: Equity, Inclusiveness and Sustainability**

Appreciate equity, inclusiveness and sustainability and diversity; acquire ethical and moral reasoning and values of unity, secularism and national integration to enable to

act as dignified citizens; able to understand and appreciate diversity (caste, ethnicity, gender and marginalization), managing diversity and use of an inclusive approach to the extent possible.

### **GA9: Lifelong Learning**

Ability to acquire knowledge and skills, including learning how to gain knowledge, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of workplace through knowledge / skill development/ reskilling.

### **Programme Outcomes (PO)**

#### **PO1: Critical thinking and Analytical reasoning**

Capability to analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories to develop knowledge and understanding; critical sensibility to lived experiences, with self-awareness and reflexivity of both the self and the society.

#### **PO2: Scientific reasoning and Problem solving**

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

#### **PO3: Multi-disciplinary/interdisciplinary/transdisciplinary Approach**

Acquire interdisciplinary/multidisciplinary/transdisciplinary knowledge base, as a result of the learning they engage within their programme of study; develop a collaborative-multidisciplinary/interdisciplinary/transdisciplinary-approach to formulate constructive arguments and rational analysis for achieving common goals and objectives.

#### **PO4: Communication Skills**

Ability to express thoughts and ideas effectively in writing and in speech; communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

**PO5: Leadership Skills**

Ability to work effectively and lead respectfully with diverse teams; setting direction, formulating an inspiring vision, building a team that can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

**PO6: Social Consciousness and Responsibility**

Ability to contemplate on the impact of research findings on conventional practices, and a clear understanding of responsibility towards societal needs and reaching the targets for attaining inclusive and sustainable development.

**PO7: Equity, Inclusiveness and Sustainability**

Appreciate equity, inclusiveness and sustainability and diversity; acquire ethical and moral reasoning and values of unity, secularism and national integration to enable to act as dignified citizens; able to understand and appreciate diversity (caste, ethnicity, gender and marginalization), managing diversity and use of an inclusive approach to the extent possible.

**PO8: Moral and Ethical Reasoning**

Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour.

**PO9: Networking and Collaboration**

Acquire skills to be able to collaborate and network with educational institutions, research organisations and industrial units in India and abroad.

**PO10: Lifelong Learning**

Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of workplace through knowledge/skill development/reskilling.

### Syllabus Index

Name of the Major: **Computer Science**

#### Semester 1

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/week			
					L	T	P	O
24SACCSC1DA101 24SACCSC1DB101	Art of Computing and Problem Solving	DSC A (Major)/ DSC B (Minor)	4	5	3	0	2	0
24SACCSC1MD101	Cyber Laws and Online Safety	MDC	3	4	2	0	2	0
24SACCSC1MD102	Internet and Web Technologies							

L — Lecture, T — Tutorial, P — Practical/Practicum , O — Others

**Semester 2**

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution/week			
					L	T	P	O
24SACCSC2DA101 24SACCSC2DB101	Python Programming	DSC A (Major)/ DSC B (Minor)	4	5	3	0	2	0
24SACCSC2MD101	Data Visualization using Python	MDC	3	4	2	0	2	0
24SACCSC2MD102	Mastering Spreadsheets							

**Semester 3**

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution/week			
					L	T	P	O
24SACCSC3DA201	Database Management Systems	DSC A	4	5	3	0	2	0
24SACCSC3DA202	Data Structures using C	DSC A	4	5	3	0	2	0
24SACCSC3DE201	Introduction to Data Science(Data Science and Analytics Specialization)	DSE	4	4	4	0	0	0
24SACCSC3DE202	Introduction to Mobile and Web Technologies (Web and Mobile Technologies Specialization)							
24SACCSC3DE203	Introduction to Embedded Systems ( Embedded Systems and User Interface Design Specialization)							
24SACCSC3DE204	Ethical Hacking							
24SACCSC3DB201	Python for Data Analytics (Minor for Others)	DSC B	4	5	3	0	2	0
24SACCSC3MD201	Cloud Computing Essentials	MDC	3	3	3	0	0	0
24SACCSC3VA201	White Hat Hacking	VAC	3	3	3	0	0	0

**Semester 4**

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/week			
					L	T	P	O
24SACCSC4DA201	OOPs Concepts using JAVA	DSC A	4	5	3	0	2	0
24SACCSC4DA202	Computer Networks	DSC A	4	5	3	0	2	0
24SACCSC4DE201	Data Mining (Data Science and Analytics Specialization)	DSE	4	4	4	0	0	0
24SACCSC4DE202	Mobile App Development (Web and Mobile Technologies Specialization)							
24SACCSC4DE203	System Programming (Embedded Systems and User Interface Design Specialization)							
24SACCSC4DB201	Introduction to Database Management Systems(Minor for Others)	DSC B	4	5	3	0	2	0
24SACCSC4SE201	Foundations of Data Science	SEC	3	3	3	0	0	0
24SACCSC4SE202	Computer Hardware Maintenance							

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/week			
					L	T	P	O
24SACCSC4SE203	Visualization Tools for Data Analytics	SEC	3	3	3	0	0	0
24SACCSC4VA201	Green Computing Techniques	VAC	3	3	3	0	0	0
24SACCSC4IN201	Internship	INT	2					

### Semester 5

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution/ week			
					L	T	P	O
24SACCSC5DA301	Software Engineering	DSC	4	4	4	0	0	0
24SACCSC5DA302	Operating Systems	DSC	4	4	4	0	0	0
24SACCSC5DE301	Computer Security	DSE	4	4	4	0	0	0
24SACCSC5DE302	Resource Optimization Techniques							
24SACCSC5DE303	Artificial Intelligence (Data Science and Analytics Specialization)	DSE (Any two)	4	4	4	0	0	0
24SACCSC5DE304	Web Designing using PHP (Web and Mobile Technologies Specialization )							

24SACCSC5DE305	Design Principles of User Computer Interaction ( Embedded Systems and User Interface Design Specialization )							
24SACCSC5DE306	Advanced Cryptography & Network Security	DSE	4	4	4	0	0	0
24SACCSC5SE301	Software Development Lab 1	SEC	3	3	3	0	0	0

### Semester 6

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution/week			
					L	T	P	O
24SACCSC6DA301	Cloud Computing	DSC	4	4	4	0	0	0
24SACCSC6DA302	Software Development Lab 2	DSC	4	7	1	0	6	0
24SACCSC6DE301	Big Data Analytics (Data Science and Analytics)							

	Specialization)							
24SACCSC6DE302	Internet of Things (Web and Mobile Technologies Specialization)	DSE (Any two)	4	4	4	0	0	0
24SACCSC6DE303	Understanding MP and MC Architecture ( Embedded Systems and User Interface Design Specialization)							
24SACCSC6DE304	Digital Image Processing	DSE	4	4	4	0	0	0
24SACCSC6DE305	Social Media Mining	DSE	4	4	4	0	0	0
24SACCSC6SE301	Machine Learning using Python							
24SACCSC6SE302	Natural Language Processing	SEC	3	3	3	0	0	0
24SACCSC6SE303	Data Analytics for Business							
24SACCSC6VA301	User Centric	VAC	3	3	3	0	0	0

	Computing and Software Standards							
24SACCSC6VA302	Introduction to Cyber Crimes, Forensics & Cyber Laws							

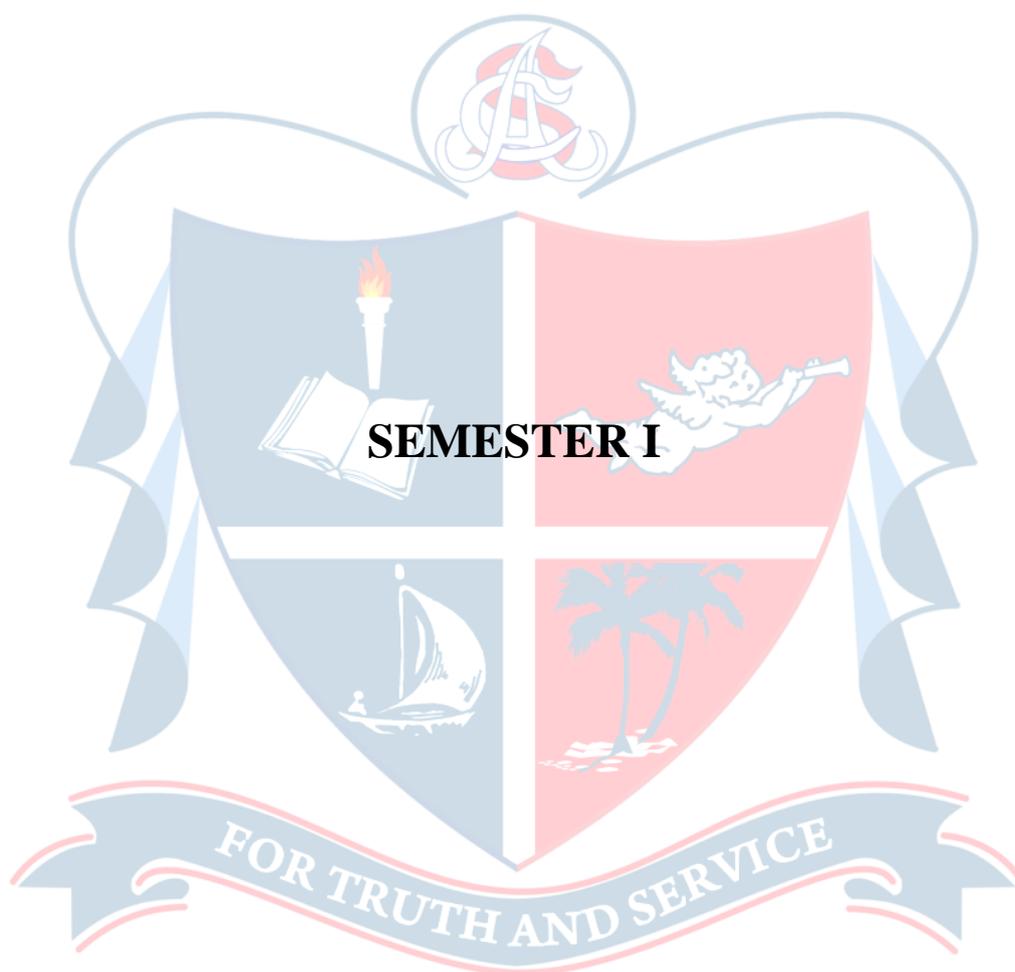
**Semester 7**

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution/week			
					L	T	P	O
24SACCSC7CC401	Advanced Java Programming	DCC	4	5	3	0	2	
24SACCSC7CC402	Advanced Database Management Systems	DCC	4	4	4	0	0	
24SACCSC7CC403	Advanced Data Structures	DCC	4	4	4	0	0	
24SACCSC7DE401	Advanced Operating System Concepts	DCE	4	4	4	0	0	
24SACCSC7DE402	Digital Image Computing	DCE	4	4	4	0	0	
24SACCSC7DE403	Big Data Management	DCE	4	4	4	0	0	

	Using R							
24SACCSC7DE404	Block chain Technology	DSE	4	4	4	0	0	
24SACCSC7DE405	Web Security	DSE	4	4	4	0	0	

### Semester 8

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution/week			
					L	T	P	O
24SACCSC8CC401	Advanced Computer Networks	DCC	4	5	3	0	2	
24SACCSC8CC402	Computational Research Methodology	DCC	4	5	3	0	2	
24SACCSC8DE401	Neural Networks and Deep Learning	DCE	4	5	3	0	2	
24SACCSC8DE402	Pattern Recognition	DCE	4	5	3	0	2	
24SACCSC8DE403	Generative AI	DCE	4	5	3	0	2	
24SACCSC8PR401	PROJECT/Dissertation	PRJ	12					





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>						
<b>Course Name</b>	<b>Art of Computing and Problem Solving</b>						
<b>Type of Course</b>	<b>DSC A</b>						
<b>Course Code</b>	24SACCSC1DA101						
<b>Course Level</b>	<b>100</b>						
<b>Course Summary</b>	This course covers fundamental concepts in computer programming, including algorithms, flowcharts, programming languages, control flow structures, arrays, and functions, emphasizing practical implementation through a series of hands-on exercises. Students will gain proficiency in solving problems using the C programming language.						
<b>Semester</b>	1		Credits			4	Total Hours
<b>Course Details</b>	Learning Approach		Lecture	Tutorial	Practical	Others	
			3	0	1	0	75
<b>Pre-requisites, if any</b>							

**COURSE OUTCOMES (CO)**

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamentals of computing and problem-solving tools and techniques.	U	1
2	Illustrate the basics of programming using C language.	U	1
3	Apply C data structures and control structures in programming.	A	2
4	Apply logic in designing solutions to various problems using C Language.	A	3

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1		Introduction to Computing and problem solving.	15	
	1.1	Basics of Computing- Bit, Byte, Data, and Information-Computer as a Data Processing machine-Computer Programs and Software-System and Application Software.	3	1
	1.2	Problem Solving Life Cycle (Software Development Method) – Specify the problem requirements - Analyze the problem- Design the algorithm - Implement the algorithm-Test and verify the completed program-Maintain and update the program.	3	1

	1.3	Understanding basic Problem-Solving Tools: Algorithms and Flowcharts- Examples.	4	1
	1.4	Problem solving approaches: Top-down approach, Bottom-up approach- Structured programming concepts.	2	1
	1.5	Computer Programming-Classification of Computer languages- Machine, Assembly and High-level languages, Language translators, Debugging, Types of errors- Syntax errors, Logical errors and Runtime errors.	3	1
	Introduction to Programming		12	
2	2.1	Introduction to C Programming: Character Set, Structure of a 'C' Program, Identifiers and keywords, Data Types, Variables, Constants, Operators, Expressions.	8	2
	2.2	Input and Output in C – Formatted functions, unformatted functions, commonly used library functions.	4	2
3	Control Flow Structures and Data Structures		18	
	3.1	Decision Statements- If, if-else, nested if-else, if-else-if ladder. Multi Branching Statement (Switch), Break and Continue, Unconditional Branching (Go to Statement).	6	3
	3.2	Loop control- for loops, nested for loops, while loops, do while loop. Nested Looping statements.	6	3
	3.3	Arrays: Declaration and Initialization of one and two- dimensional arrays, Strings.	3	3

	3.4	Functions: Definition-Declaration-Prototypes and Function call- actual and formal arguments.	3	3
4	Lab Practice		30	
	4.1	Simple C programs	5	4
	4.2	Program to illustrate control statements, Switch statement	5	4
	4.3	Program to illustrate looping statements	10	4
	4.4	Program to illustrate arrays	5	4
	4.5	Program to illustrate functions and user-defined functions	5	4
5	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods.</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Cyber Laws and Online Safety					
<b>Type of Course</b>	MDC					
<b>Course Code</b>	24SACCSC1MD101					
<b>Course Level</b>	100					
<b>Course Summary</b>	This comprehensive course on Cyber Laws, IT Act, and Online Security is designed to provide participants with a thorough understanding of the legal and security aspects in cyberspace. By the end of this course, participants will not only have a comprehensive understanding of cyber laws, cybercrimes, and online security but will also possess practical skills to navigate the digital realm safely and responsibly.					
<b>Semester</b>	1	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe cyber laws, IT Act, data protection, cybercrimes, cyber bullying, and harassment laws effectively.	U	1
2	Analyze internet security, passwords, browsing, social media, transactions.	An	1,2
3	Apply the acquired knowledge on cyber laws, IT security measures, and ethical considerations in real-world scenarios to safeguard digital information.	A	2,3

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Cyber Laws, IT Act and Cyber Crimes			
	1.1	Introduction to Cyber laws: Definition and Scope, Key legal concepts in cyber space.	2	1
	1.2	IT Act : Overview of the IT Act 2000, Offenses and penalties under the IT Act, Amendments and evolving landscape.	4	1
	1.3	Data Protection and Privacy Laws : Principles of Data Protection, Privacy laws and regulations.	3	1
	1.4	Cyber Crimes: Types of Cybercrimes, Hacking and unauthorized access, Identity theft and cyber fraud.	4	1
	1.5	Cyber Bullying and Harassment: Definition and Forms of Cyber Bullying, Legal Perspective on Cyber bullying.	4	1
	1.6	Harassment Laws and social media, Reporting and preventing cyber bullying.	3	1
2	Online Security			
	2.1	Introduction to Internet Security: Overview of Internet Security, Importance of Online Safety.	2	2
	2.2	Passwords and Authentication: Importance of Strong Password, Multi Factor Authentication (MFA).	2	2

	2.3	Secure Browsing Practices: Recognizing and Avoiding phishing Attacks, Identifying Secure Websites (HTTPS).	2	2
	2.4	Social Media Security: Privacy settings on Social media platforms, Secure sharing information.	2	2
	2.5	Online Transaction and Financial Security: Secure online shopping, Banking and Financial Security, Payment Card safety.	2	2
3	Practical Applications of Cyber Laws and Online Safety			
	3.1	Case Analysis: Assign students a cyber law case to analyze. They should present a summary of the case, identify key legal concepts involved, and discuss the offenses and penalties under the IT Act that are relevant to the case.	6	3
	3.2	Legislation Review: Ask students to review recent amendments to the IT Act and research how these changes impact the legal landscape. They should present their findings and discuss the evolving nature of cyber laws.	6	3
	3.3	Cybersecurity Incident Response Plan: Ask students to create a basic incident response plan for a hypothetical organization. This should include steps to take in case of hacking, unauthorized access, or a cybersecurity incident.	6	3
	3.4	Password Security Audit: Students should conduct a password security audit for their personal accounts. They should evaluate the strength of their passwords, implement multi-factor authentication where possible, and suggest	6	3

		improvements.		
	3.5	Phishing Awareness Campaign: Task students with creating a phishing awareness campaign.  Secure Online Transactions: Ask students to research and compile a guide on best practices for secure online transactions. This should cover topics such as secure online shopping, banking, and payment card safety.	6	3
4		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Lectures, Discussions, Case Analysis
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 15 Marks</b></p> <ol style="list-style-type: none"> <li>Written test</li> <li>Assignments</li> </ol> <p><b>CCA for Practical: 15 Marks</b></p> <ol style="list-style-type: none"> <li>Assignments</li> <li>Record</li> <li>Viva</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 35 Marks (1 Hr)</b></p> <p>Part A: MCQ (Answer all) - (15*1=15 Marks)</p>

	<p>Part B: Short Answer Questions(4 out of 6 Questions) – (4*5=20 Marks)</p> <p><b>ESE for Practical: 35 Marks</b></p> <ol style="list-style-type: none"><li>1. Report - 15 Marks</li><li>2. Viva - 20 Marks</li></ol>
--	--

## REFERENCES

1. Vakul Sharma, “Information Technology Law and Practice”, 3rd ed. 2011, Universal Law Pub., New Delhi.
2. Adv. Prashant Mali, “Cyber Law & Cyber Crimes”, Snow White Publications Pvt. Ltd, 2nd ed. 2015.
3. Michael Cross , “Social Media Security: Leveraging Social Networking While Mitigating Risk”, Elsevier, 2014.
4. William Stallings & Lawrie Brown “ Computer Security – Principles and Practice” 3rd ed., Pearson Pub., 2017.

## SUGGESTED READINGS

1. “Cyber Law in India” by Pavan Duggal
2. “Cyber Security: APractitioner’s Guide” by Eric Cole
3. “Principles of Intellectual Property” by Stephen M McJohn 4. “The Indian Cyber Law” by Sandeep Agrawal



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Internet and Web Technologies</b>					
<b>Type of Course</b>	<b>MDC</b>					
<b>Course Code</b>	<b>24SACCSC1MD102</b>					
<b>Course Level</b>	<b>100</b>					
<b>Course Summary</b>	The course covers the fundamentals of computer networks, including types, topologies, communication mediums, networking tools, security, and an introduction to the Internet, HTML, and webpage design.					
<b>Semester</b>	1	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>		2	0	1	0	60

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamentals of computer networks and Internet.	U	1
2	Illustrate basic HTML tags for webpage designing.	U	1,2
3	Design websites using HTML tags.	A	2,3

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Computer networks and Internet			
	1.1	Computer Networks –Types of Networks: WAN, MAN, LAN, PAN, CAN- Benefits of Networks.	2	1
	1.2	Network Topology –Bus, Ring, Star, Tree, Mesh, Hybrid- Communication Medium: Wired and Wireless.	4	1
	1.3	Networking Tools- MODEM, Repeater, Hub, Switches, Routers, Bridge, Gateway- Network Security –Firewalls.	3	1
	1.4	Internet - History, Benefits and Drawbacks, Internet Protocols: TCP/IP, FTP, HTTP, IP Address, Domain Name System (DNS), URL.	3	1
	1.5	Web Browsers, WWW, Search Engines – Types, Academic Search Techniques - Applications of Internet.	3	1
2	HTML and Webpage			
	2.1	Introduction to HTML – Essentials- Static & Dynamic Web Pages - Structure of a Web Page.	2	2
	2.2	Designing Web Pages- HTML Tags -Text Formats- Working with Text- Presenting and Arranging Text-Paragraphs- Animated Effects: Marquee – using White Space.	5	2
	2.3	Tables in HTML Working with Links.	4	2

	2.4	Lists, Images, Thumbnails, Audio & Video-Forms & Frames.	4	2
3	Lab Practice: Webpage designing			
	3.1	Text Formatting: Create a webpage demonstrating various text formatting options such as bold, italics, underline, strikethrough, and superscript/subscript using HTML tags.	6	3
	3.2	Lists: Develop a webpage showcasing different types of lists (unordered, ordered, and definition lists). Experiment with nested lists.	6	3
	3.3	CTabular Presentation: Build a webpage illustrating the use of HTML tables for organizing data. Explore table attributes for modifying cell spacing, padding, borders, and alignment. Incorporate colspan and rowspan attributes for complex table layouts.	6	3
	3.4	Form Creation: Construct a webpage containing a form with various input elements such as text fields, checkboxes, radio buttons, select dropdowns, and text areas.	6	3
	3.5	PFrame Integration: Design a webpage with multiple frames using the <frame> and <frameset> tags. Experiment with different frame configurations such as rows, columns, and nested frames. Showcase the use of the <noframes> tag for browsers that do not support frames.	6	3
4		<b>Teacher specific content</b>		

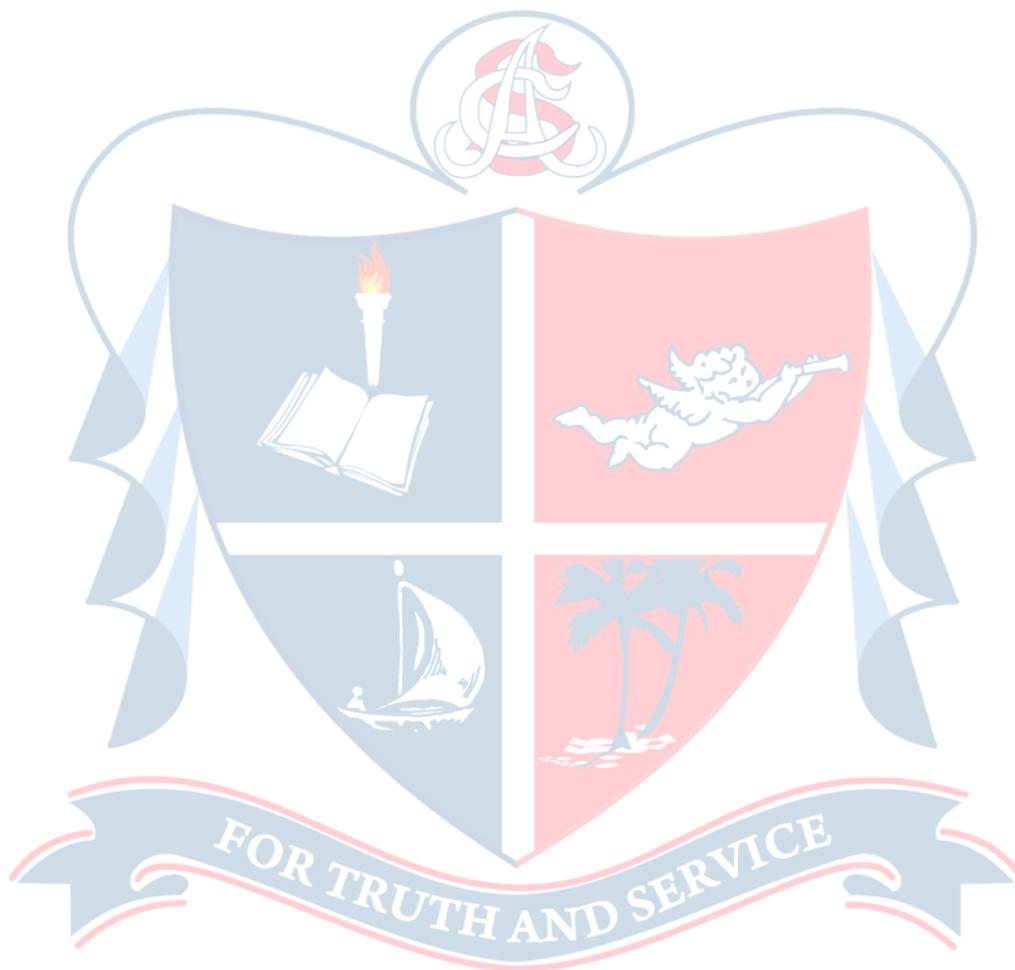
<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b>  Lecture, Practical, Demonstration through ICT tools
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 15 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 15 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 35 Marks (1 Hrs)</b></p> <p>Part A: MCQ (Answer all) - (15*1=15 Marks)</p> <p>Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks)</p> <p><b>ESE for Practical: 35 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"> <li>1. Design and Development - 20 Marks</li> <li>2. Viva - 10 Marks</li> <li>3. Record - 5 Marks</li> </ol>

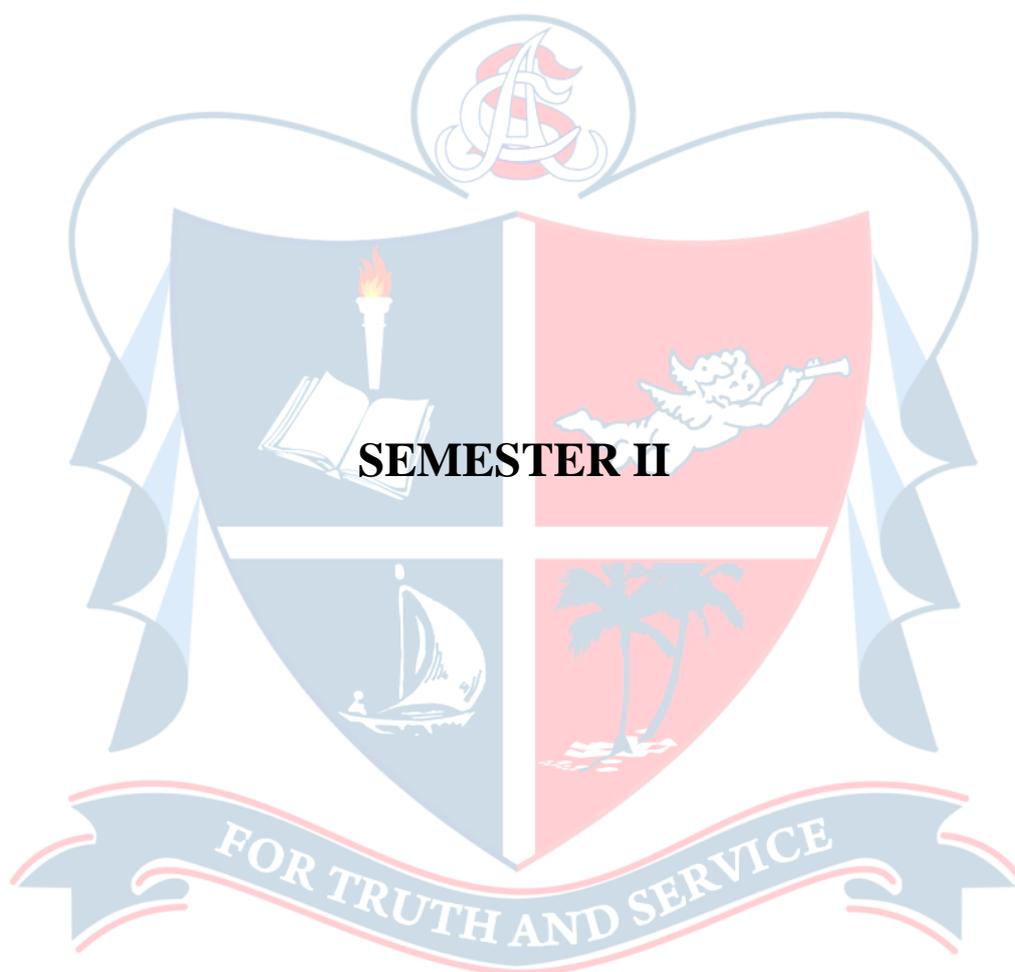
**REFERENCES**

1. Raj Kamal, "Internet & Web Technologies", Tata McGraw Hill.

**SUGGESTED READINGS**

1. Thomas. A. Powell, "HTML & CSS: The Complete Reference", 5th Edition, Tata McGraw Hill.
2. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson.







## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Python Programming					
<b>Type of Course</b>	DSC A					
<b>Course Code</b>	24SACCSC2DA101					
<b>Course Level</b>	100					
<b>Course Summary</b>	This course aims to provide students with a well-rounded understanding of Python programming, empowering them to tackle a variety of programming challenges and laying the groundwork for more advanced programming endeavours.					
<b>Semester</b>	2	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>		3	0	1	0	75

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe fundamental concepts of Python programming language	U	1
2	Apply Python control structures in programming	A	2
3	Apply Python data structures in programming	A	1,2
4	Develop Python programs demonstrating control flow structures and data structures	A	2,3

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1		Introduction to Python Programming	12	
	1.1	Python features, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity	6	1
	1.2	Data types-Numbers, Boolean, Strings, None-Indentation, Comments, Reading Input, Print Output, Type Conversions	6	1
2		Python Control Structures	15	
	2.1	Decision Control Flow Statements – if, if-else, elif-else, nested if- Example python scripts	7	2
	2.2	Iterative statements - while, for, Nested loops, break and continue statements- Example python scripts	8	2
3		Python Data Structures	18	
	3.1	Lists: Creating Lists, Basic List Operations. list() function, Indexing and Slicing, Built-in-functions, List Methods, del statement.	3	3
	3.2	Tuples: Creating Tuples, Basic Tuple Operations, tuple() function, Indexing and Slicing, Built-in-functions on Tuples, Tuple methods, zip() Function.	3	3
	3.3	Dictionaries: Creating Dictionary, Accessing, and modifying, dict() function, Built-in- functions,	3	3

		Dictionary methods, del statement.		
	3.4	Sets: Creating sets, Set methods	3	3
	3.5	Functions: Built-in-functions, User defined functions, Function Calls, The return Statement and void Function	3	3
	3.6	Files: Opening a file – Modes for opening a file and Attributes of file object, Closing a file, Writing to a file, Reading from a file, Renaming a file, Deleting a file	3	3
4		<p>Lab Practice</p> <ol style="list-style-type: none"> <li>1. Basic programs in Python: Display the use of variables and basic expressions, demonstrate arithmetic operators and data type conversions, create a Python script that involves working with numbers, floats, and string operations.</li> <li>2. Programs Using Control structures: Logical operators and control flow using ifelse statements, while and for loops in Python.</li> <li>3. Programs Using Data structures: Manipulate lists, tuple, dictionary and sets Programs demonstrating different data structure methods.</li> <li>4. Programs using function: Python script incorporating basic in-built functions and demonstrating their usage. Implementation of user-defined functions, function calls, and parameterized function calls.</li> <li>5. Programs using Files: Python scripts to open, read, and write to files, renaming and deleting files, illustrating file handling concepts in Python.</li> </ol>	30	4

5	<b>Teacher specific content</b>		
---	---------------------------------	--	--

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p style="text-align: center;"><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p style="text-align: center;"><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions(1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p>

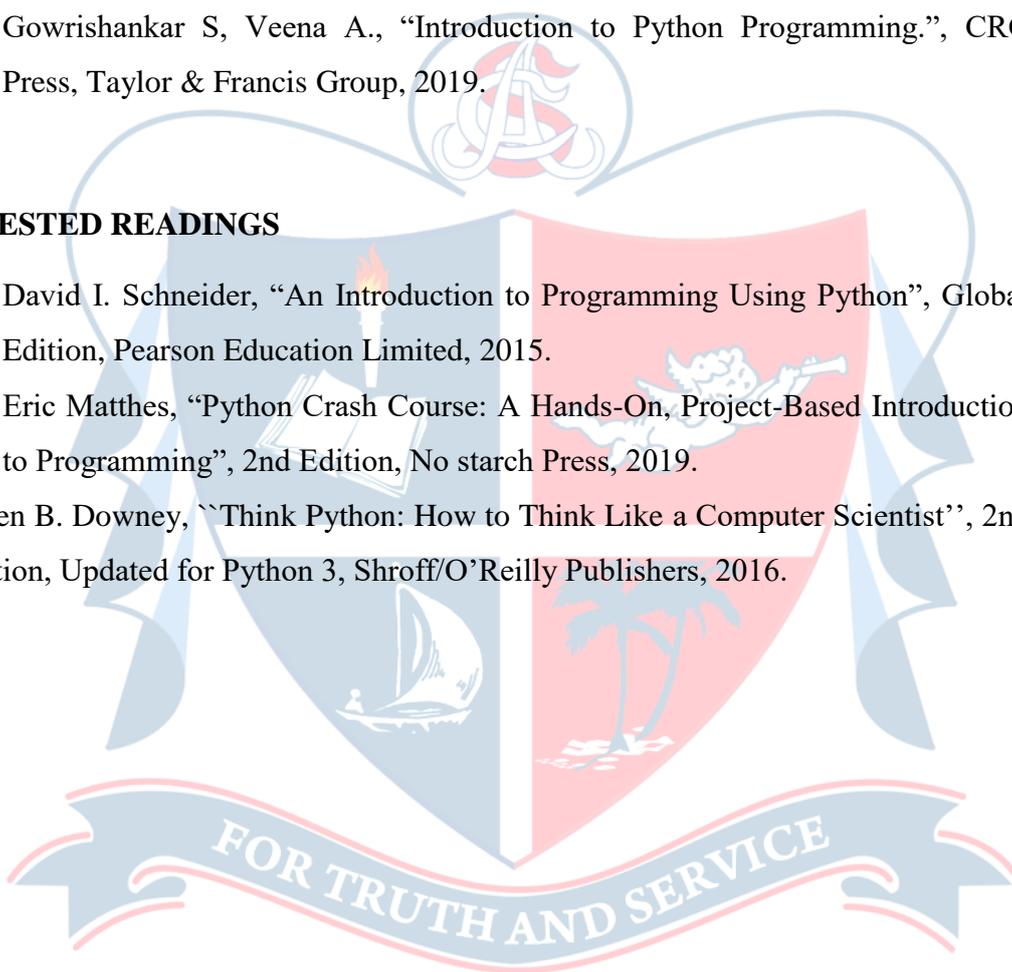
	<ol style="list-style-type: none"><li>1. Logic &amp; Successful Compilation - 5 Marks</li><li>2. Output - 5 Marks</li><li>3. Viva - 5 Marks</li><li>4. Record - 5 Mark</li></ol>
--	--

## REFERENCES

1. Gowrishankar S, Veena A., "Introduction to Python Programming.", CRC Press, Taylor & Francis Group, 2019.

## SUGGESTED READINGS

1. David I. Schneider, "An Introduction to Programming Using Python", Global Edition, Pearson Education Limited, 2015.
2. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", 2nd Edition, No starch Press, 2019.
3. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Data Visualization using Python</b>					
<b>Type of Course</b>	<b>MDC</b>					
<b>Course Code</b>	<b>24SACCSC2MD101</b>					
<b>Course Level</b>	<b>100</b>					
<b>Course Summary</b>	This course offers a comprehensive introduction to data visualization principles and practices. Students will learn the importance and applications of data visualization, develop skills using popular libraries like Matplotlib, Seaborn, and Plotly, and explore best practices for effective visual representation. By the end of the course, students will apply these techniques to real-world datasets and create compelling data visualization projects.					
<b>Semester</b>	2	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>		2	0	1	0	60

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate the fundamental principles of data visualization.	U	1
2	Use various plotting techniques for data visualization.	A	1,2

3	Apply data visualization techniques to real-world datasets using Python libraries.	A	1,2,3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	<b>Introduction to Data Visualization</b> Overview of data visualization concepts, Importance and applications of data visualization.	5	1
	1.2	<b>Introduction to Matplotlib:</b> Basic plotting with Matplotlib, Customizing plots: labels, colors, styles.	5	1
	1.3	Plot types: line plots, scatter plots, bar plots, Subplots and layouts, Annotations and text, Plotting with pandas.	5	1
2	2.1	<b>Introduction to Seaborn:</b> Seaborn basics and advantages, Statistical plotting with Seaborn, Seaborn themes and aesthetics.	5	2
	2.2	<b>Advanced Seaborn:</b> Multi-plot grids, Categorical plots.	5	2

	2.3	<b>Seaborn extensions:</b> Swarm plots, Violin plots.	5	2
3	3.1	Introduction to Plotly, Overview of Plotly library, Interactive plotting basics, Creating interactive charts and dashboards, Customizing interactive plots, Plotly Express for rapid visualization, Plotly Dash for web-based applications.	10	3
	3.2	<b>Data Visualization Best Practices:</b> Principles of effective visualization, Choosing the right chart type, Color theory and accessibility.	5	3
	3.3	<p><b>Case Studies and Real-world Applications</b></p> <ul style="list-style-type: none"> <li>• Visualizing real-world datasets</li> <li>• Apply learned techniques to a self-selected dataset</li> <li>• Create a comprehensive data visualization project</li> </ul>	15	3
4		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <p>Lecture, Demonstration, Lab Exercises</p>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 15 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 15 Marks</b></p>

	<ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 35 Marks (1 Hrs)</b></p> <p>Part A: MCQ (Answer all) - (15*1=15 Marks)</p> <p>Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks)</p> <p><b>ESE for Practical: 35 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"> <li>1. Design and Development - 20 Marks</li> <li>2. Viva - 10 Marks</li> <li>3. Record - 5 Marks</li> </ol>

## REFERENCES

1. Kalilur Rahman, "Python Data Visualization Essential Guide" , BPB Publications, 2021

## SUGGESTED READINGS

1. Jake VanderPlas, "Python Data Science Handbook Essential Tools for Working with Data", O'Reilly Media, 2016.
2. "Interactive Data Visualization for the Web" by Scott Murray
3. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic
4. Additional Resources: Online documentation and tutorials for Matplotlib, Seaborn, and Plotly.
5. Kaggle and GitHub repositories for code examples and projects.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Mastering Spreadsheets</b>					
<b>Type of Course</b>	<b>MDC</b>					
<b>Course Code</b>	<b>24SACCSC2MD102</b>					
<b>Course Level</b>	<b>100</b>					
<b>Course Summary</b>	This course covers fundamental spreadsheet skills, advanced formula application, data visualization techniques, pivot table analysis, and macro automation for effective data processing, analysis, and visualization.					
<b>Semester</b>	2	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate the fundamental concepts of spreadsheet packages	U	1
2	Apply functions, formulas, charting techniques, and pivot tables for data representation and analysis	A	1,2
3	Utilize spreadsheet software to perform numerical computations and analyze data across various datasets	A	2,3

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Spreadsheet as a processing, analysis and visualisation tool, Layout of a worksheet- Title bar, Menu bar, Formula bar.	5	1
	1.2	Cell addressing, Data entry, Data Types, Data formatting, Data selection, Named ranges, Importing Data.	5	1
	1.3	Fill handle, Autofill, Autosum, Borders, Find and Replace, Sort, Filter, Advanced filter, Conditional formatting.	5	1
2	2.1	Formulas- Absolute addressing and relative addressing, IF statement, Functions- Categories, Exploring functions -Mathematical, Statistical, Text, Financial, and Date functions.	6	2
	2.2	Data representations and comparison using charts and pivot table- Different type of charts, Creation of charts, Setting Chart parameters, Customising charts, Creating and Manipulating Pivot table.	6	2
	2.3	Advanced features - Macros, Advantages of Macro, Creating and editing a macro, running a macro, Exporting Data, Printing data and result.	3	2
3	3.1	Basic Spreadsheet Skills: Create a simple spreadsheet including various types of data, format cells, use basic functions like autosum, and apply conditional formatting to highlight	8	3

		important information.		
	3.2	Formula and Functions: Create a spreadsheet and apply formulas and functions for data computation (Mathematical, Statistical, Text, Financial, and Date functions).	6	3
	3.3	Data Visualization with Charts: Explore different types of charts to represent data by adjusting chart parameters and customizing visual elements for clarity and impact.	8	3
	3.4	Pivot Table Analysis: Create a pivot table to analyze data, explore different dimensions, and summarize information using calculated fields. Macro Automation: Automate repetitive tasks using macros.	8	3
<b>4</b>		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <p>Lecture, Practical, Demonstration through ICT tools</p>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 15 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 15 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> </ol>

	<p>3. Observation of practical skills 4. Viva</p>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 35 Marks (1 Hrs)</b></p> <p><b>Written Test (35 Marks)</b></p> <p>Part A: MCQ (15*1=15 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p><b>ESE for Practical: 35 Marks (1.5 Hrs)</b></p> <p>1. Procedure - 10 Marks 2. Output - 10 Marks 3. Viva - 10 Marks 4. Record - 5 Marks</p>

## REFERENCES

1. Documentation Team, LibreOffice. LibreOffice 7.1 Calc Guide. N.p., Jean Hollis Weber, 2021.

## SUGGESTED READINGS

1. Documentation Team, LibreOffice. "Getting Started with LibreOffice 6.0". Friends of OpenDocument, INC, 2018.
2. <https://documentation.libreoffice.org/assets/Uploads/Documentation/en/GS7.3/GS73-GettingStarted.pdf>





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Database Management Systems					
<b>Type of Course</b>	DSC A					
<b>Course Code</b>	24SACCSC3DA201					
<b>Course Level</b>	200					
<b>Course Summary</b>	This course provides a comprehensive exploration of fundamental concepts in database management. The course delves into the Relational Model, Entity-Relationship Modeling, SQL, normalization. The course also covers transaction processing, desirable properties of transactions					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental concepts of database systems.	U	1
2	Analyse Relational database model	An	1,2

3	Apply SQL queries to create and manipulate relational databases.	A	2,3
4	Apply DDL Commands to manage Database operations.	A	1,2,3
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to database, database management systems, functions of DBMS, characteristics of database approach	2	1
	1.2	Database users- database administrator, database designers, end users. Advantages of using DBMS approach.	2	1
	1.3	Database system Concepts and Architecture - Data model, schema, instance, categories of data model, data independence- physical and logical data independence, three-schema architecture.	2	1
	1.4	Database system environment- DBMS component modules	2	1
	1.5	Conceptual data modeling using Entity Relationship model- main phases of database design.	2	1
	1.6	Entity type, entity set, attributes, types of attributes, domain of attributes, keys- super key,	2	1

		candidate key, primary key		
	1.7	Relationship Types, Relationship Sets, Roles and Structural Constraints – Weak Entity Types – Notation for ER diagrams – Sample ER diagrams.	3	1
2	2.1	Relational Data Model- Domains, Attributes, Tuples and Relations-Characteristics of Relations –Relational Model Constraints and Relational Database Schemas : Domain Constraints, Key Constraints, Relational Database Schemas, Entity Integrity, Referential Integrity, and Foreign Keys.	7	2
	2.2	Normalization: Informal Design Guidelines for Relational Schemas –Functional Dependencies – Normal forms : First Normal Form, Second Normal Form, Third Normal Form – General Definitions of Second and Third Normal Forms – Boyce-Codd Normal Form.	8	2
3	3.1	Structured Query Language - DDL, DML, DCL commands	1	3
	3.2	Basic data types in SQL, Data Definition commands : CREATE, ALTER, DROP - Adding constraints in SQL	2	3
	3.3	Basic SQL Queries : INSERT, SELECT, DELETE, UPDATE, Substring comparison using LIKE operator, BETWEEN operator	3	3
	3.4	Ordering of rows – SQL set operations: UNION, EXCEPT, INTERSECT	2	3
	3.5	Nested queries, EXISTS and UNIQUE functions, Renaming of attributes	2	3

	3.6	Joining of tables, Aggregate functions ,GROUP BY, Managing Views	2	3
	3.7	Transaction-state, desirable properties of transaction	3	3
4	4.1	<ul style="list-style-type: none"> <li>● Creating and altering the structure of a table in the database using DDL commands</li> <li>● Inserting rows to the table using INSERT command</li> <li>● Modifying data in the table using UPDATE and DELETE</li> <li>● Basic querying using SELECT</li> </ul>	30	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods.</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>

<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) – (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"><li>1. Coding and Output - 10 Marks</li><li>2. Viva - 5 Marks</li><li>3. Record - 5 Marks</li></ol>
--

## REFERENCES

1. Ramez Elmasri and Shamkant B. Navathe (2010). Database Systems (6th Edition). Pearson Education.

## SUGGESTED READINGS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 7th Edition, McGraw Hill
2. C.J Date- An Introduction to Database Systems, Eighth edition, Pearson Education, 2003.
3. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems, Third edition, Mc Graw Hill International Edition.
4. Dipin Desai, An Introduction to Database Systems, First Edition, Galgotia Publications.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Data Structures using C</b>					
<b>Type of Course</b>	<b>DSC A</b>					
<b>Course Code</b>	<b>24SACCSC3DA202</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course provides the concepts of fundamental data structures and their implementations in C. Starting with an introduction to structured data, students delve into arrays, stacks, queues, linked lists and trees. The course covers memory allocation, operations, applications and emphasizes practical examples and hands-on programming					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>	Basic knowledge of programming in C and an understanding of fundamental computer science concepts.					
		3	0	1	0	75

**COURSE OUTCOMES (CO)**

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe functions, the fundamental concepts of static and dynamic data structures and Compare and Contrast different searching and sorting techniques.	U	1
2	Apply linear data structures such as stacks and queues	A	2
3	Implement operations on linked lists and trees.	An	2
4	Devise programs for implementing Fundamental Data Structures.	A	1,2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Function Calls , Parameterized function calls, Function returns, Recursive functions, types, Scope concepts - local, global	3	1
	1.2	Introduction to Data Structures, Definition, classification of data structures, Primitive and Nonprimitive	2	1
	1.3	Operations on data structures, Arrays, Representation of array in memory	3	1
	1.4	Linear array operations, Search-Searching techniques - Linear search, Binary Search, Sort - Sorting Techniques, Bubble sort, Merge sort, Recursion.	4	1
2	2.1	Stack, Definition, Array representation of	3	2

		stack, Operations on stack		
	2.2	Infix, prefix and postfix notations, Conversion of an arithmetic expression from infix to postfix, Postfix evaluation, Applications of stack	5	2
	2.3	Queue- Definition, Array representation of queue, Simple queue operations, Circular queues, Double ended queue, Priority queue..	5	2
3	3.1	Dynamic memory allocation and pointers, Linked list definition, Components of linked list, Representation of linked list, Advantages and disadvantages of linked lists	5	3
	3.2	Types of linked list, Singly linked list - Operations on singly linked list	5	3
	3.3	Trees - Concept of recursion, trees, tree terminology, binary trees, representation of binary trees, Types of binary tree. creation and operations on binary tree,	5	3
	3.4	Binary search trees, Creation of binary search tree, tree traversing methods – examples	5	3
4	Practicals		30 Hrs	
	4.1	Implement array insertion, Deletion	5	4
	4.2	Implement Linear Search, Binary Search, Bubble Sort, Selection Sort, Merge Sort	6	4
	4.3	Implement stack and Queue operations using arrays	6	4
	4.4	Implement Circular Queue operations.	6	4

	4.5	Implement operations on a linked list	7	4
<b>5</b>	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>• Use of ICT tools in conjunction with traditional classroom teaching methods.</li> <li>• Interactive sessions</li> <li>• Class discussions</li> <li>• Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) – (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p>

	<p style="text-align: center;"><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"><li>1. Logic &amp; Successful Compilation - 5 Marks</li><li>2. Output - 5 Marks</li><li>3. Viva - 5 Marks</li><li>4. Record - 5 Marks</li></ol>
--	---

## REFERENCES

1. G.S Baluja (2004). Data Structures Through C (A Practical Approach) (2nd Edition). Danapat Rai & Co.
2. Ellis Horowitz and Sartaj Sahni. Fundamentals of Data Structures (2nd Edition). Galgotia Publications.

## SUGGESTED READINGS

1. Seymour Lipschutz, Theory and Problems of Data Structures, Schaums Outline Series, 2006, McGraw Hill
2. Yedidyah Lamngsam, Moshe Augustein, Aaron M Tenenbaum- Data structures using C and C++, Second Edition, Prentice Hall



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Introduction to Data Science</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC3DE201</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course covers key concepts from data collection to modeling, emphasizing practical skills in preprocessing, exploratory analysis, and linear regression. With real-world applications and security considerations, learners gain essential knowledge for success in data science.					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the need, evolution, roles, life cycle, applications, prerequisites, tools, and security issues in data science.	U	1

2	Understand data types, sources, collection methods, statistical descriptions, and pre-processing techniques.	A	2
3	Analyse the importance, types, techniques, steps, and tools for performing exploratory data analysis	An	2
4	Analyze the steps in data science modeling, including linear regression, model selection, diagnostics, evaluation metrics, and cross-validation techniques.	U,An	1,2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Data Science - Need of data Science - Evolution of Data Science – Data Science Roles	5	1
	1.2	Data Science Life Cycle - Applications of Data Science in various fields – Prerequisites & Tools for Data Science - Data Security Issues.	7	1
2	2.1	Introduction to Data - Types of data - Sources of data – Data Collection methods - Basic Statistical Descriptions of Data	7	2
	2.2	Data Pre-Processing Overview:Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.	5	2
3	3.1	Exploratory Data Analytics – Importance of EDA – Types of EDA	5	3

	3.2	Univariate Analysis, Bivariate Analysis, Multivariate Analysis	5	3
	3.3	Specialized EDA Techniques - Steps for performing EDA - Tools for Performing EDA.	7	3
4	4.1	Data Science Modelling – Steps in Data Science Modelling - Simple Linear Regression - Multiple Linear Regression	6	4
	4.2	Linear Model Selection and Diagnostics. - Model Evaluation and Metrics in Data Science - Common Evaluation Metrics: Confusion matrix - Mean Absolute Error (MAE) - Mean Squared Error (MSE) - Root Mean Squared Error (RMSE)	10	4
	4.3	Cross Validation: K-fold cross-validation - stratified cross-validation.	3	4
5	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods.</li> <li>● Interactive sessions</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>

	<p style="text-align: center;"><b>B. Semester End examination</b></p> <p style="text-align: center;"><b>ESE for Theory:70 Marks (2 Hrs)</b></p> <p style="text-align: center;">Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p style="text-align: center;">Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p style="text-align: center;">Part C: Essay Questions (2 out of 4 Questions)- (2*10=20 Marks)</p>
--	--

### References

1. Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013

### SUGGESTED READINGS

1. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global
2. Tilman M. Davies " The Book of R" 2016, No Starch Press
3. T. M. Mitchell, "Machine Learning", McGraw Hill, 2017



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Introduction to Mobile and Web Technologies</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC3DE202</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course provides a comprehensive overview of mobile and web technologies, covering their history, core technologies, web and mobile architecture, responsive design principles, and security practices, while also exploring emerging trends like Progressive Web Apps (PWAs) and the role of AI and ML in modern applications.					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the history and Current Landscape of Mobile and Web Technologies	U	1

2	Understand web architecture basics, core technologies, popular frameworks, server-side tech, and responsive design principles for improved cross-device experiences	A	2
3	Demonstrate the mobile architecture, explores core technologies and emphasizes principles of user experience design for intuitive mobile interfaces.	U, An	2
4	Apply security measures against common vulnerabilities, secure mobile apps through encryption and coding practices, develop Progressive Web Apps, and explore AI and ML in mobile and web technologies.	U,A	1,2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	History and Evolution-Early web and mobile technologies, Milestones in the development of the internet and mobile devices.	5	1
	1.2	Current Landscape-Overview of modern mobile and web technologies, Key players in the industry (Apple, Google, Microsoft, etc.)	5	1

2	2.1	Web Architecture-Client-server model, Front-end vs. back-end, Web protocols (HTTP/HTTPS).	5	2
	2.2	Core Web Technologies-HTML, CSS, and JavaScript, Web development frameworks (React, Angular, Vue.js), Server-side technologies (Node.js, Django, Ruby on Rails).	7	2
	2.3	Responsive Web Design-Principles of responsive design, Media queries and flexible grid layouts.	5	2
<b>Mobile Technologies</b>				
3	3.1	Mobile Architecture- Mobile operating systems (iOS, Android), Mobile app lifecycle	5	3
	3.2	Core Mobile Technologies- Native vs. hybrid vs. web apps, Mobile development frameworks (React Native, Flutter, Xamarin)	5	3
	3.3	User Experience in Mobile Apps- Principles of mobile UI/UX design, Human Interface Guidelines (HIG) and Material Design.	5	3
<b>Security and Trends in Mobile and Web Applications</b>				
4	4.1	Web Application Security- Common vulnerabilities (XSS, SQL Injection), Security best practices.	5	4
	4.2	Mobile Application Security - Data encryption, Secure coding practices.	5	4

	4.3	Progressive Web Apps (PWAs)-Features and benefits, Development considerations. Artificial Intelligence and Machine Learning in Mobile and Web- Current applications and future possibilities.	8	4
5	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods.</li> <li>● Interactive sessions</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory:70 Marks (2 Hrs)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>

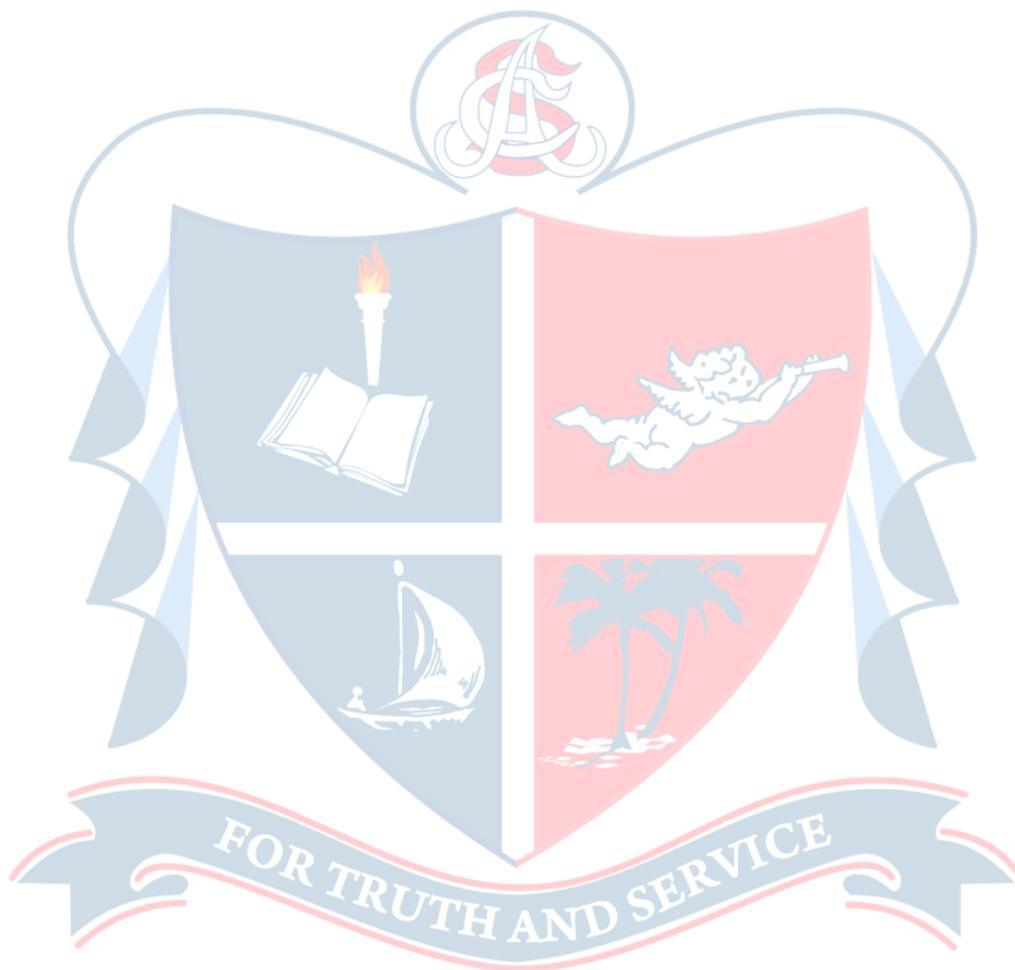
## REFERENCES

1. "Mobile Application Development: A Practical Approach" by Jeff McWherter and Scott Gowell

2. "Web Security for Developers: Real Threats, Practical Defense" by Malcolm McDonald

### **SUGGESTED READINGS**

1. "HTML and CSS: Design and Build Websites" by Jon Duckett
2. "JavaScript and JQuery: Interactive Front-End Web Development" by Jon Duckett
3. "Responsive Web Design with HTML5 and CSS" by Ben Frain





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Introduction to Embedded Systems</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC3DE203</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course covers the basics of computer architecture and embedded systems, including memory concepts, program execution, and the differences between microprocessors and microcontrollers, as well as their applications in various fields such as automotive electronics, robotics, and biomedical applications.					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Basic knowledge in Computer Fundamentals.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamentals of computer architecture	U	1
2	Understand the embedded systems, their applications, features, and components.	A	2

3	Analyze embedded systems, focusing on MCUs, especially 8-bit MCUs, memory, low power design, interfacing techniques, real-world sensors and control of displays and relays.	An	2
4	Apply embedded system knowledge to real-world applications like mobile phones, RFID, sensor networks, robots, and medical devices	U,A	1,2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Computer architecture			
1	1.1	Binary System – Memory concept – Memory capacity- Program execution logic.	5	1
	1.2	Instruction Pointer – Execution logic of programs stored in ROM and RAM – BIOS program .	7	1
	Introduction to embedded systems			
2	2.1	Embedded systems- Application areas- features and characteristics , model of an embedded system.	5	2

	2.2	Microprocessor Vs microcontroller, concept of interfacing ports, example of a simple embedded system, MCUs: 4/8/16/32 bits	7	2
	Embedded systems			
3	3.1	Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems.	5	3
	3.2	Low power design, pull up and pull down resistors, Interfacing ADC and DAC	5	3
	3.3	Real world sensors- Temperature Sensor, Light Sensor, Proximity/range Sensor; Display and Relays control.	10	3
4	Examples of embedded systems			
	4.1	Mobile phone, automotive electronics, radio frequency identification (RFID), wireless sensor networks(WISENET).	6	4
	4.2	Robotics, biomedical applications, brain machine interface, Concept of embedded programming	10	4
5	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods.</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory:70 Marks (2 Hrs)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) -(6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>

**REFERENCES**

1. Lyla B Das, Embedded systems: An Integrated Approach, 1st Ed., Pearson, 2013

**SUGGESTED READINGS**

1. Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
2. Kanta Rao B, Embedded Systems, 1st Ed., PHI 3. Frank Vahid & Tony Givargis, Embedded System Design, 2nd Edition, John Wiley



## Department of Computer Science St. Albert's College (Autonomous), Ernakulam

<b>Programme</b>	<b>B.Sc. (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Ethical Hacking</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC3DE204</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	Foundational understanding of ethical hacking, computer network be familiar with common hacking tools and methodologies, and possess the skills to conduct ethical hacking assessments in a controlled and responsible manner.					
<b>Semester</b>	3	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Strong foundational understanding of IT and networking.					

### COURSE OUTCOMES (CO)

<b>CO No.</b>	<b>Expected Course Outcome</b>	<b>Learning Domains *</b>	<b>PO No</b>
1	Outline the vulnerabilities in a system or network.	K,U	PO1
2	Analyze and critically evaluate techniques used to break into an insecure web application and identify	K, An	PO2

	relevant countermeasures.		
3	Critically evaluate the potential counter measures to advanced hacking techniques.	U, An	PO1
4	Explain computer forensic fundamentals.	U, An	PO3
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Ethics of Ethical Hacking, Ethical Hacking and the Legal System, Proper and Ethical Disclosure.	2	1
	1.2	Ethical Hacking-Overview-Hacker types-Threats and attacks ,Vulnerabilities	3	1
	1.3	Phases of hacking: Reconnaissance-Scanning-Maintaining Access with Backdoors and Rootkits-Clearing traces.	7	1
2	2.1	Vulnerability Analysis- Passive Analysis, Advanced Static Analysis with IDA Pro,	7	2
	2.2	Advanced Reverse Engineering, Client-Side Browser Exploits, From Vulnerability to Exploit.	5	2
3	3.1	Hacking windows – Network hacking – Web hacking – Password hacking	5	3
	3.2	A study on various attacks – Input validation attacks – SQL injection attacks – Buffer overflow attacks - Privacy	7	3

		attacks.		
4	4.1	TCP / IP – Checksums – IP Spoofing port scanning, DNS Spoofing.	5	3
	4.2	Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models.	4	3
	4.3	Firewalls – Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls. Batch File Programming.	5	3
5	5.1	Overview of computer forensics technology: computer forensics services-Data seizure - Data duplication and preservation - Data recovery- Document searches-Media conversion-Expert witness services - Computer evidence service options-Other miscellaneous services.	10	4

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>• Lecture</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p>CCA for Theory: 30 Marks</p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>





## Department of Computer Science St. Albert's College (Autonomous), Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Python for Data Analytics					
<b>Type of Course</b>	DSC A					
<b>Course Code</b>	24SACCSC3DB201					
<b>Course Level</b>	200					
<b>Course Summary</b>	This course is designed to teach students how to analyze different types of data using Python. Students will learn how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations and predict future trends from data.					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>		3	0	1	0	75

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe data, its type and the data analysis process.	U	1
2	Illustrate the numerical computation of data using NumPy library.	U	1

3	Analyse data manipulation and visualization using Pandas and Matplotlib library respectively.	An	1
4	Implement various Python libraries to perform data analysis tasks.	A	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	<b>Introduction to Data analysis:</b>		10hrs	
	1.1	Understanding structured and unstructured data	2	1
	1.2	Data Analysis process -Defining objectives, Data collection, Data cleaning, Data analysis, Data interpretation and visualization, Types of data analysis	8	1
2	<b>Numerical Computation with NumPy Library</b>		15hrs	
	2.1	Ndarray, Creating Ndarrays, Data types for Ndarrays, Arithmetic with NumPy Arrays	5	2
	2.2	Basic Indexing and Slicing, Boolean	5	2

		Indexing and Fancy indexing.		
	2.3	Universal functions, Mathematical and statistical functions, Sorting.	5	2
	<b>Data Manipulation and Visualization</b>		20hrs	
3	3.1	<b>Data Manipulation with Pandas Library:</b> Introduction to Pandas Object, Pandas data structures- Series, DataFrame, Index object.	6	3
	3.2	Functionalities- Reindexing, Indexing, Selection, Filtering, Sorting, Ranking, Summarizing and Computing Descriptive Statistics, Handling missing data, Hierarchical indexing.	8	3
	3.3	Introduction to Data visualization: Matplotlib Library, pyplot, Data visualization using matplotlib - bar plot, line plot, histogram, pie chart, box plots, density plots and scatter plot.	6	3
4	<b>Lab Practice</b>		30hrs	
	4.1	Implementation of Narray Basic Operations - Indexing, Slicing and Iterating, Conditions and Boolean Arrays, Shape Manipulation, Array Manipulation	10	4

	4.2	Implementation of DataFrames, Reading from csv files, Python programs to use data cleaning, loc() function, iloc() function, Descriptive Statistics – count(), sum(), mean(), median(), mode(), std(), min(), max() and cumsum(). Reading from csv files, Data cleaning, Inserting columns into DataFrames, Deleting columns from DataFrame, Concatenating DataFrame, Writing back to csv files.	10	4
	4.3	Data Visualization using bar plot, line plot, histogram, pie chart, box plots, density plots, and scatter plot.	10	4
5	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods.</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <p>1. Written test</p>

	<p>2. Assignments</p> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) -(1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"> <li>1. Logic &amp; Successful Compilation - 5 Marks</li> <li>2. Output - 5 Marks</li> <li>3. Viva – 5 Marks</li> <li>4. Record - 5 Marks</li> </ol>

## REFERENCES

1. Wes Mckinney, "Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter" 3rd Edition, O'Reilly, 2022. Free online access: <https://wesmckinney.com/book/>

## SUGGESTED READINGS

1. Fabio Nelli, "Python Data Analytics Data Analysis and Science Using Pandas, Matplotlib, and the Python Programming Language", Edition 1, 2015, Apress.
2. William McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython", Edition 2, 2017, Shroff/O'Reilly.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Cloud Computing Essentials					
<b>Type of Course</b>	MDC					
<b>Course Code</b>	24SACCSC3MD201					
<b>Course Level</b>	200					
<b>Course Summary</b>	This course provides a comprehensive overview of cloud computing, covering its definition, models, architecture, services, applications, virtualization technologies, and a comparative analysis of leading cloud service providers, with a case study on Amazon Web Services.					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the concept, types, pros and cons of Cloud Computing.	U	1

2	Demonstrate the Cloud architecture and compare and contrast various Cloud service models.	An	1
3	Analyse Abstraction and Virtualization technologies and Compare the features of leading Cloud Service Providers.	An	1
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to Cloud Computing		10hrs	
1	1.1	Defining Cloud Computing, Cloud types- The NIST model, The Cloud Cube model, Deployment models, Service models.	10	1
	1.2	Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing.	5	1
	Cloud Architecture, Services and Applications		15hrs	
2	2.1	Exploring the Cloud Computing Stack, connecting to the Cloud.	5	2
	2.2	Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS).	6	2
	2.3	Identity as a Service (IDaaS), Compliance as a Service (CaaS).	4	2

	Abstraction and Virtualization		20hrs	
3	3.1	Introduction to Virtualization Technologies, Load Balancing and Virtualization.	4	3
	3.2	Understanding Hyper visors, Understanding Machine Imaging, Porting Applications.	4	3
	3.3	Leading Cloud Service Providers – Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP)- Comparative analysis of features and services.	4	3
	3.4	Case study: Using AWS	3	3
4	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>Lecture, Demonstration through ICT tools</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>Written test</li> <li>Assignments</li> </ol>

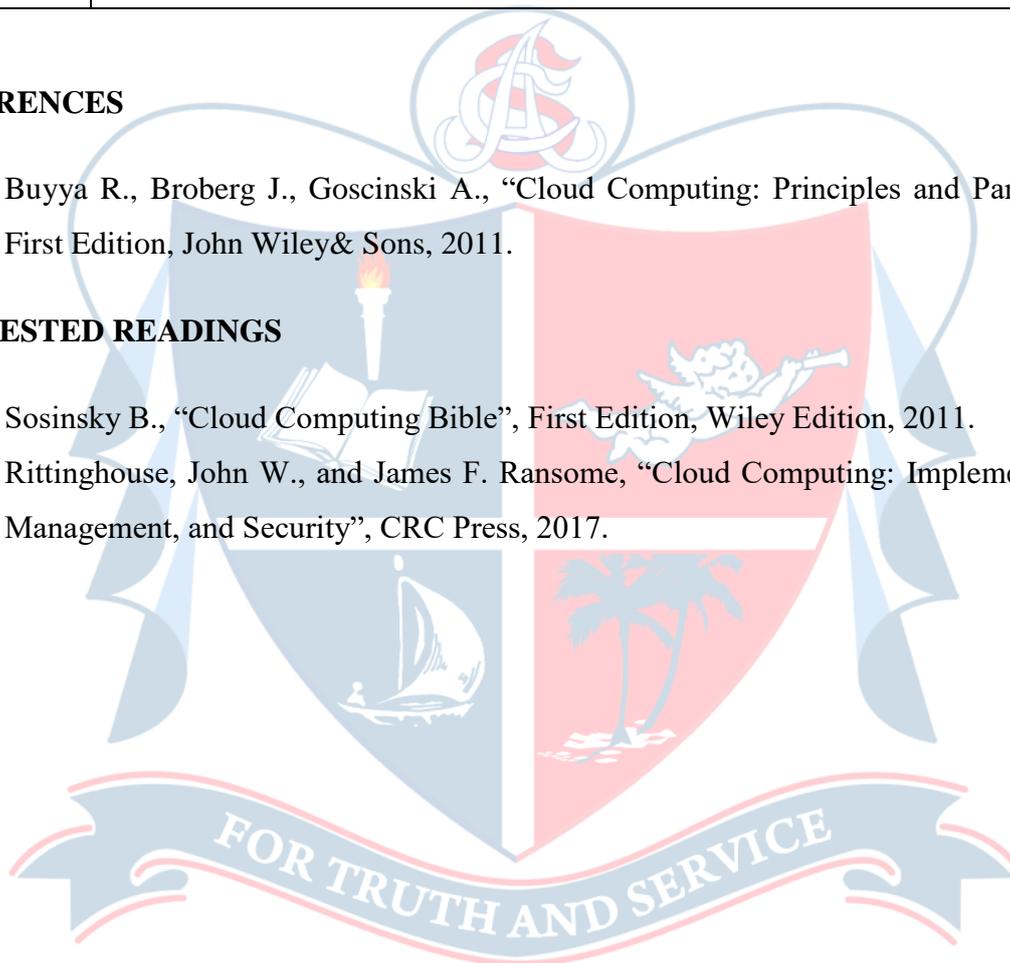
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)</p>
--	--

## REFERENCES

1. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", First Edition, John Wiley & Sons, 2011.

## SUGGESTED READINGS

1. Sosinsky B., "Cloud Computing Bible", First Edition, Wiley Edition, 2011.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2017.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	White Hat Hacking					
<b>Type of Course</b>	VAC					
<b>Course Code</b>	24SACCSC3VA201					
<b>Course Level</b>	200					
<b>Course Summary</b>	This course delivers the basic idea about ethical hacking					
<b>Semester</b>	3	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>		3	0	0	0	45

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the concept of Ethical Hacking	U	1
2	Describe the Information Gathering Methodology and Tools used by Hackers	U	1
3	Summarize various methods of System Hacking	U	1

***\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)***

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Understanding the importance of security- Concept of ethical hacking and essential Terminologies: Threat, Attack – Vulnerabilities- Target of Evaluation– ExploitPhases involved in hacking.	15	1
2	2.1	Footprinting - Introduction to foot printing - Understanding the information gathering methodology of the hackers-Tools used for the reconnaissance phase -Port Scanning – Introduction using port scanning tools- Ping sweeps- Scripting Enumeration.	15	2
3	3.1	Aspect of remote password guessing- Role of eavesdropping -Various methods of password cracking- Keystroke Loggers- Understanding Sniffers - Comprehending Active and Passive Sniffing- ARP Spoofing and RedirectionDNS and IP Sniffing- HTTPS Sniffing.	15	3

4	4.1	Implementation of Narray Basic Operations - Indexing, Slicing and Iterating, Conditions and Boolean Arrays, Shape Manipulation, Array Manipulation	10	4
5	<b>Teacher specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>Lecture, Demonstration through ICT tools</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>Written test</li> <li>Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)</p>

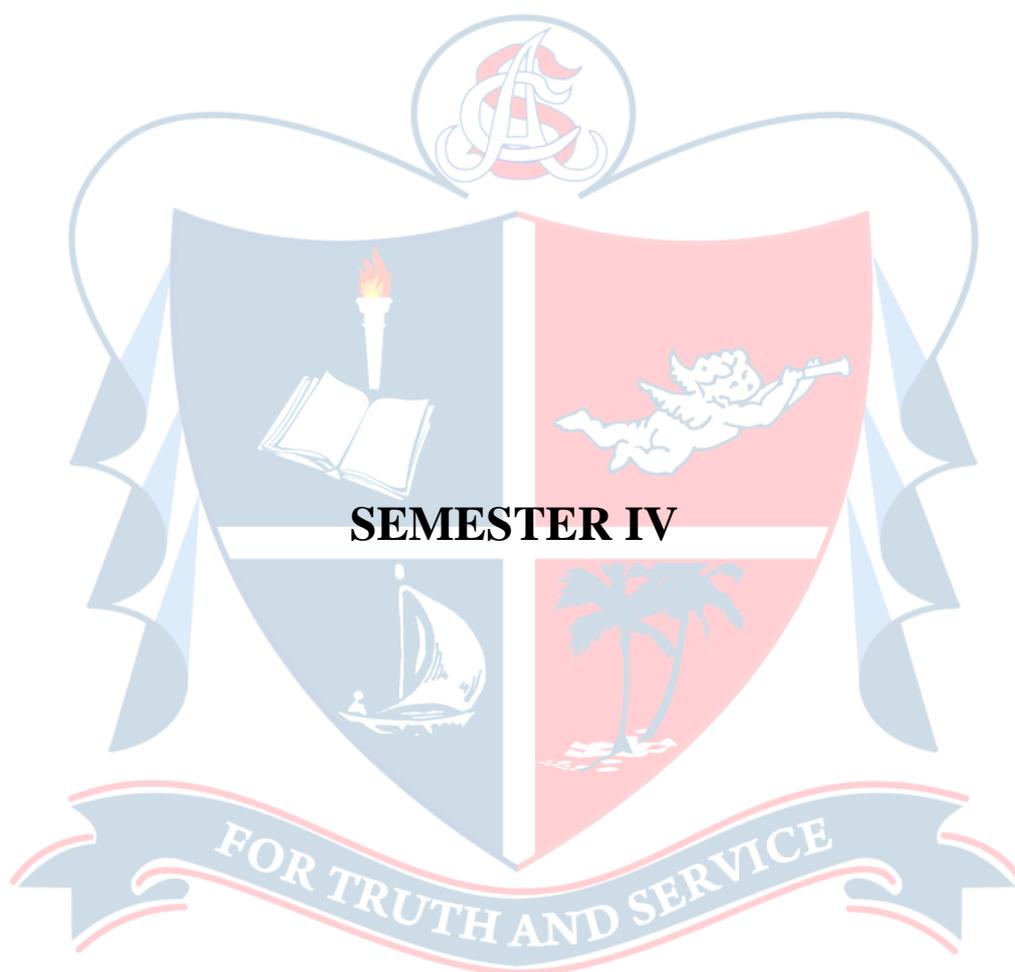
## REFERENCES

1. Kimberly Graves (2010). Certified Ethical Hacker. Wiley India Pvt Ltd.
2. Michael T. Simpson (2010). Hands-on Ethical Hacking & Network Defence. Course Technology.

### SUGGESTED READINGS

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing" Ethical Hacking and Penetration Testing Made Easy, Syngress Media, Second Revised Edition, 2013.
2. RajatKhare, "Network Security and Ethical Hacking", Luniver Press, 2006.
3. Ramachandran V, "Wireless Penetration Testing Beginner's Guide " 3rd edition Packt Publishing, 2011.
4. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003.







## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>OOPs Concepts using JAVA</b>					
<b>Type of Course</b>	<b>DSC A</b>					
<b>Course Code</b>	<b>24SACCSC4DA201</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	<b>Programming concepts of JAVA Language</b>					
<b>Semester</b>	4	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Knowledge about program logic					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply OOP concepts and Java fundamentals to develop robust programs.	A	1,2
2	Analyse class structure, inheritance, method implementation, and array handling in Java.	An	1,3
3	Demonstrate Java packages, exception handling, multithreading, Swing components, and event handling.	A	1,2
4	Demonstrate proficiency in Java programming	A	2

	through practical implementation and problem-solving.		
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Concepts of Object Oriented Programming, Benefits of OOP,	1	1
	1.2	Features of Java, Java Environment, Java tokens. Constants, variables, data types, operators.	2	1
	1.3	Control statements-branching, looping and jump statements, labelled loops.	7	1
2	2.1	Defining a class, fields declaration, method declaration , creating object, accessing class members	4	2
	2.2	Method overloading, constructors, constructor overloading	4	2
	2.3	Command line arguments, super keyword, static members,	4	2
	2.4	Inheritance, overriding methods, dynamic method despatch, final (variables, methods and classes), abstract methods and classes, interfaces, visibility control.	4	2
	2.5	Arrays-one dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays. String class.	4	2
3	3.1	Packages:- Java API packages overview(lang, util, io, swing, applet), user defined packages-creating packages, using packages.	3	3
	3.2	Exception handling techniques, Multithreading creation of multithreaded program-Thread class – Runnable interface-thread life cycle.	4	3

	3.3	Swing components-ImageIcon, JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTable, JTabbedPane, JScrollPane,	4	3
	3.4	Event handling –Delegation Event Model-event classes-sources of events-event listeners.	4	3
4		<ul style="list-style-type: none"> <li>• Implement basic OOP concepts through hands-on exercises.</li> <li>• Develop Java applications demonstrating inheritance and polymorphism</li> <li>• Utilize arrays and strings in practical coding tasks</li> <li>• Create and use custom packages</li> <li>• Implement exception handling techniques.</li> <li>• Build multithreaded Java programs to handle concurrent tasks efficiently.</li> <li>• Design and develop graphical user interfaces using Swing components</li> <li>• Implement event handling mechanisms to respond to user interactions effectively.</li> </ul>	30	4
5		<b>Teacher Specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>• Use of ICT tools in conjunction with traditional classroom teaching methods</li> <li>• Interactive sessions</li> <li>• Class discussions</li> <li>• Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> </ol>

	<p>3. Observation of practical skills</p> <p>4. Viva</p>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"> <li>1. Logic &amp; Successful Compilation - 5 Marks</li> <li>2. Output - 5 Marks</li> <li>3. Viva - 5 Marks</li> <li>4. Record - 5 Marks</li> </ol>

## REFERENCES

1. E. Balagurusamy (2014). Programming with Java (3rd Edition). McGraw Hill Education. (Module 1, 2 and 3)
2. Patrick Naughton (2002). Java 2 The Complete Reference (7th Edition). Osborne/McGraw-Hill.(Module 4 and 5)

## SUGGESTED READINGS

1. Cay S. Horstmann & Gary Cornell – Core Java Volume 1 – Fundamentals, Eighth edition.
2. K. Somasundaram – Programming in Java 2, First edition, Jaico Publishing House.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Computer Networks</b>					
<b>Type of Course</b>	<b>DSC A</b>					
<b>Course Code</b>	<b>24SACCSC4DA202</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course provides a concise overview of key networking concepts and protocols, covering network topologies, layered architecture, circuit switched and packet-switched networks, error detection, routing algorithms, and transport protocols like UDP and TCP, as well as internet protocols such as FTP, SMTP, Telnet, HTTP, and DNS.					
<b>Semester</b>	4	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Basic Knowledge of Computers					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate a solid understanding of fundamental networking concepts.	K	1
2	Illustrate the concepts of circuit-switched and packet-switched networks.	U	1,2
3	Explore techniques for detecting and correcting errors in transmitted data.	A	2
4	Describe the functionality of various layers of network model	U	1

\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S),

**Interest (I) and Appreciation (Ap)****COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
	<b>Introduction to Computer Networks , Network Architecture Models</b>		15hrs	
1	1.1	Network definition; network topologies; types of network, types of connections, protocols and standards.	7	1
	1.2	Layered architecture approach, OSI Reference Model, TCP/IP Reference Model.	8	1
	<b>Switching</b>		15 hrs	
2	2.1	Circuit Switched Network, Three Phases, Packet Switching, Datagram Networks	7	2
	2.2	Virtual Circuit Networks, Three Phases, Connection Oriented and Connectionless Services.	8	2
	<b>Data Link Layer Functions and Protocol, Network Layer Functions and Protocols</b>		15 hrs	
3	3.1	Error detection and error correction techniques error recovery protocols	5	3
	3.2	Framing, Flow control and Error control Noisy and Noiseless channel protocols-stop and wait ARQ, goback-n ARQ; Point to Point Protocol on Internet.	5	3
	3.3	Routing; routing algorithms network layer protocol of Internet- IPV4, IPV6.,	5	3
	<b>Transport Layer Functions and Protocols, Overview of Application layer protocol</b>			
4	4.1	Elements of Transport Protocols, Internet Transport protocols: UDP, TCP	7	4
	4.2	FTP (File Transfer protocol), SMTP (Simple, Mail Transfer Protocol), Telnet and remote login protocol, WWW (World Wide Web), HTTP (Hyper Text Transfer	8	4

		protocol), DNS, Uniform Resource Locator		
<b>5</b>		<b>Teacher Specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>• Use of ICT tools in conjunction with traditional classroom teaching methods</li> <li>• Interactive sessions</li> <li>• Class discussions</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p>CCA for Theory: 30 Marks</p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>

## REFERENCES

1. B. A. Forouzan, Data Communications and Networking (Fourth edition). THM, 2007

## SUGGESTED READINGS

1. A. S. Tanenbaum: Computer Networks, Fourth edition, PHI , 2002
2. Stallings, W. (2013). Data and Computer Communications. Pearson Education India.
3. Kurose, J. F., & Ross, K. W. (2017). Computer Networking: A Top-Down Approach. Pearson Education India.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Data Mining</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC4DE201</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This Course provides the concept of Data Mining techniques and its implementation. Introducing the basic concept of Data Mining and Data warehouse, Association Rule Mining and Supervised and Unsupervised classification techniques. Implementation of the above Data Mining techniques using some open databases explores hands-on programming to analyse different real world problems.					
<b>Semester</b>	4	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Basic knowledge of any programming language like Python, C++, java etc. and an understanding of Basic database concepts.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate understanding of data mining techniques and methodologies effectively.	U	1
2	Apply concepts of data warehousing, OLAP, and association rule mining.	A	2
3	Analyse Supervised and Unsupervised Classification	An	2

4	Apply Association Rule mining, Supervised and Unsupervised Classification techniques.	A	1,2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction Data Mining, Data Ware House, Transactional Databases.	3	1
	1.2	Data Mining Functionalities Characterization and Discrimination, Mining frequent patterns, Association and correlation, Classification and Prediction, Cluster Analysis, Classification of Data Mining Systems	3	1
	1.3	Data Mining Task Primitive, Integration of Data Mining systems, Major issues in Data Mining, Data integration and transformation, Data reduction, Data Discretization. Data Pre-processing.	4	1
2	2.1	Data Warehouse and OLAP technology ,Comparative study of OLTP and OLAP	3	2
	2.2	Data Warehouse, Multidimensional data Model, Data warehouse architecture, Data Warehouse implementation,.	4	2
	2.3	OLAP, Data Warehouse and data mining	4	2
	2.4	Association Rules and Classification Concepts , Support and Confidence	3	2
	2.5	Efficient and Scalable Frequent item set Mining methods, Mining various kind of association rules,	3	2
	2.6	Apriori Algorithm From association mining to Co-relation analysis	3	2
3	3.1	Classification and prediction, Issues, Classification by Decision tree induction	4	3

	3.2	Bayesian Classification, Rule-based classification, Support Vector Machine-nearest neighbor (KNN), Prediction.	4	3
	3.3	Cluster Analysis Definition, Types of data in cluster analysis,	3	3
	3.4	Clustering methods-Partitioning methods, K-means and k-medoids, from k-medoids to CLARANS, Hierarchical methods	4	3
	Practicals		30hrs	
4	4.1	Load and Analyse Database, Identify Noise and Missing Values.	7	4
	4.2	Implement Apriori algorithm for identifying frequent Pattern.	7	4
	4.3	Implement Supervised classification techniques	8	4
	4.4	Implement Unsupervised Classification techniques	8	4
5		<b>Teacher Specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p>

	<p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks(1.5 Hrs)</b></p> <ol style="list-style-type: none"> <li>1. Design and Development - 10 Marks</li> <li>2. Viva - 5 Marks</li> <li>3. Record - 5 Marks</li> </ol>

### References

1. Jiawei Han and Micheline Kamber(2006), Data Mining :Concepts and Techniques(2<sup>nd</sup> ed.).Elsevier

### SUGGESTED READINGS

1. Witten and Frank, Data Mining Practical Machine Learning Tools and Techniques,2nd ed.Elsevier,2005
2. Soman, Divakar and Ajay, Data Mining Theory and Practice, PHI, 2006
3. Margaret H Dunham, Data Mining: Introductory and Advanced Topics, Person



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Mobile App Development</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC4DE202</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	Introduction to mobile application development, user interface designing, data management and core functionalities of mobile applications and web services and Develop mobile applications using GUI and Layouts.					
<b>Semester</b>	4	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the process of developing mobile applications and explore Android development.	U	1
2	Apply Android components for UI development, data persistence, and user interaction.	A	1
3	Apply Android content providers for data sharing, SMS messaging, email sending, and location-based services and Utilize HTTP and JSON for consuming web services.	A	1,2
4	Apply essential Android Programming concepts and Develop various Android applications related to layouts	A	1,2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
	<b>Introduction to Mobile apps</b>		10hrs	
1	1.1	Mobile Application Development - Mobile Applications and Device Platforms - Alternative for Building Mobile Apps - Comparing Native vs. Hybrid Applications -The Mobile Application Development Lifecycle-The Mobile Application Front-End-The Mobile Application Back-End	5	1
	1.2	Key Mobile Application Services-What is Android-Android version history-Obtaining the Required Tools- Launching Your First Android Application-Exploring the IDE-Debugging Your Application-Publishing Your Application	5	1
	<b>Android Activities , User Interface, Basic Views,Fragments, and Data Persistence</b>		20 hrs	
2	2.1	Understanding Activities-Linking Activities Using Intents-Fragments-Displaying Notifications	3	2
	2.2	Understanding the Components of a Screen-Adapting to Display Orientation-Managing Changes to Screen Orientation	2	2
	2.3	Utilizing the Action Bar-Creating the User Interface Programmatically Listening for UI Notifications	5	2
	2.4	Using Basic Views-Using Picker Views - Using List Views to Display Long Lists	3	2
	2.5	Understanding Specialized Fragments - Using Image Views to Display Pictures -Using Menus with Views Using Web View- Saving and Loading	7	2

		User Preferences-Persisting Data to Files-Creating And Using Databases.		
		<b>Sharing Data and Advanced Functionality, Web Services</b>		
3	3.1	Sharing Data in Android-Creating Your Own Content Providers -Using the Content Provider	5	3
	3.2	SMS Messaging -Sending Email-Displaying Maps-Getting Location Data- Monitoring a Location.	5	3
	3.3	Consuming Web Services Using HTTP Consuming JSON Services	3	3
4	<p>Lab Experiments</p> <ol style="list-style-type: none"> <li>1. Develop an application that uses GUI components, Font and Colours</li> <li>2. Develop an application that uses Layout Managers and Event listeners.</li> <li>3. Develop a native calculator application.</li> <li>4. Write an application that draws basic graphical primitives On the screen.</li> <li>5. Develop an application that makes use of RSS Feed.</li> <li>6. Implement an application that implements Multi-threading</li> <li>7. Develop a native application that uses GPS location information.</li> <li>8. Implement an application that writes data to the SD card.</li> <li>9. Implement an application that creates an alert upon receiving a message.</li> </ol>	30hrs	4	
5		<b>Teacher Specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b>  <b>A.Continuous Comprehensive Assessment (CCA)</b>  <b>CCA for Theory: 25 Marks</b> 1. Written test 2. Assignments  <b>CCA for Practical: 5 Marks</b> 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	<b>B.Semester End examination</b>  <b>ESE for Theory: 50 Marks (1.5 Hrs)</b>  <b>Written Test (50 Marks)</b> Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)  <b>ESE for Practical: 20 Marks(1.5 Hrs)</b> 1. Design and Development - 10 Marks 2. Viva - 5 Marks 3. Record - 5 Marks

## REFERENCES

1. Jerome DiMarzio. "Beginning Android Programming with Android Studio"(4thEdition). -Module 1, 2

2. Anubhav Pradhan and Anil V Deshpande, Wiley Publications (2014). Composing Mobile Apps: Learn, Explore and Apply using Android. ISBN: 978-81-265-4660-2. - Module 2, 3, 4
3. Bill Phillips and Chris Stewart, Big Nerd Ranch Guides. Android Programming: The Big Nerd Ranch Guide - Module 5

### SUGGESTED READINGS

1. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", 2017.
2. Neil Smyth, "Android Studio 3.0 Development Essentials: Android", 8th Edition.
3. Pradeep Kothari, "Android Application Development (With KitKat Support)", Black Book 2014.

### WEB REFERENCES:

1. <https://developer.android.com/guide>
2. [https://en.wikipedia.org/wiki/Android\\_10](https://en.wikipedia.org/wiki/Android_10)
3. Develop App for Free
4. <https://flutter.dev/>
5. <http://ai2.appinventor.mit.edu>
6. [https://en.wikipedia.org/wiki/Android\\_version\\_history](https://en.wikipedia.org/wiki/Android_version_history)
7. <https://aws.amazon.com/mobile/mobile-application-development/>
8. (Unit1) [https://en.wikipedia.org/wiki/Mobile\\_app\\_development](https://en.wikipedia.org/wiki/Mobile_app_development)





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>System Programming</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC4DE203</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course equips students with a solid foundation in system software, language processors, and the tools used in program development. Through theoretical learning, students will gain the knowledge and skills necessary for effective software development in various computing environments.					
<b>Semester</b>	4	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>		3	0	1	0	75

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe system software, language processing and Assemblers fundamentals.	U	1
2	Identify Macro processors, interpreters, compilers, and software tools for program development.	A	1
3	Analyze the functions and concepts of linkers and loaders.	An	1
4	Apply language processing techniques using LEX and YACC.	A	2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S),*

***Interest (I) and Appreciation (Ap)*****COURSE CONTENT****Content for Classroom transaction (Units)**

<b>Module</b>	<b>Units</b>	<b>Course description</b>	<b>Hrs</b>	<b>CO No.</b>
1	1.1	Overview of system software and its role	2	1
	1.2	Language Processing Activities: Fundamentals of Language Processing & Language Specification.	4	1
	1.3	Scanning and Parsing,	4	1
	1.4	Elements of Assembly Language Programming	2	1
	1.5	A Simple Assembly Scheme	2	1
	1.6	Pass Structure of Assemblers, Design of a Two Pass Assembler	3	1
2	2.1	Introduction to Macros, Macro Definition and Call, Macro Expansion Different types of parameters	3	2
	2.2	Design of a Macro Preprocessor	3	2
	2.3	Interpreters: Use and overview of interpreters Compilers: Phases of the Compiler , Aspects of compilation	5	2
	2.4	Compilation of Expressions, Control Structures, Code Optimization Software Tools: Software Tools for Program Development ,Editors ,Debug Monitors	7	2
3	3.1	Introduction to linkers , Relocation and Linking Concepts	3	3
	3.2	Design of a Linker 2	2	3
	3.3	Loaders and its types, Relocatability of Programs, Linking for Overlays and Loaders.	5	3

4	4.1	<ol style="list-style-type: none"> <li>1. Write a program to implement the Lexical Analyzer.</li> <li>2. Write a lexical analyzer (using lex utility for unix).</li> <li>3. Write a Program to count the number of characters, words, spaces and lines in a given input file using LEX.</li> <li>4. Write a Program to count the numbers of comment lines in a given C program using LEX</li> <li>5. Write a Program to recognize a valid arithmetic expression and to recognize the identifiers and operators present. Print them separately using LEX</li> <li>6. Write a Program to recognize and count the number of identifiers in a given input file using LEX</li> <li>7. Write a Program to recognize a valid arithmetic expression that uses operators +, -, * and / using YACC.</li> <li>8. Write a Program to recognize a valid variable, which starts with a letter, followed by any number of letters or digits using YACC</li> <li>9. Use macro features of C language</li> </ol>	30hrs	4
5	<b>Teacher Specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> </ol>

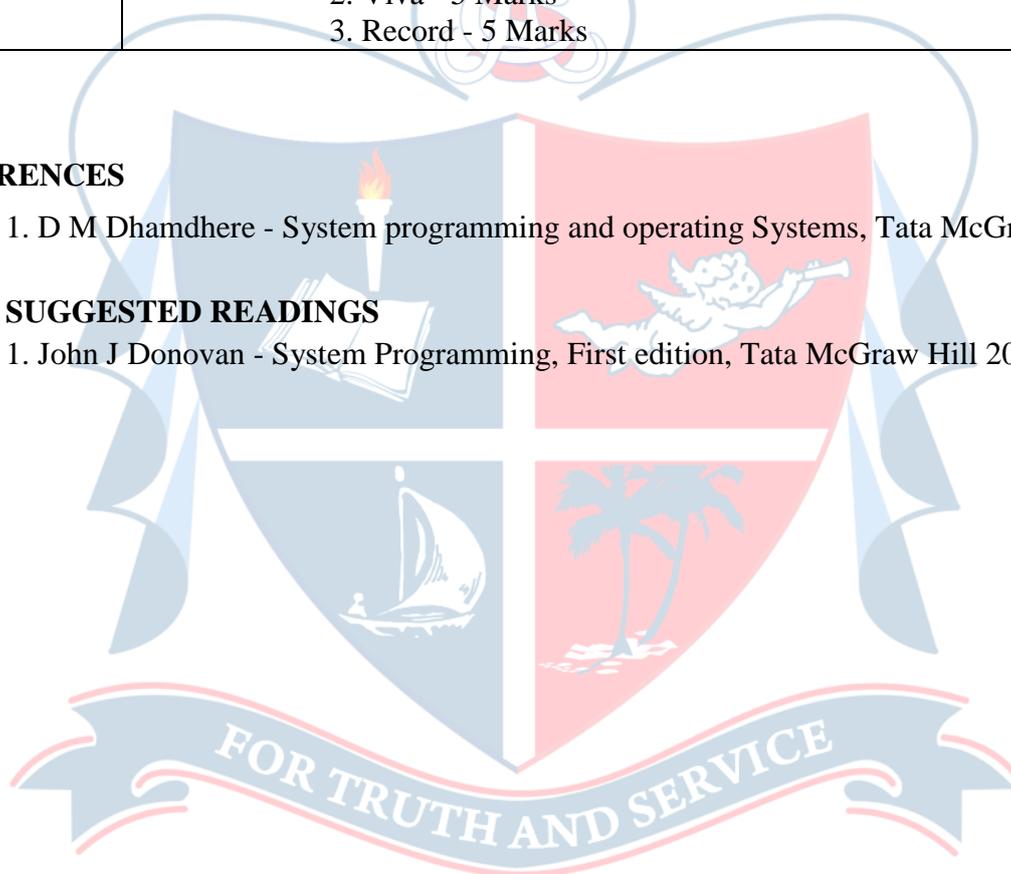
	4. Viva
	<b>B. Semester End examination</b> <b>ESE for Theory: 50 Marks (1.5 Hrs)</b> <b>Written Test (50 Marks)</b> Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions (4 out of 6 Questions) – (4*5=20 Marks) Part C: Essay Questions (1 out of 2 Questions) – (1*10=10 Marks) <b>ESE for Practical: 20 Marks(1.5 Hrs)</b> 1. Result - 10 Marks 2. Viva - 5 Marks 3. Record - 5 Marks

**REFERENCES**

1. D M Dhamdhare - System programming and operating Systems, Tata McGraw Hill

**SUGGESTED READINGS**

1. John J Donovan - System Programming, First edition, Tata McGraw Hill 2009.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Introduction to Database Management Systems</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC4DB201</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course provides a comprehensive understanding of database concepts, Relational database design, and practical experiences on MySQL database system.					
<b>Semester</b>	4	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate the basic concepts of database and database management systems.	U	1
2	Describe the fundamental concepts of Relational Database Management Systems, Data Normalization and its application in database design.	U	1
3	Design SQL queries for data definition and data manipulation.	A	2

4	Apply MYSQL to implement DDL and DML commands.	A	2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction Data vs Information, File oriented approach-Disadvantages	3	1
	1.2	Database Concepts: Character- Field-Record-File- Types of Databases-examples- DBMS – Advantages-Disadvantages, Applications.	6	1
	1.3	DBMS architecture-Database users- Database administrator (DBA), Database designers, End users, Application programmers- Database Languages- DDL-DML-DCL.,	3	1
2	2.1	.Relational database management system (RDBMS) Data models, Entity Relationship model- Features-Concepts-Entity sets, Relationship sets, Attributes-ER diagram- Conversion of ER Diagram to Relational Database.	6	2
	2.2	Relational data model-Domain, Attribute, Tuple, Relations. RDBMS – Relationships - Types of Relationships - One to One - One to Many - Many to Many	4	2
	2.3	Functional Dependency - Normalization (1NF, 2NF, 3NF).	5	2
	2.4	Defining Relationships -Referential Integrity, Key: Candidate key, Primary key, and Foreign Key.	3	2
3	3.1	Introduction to linkers , Relocation and Linking Concepts MYSQL Introduction- Features- advantages, Data types	5	3

		numeric- string-date /time-boolean, Variables, MYSQL database-table-view		
	3.2	MYSQL Commands- DDL-Create-Alter, Drop, DML-Insert, Select, Update, Delete DCL- Grant, Revoke, Command clauses- where, order by, group by, having, like, between, MYSQL Functions- aggregate functions.	10	3
	4.1	MYSQL Lab practice Implementation of Database commands- Viewing existing databases, Creating databases, Accessing databases, Deleting databases, Viewing tables in databases.	15	4
4	4.2	Implementation of DDL and DML commands- Creating table, inserting data in to table, retrieving data from table-select- selecting all data, selecting particular rows/ columns, selecting based on condition/pattern matching, working with null values, sorting data in table, modifying data in table, deleting data from table, implementing aggregate and group functions, dropping table, altering table such as Adding/ modifying/ deleting columns of tables.	15	4
5	<b>Teacher Specific content</b>			

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Use of ICT tools in conjunction with traditional classroom teaching methods</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p>CCA for Theory: 25 Marks</p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>

	<p align="center"><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p align="center"><b>B.Semester End examination</b></p> <p align="center"><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p align="center"><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p align="center"><b>ESE for Practical: 20 Marks(1.5 Hrs)</b></p> <ol style="list-style-type: none"> <li>1. Coding and Output - 10 Marks</li> <li>2. Viva - 5 Marks</li> <li>3. Record - 5 Marks</li> </ol>

**REFERENCES**

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Sixth Edition, Tata McGraw-Hill 2006 (Module 1 & 2).
2. Vikram Vaswani, "MySQL: The Complete Reference", 1st Edition, McGraw Hill Education, 2004 (Module 3 & 4).

**SUGGESTED READINGS**

1. C.J.Date, Introduction to Database Systems, 8th Ed. , Pearson Publications
2. Elvis C. Foster, Shripad Godbole, "Database Systems-A Pragmatic Approach", Apress, 2014.
3. Elmasri and Navathe, "Fundamentals of Database Systems" 6th Ed., Pearson, 2010
  - a. Page 98 of 222
4. Seyed, M. M. et.al, "Learning MySQL: Get a handle on your data", O'Reilly, 2006.
5. Ian Gilfillan, "Mastering MySQL 4", Wiley, 2003



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Foundations of Data Science					
<b>Type of Course</b>	SEC					
<b>Course Code</b>	24SACCSC4SE201					
<b>Course Level</b>	200					
<b>Course Summary</b>	This course covers the fundamentals of data analysis, including the collection and presentation of data, measures of central tendency, and measures of dispersion. Students will learn various statistical techniques and methods, providing a comprehensive understanding of statistical concepts and their applications.					
<b>Semester</b>	4	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate understanding of data collection methods and types of data.	U	1
2	Analyse various measures of central tendency and their Applications in statistics.	U	1
3	Apply probability concepts to solve real-world problems And analyse data.	A	2

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
		<b>Collection of Data, Classification of Data Frequency Distribution</b>		1
1	1.1	Introduction to Collection of Data, Primary and Secondary Data,	3	1
	1.2	Layered architecture approach, OSI Reference Model, TCP/IP Reference Model. Methods of Collecting Primary Data, Methods of Secondary Data, Statistical Errors, Rounding off Data (Approximation).	3	1
	1.3	Introduction Classification of Data - Objectives, Methods, Ways to Classify Numerical Data or Raw Data.	3	1
	1.4	Tabular, Diagrammatic and Graphical Presentation of Data: Introduction and Objectives of Tabulation, Components of a Statistical Table, General Rules for the Construction of a Table, Types of Tables	3	1
	1.5	Introduction to Diagrammatic Presentation of Data, Advantage and Disadvantage of Diagrammatic Presentation, Types of Diagrams, Introduction to Graphic Presentation of Data, Advantage and Disadvantage of Graphic Presentation, Types of Graphs.	3	1
2	2.1	Introduction to Central Tendency, Purpose and Functions of Average, Characteristics of a Good Average, Types of Averages, Meaning of Arithmetic Mean, Calculation of Arithmetic Mean, Merit and Demerits of Arithmetic Mean.	7	2

	2.2	Meaning of Median, Calculation of Median, Merit and Demerits of Median, Meaning of Mode, Calculation of Mode, Merit and Demerits of Mode, Harmonic Mean- Properties Merit and Demerits.	8	2
3	3.1	Random experiment, union and intersection of events and their meaning. Mutually exclusive, equally likely and independent events.	5	3
	3.2	Classical, Frequency and Axiomatic approaches to probability. Monotone property, Addition theorem(up to 3 events)..	5	3
	3.3	Conditional probability. Multiplication theorem(up to 3 events).Independence of events. Bayers theorem.	5	3
4		<b>Teacher Specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● ICT enabled Lecture</li> <li>● Interactive sessions</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <b>A. Continuous Comprehensive Assessment (CCA)</b> <b>CCA for Theory: 25 Marks</b> 1. Written test 2. Assignments
	<b>B. Semester End examination</b> <b>ESE for Theory: 50 Marks (1.5 Hrs)</b> <b>Written Test (50 Marks)</b> Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

**REFERENCES**

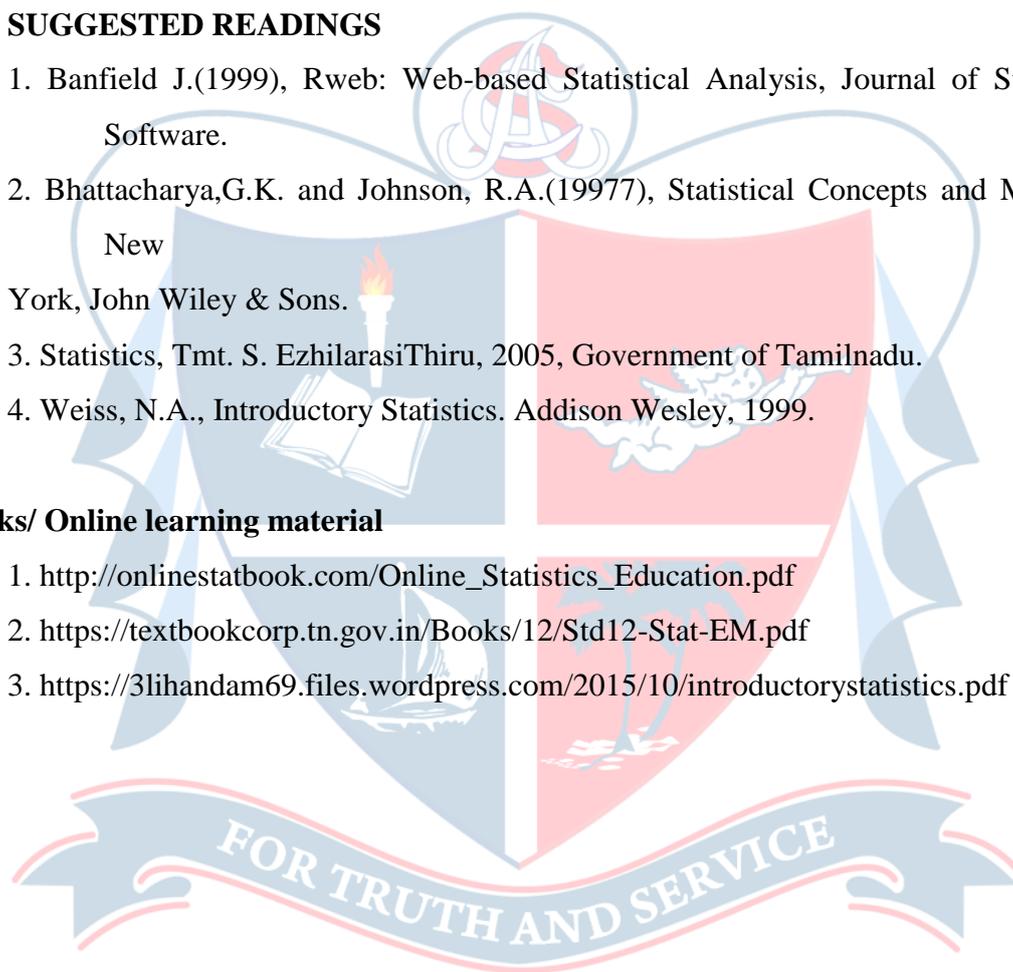
1. A. Abebe, J. Daniels, J. W. Mckean(2000). Statistics and Data Analysis.(Module )
2. David M. Lane. Introduction to Statistics. Rice University (Module 1, Module 2)
3. Gupta S.C and Kapoor V K (2002).Fundamentals of Mathematical Statistics (11th edition). (Module 3)

**SUGGESTED READINGS**

1. Banfield J.(1999), Rweb: Web-based Statistical Analysis, Journal of Statistical Software.
2. Bhattacharya,G.K. and Johnson, R.A.(1997), Statistical Concepts and Methods, New York, John Wiley & Sons.
3. Statistics, Tmt. S. EzhilarasiThiru, 2005, Government of Tamilnadu.
4. Weiss, N.A., Introductory Statistics. Addison Wesley, 1999.

**E-Books/ Online learning material**

1. [http://onlinestatbook.com/Online\\_Statistics\\_Education.pdf](http://onlinestatbook.com/Online_Statistics_Education.pdf)
2. <https://textbookcorp.tn.gov.in/Books/12/Std12-Stat-EM.pdf>
3. <https://3lihandam69.files.wordpress.com/2015/10/introductorystatistics.pdf>





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Computer Hardware Maintenance</b>					
<b>Type of Course</b>	SEC					
<b>Course Code</b>	<b>24SACCSC4SE202</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course provides a detailed understanding of computer components, system assembly, troubleshooting methodologies, preventive maintenance, and security measures, empowering participants with the skills needed for effective computer hardware management and support.					
<b>Semester</b>	4	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Summarize computer hardware, system assembly, and maintenance.	U	1
2	Demonstrate troubleshooting methodologies, identify common hardware issues using error codes, diagnostic tools and software.	An	1
3	Illustrate preventive maintenance and security measures for computer hardware.	U	1

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

### COURSE CONTENT

#### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Computer Hardware & System Assembly: Overview of Computer Hardware Components, Understanding the Motherboard, CPU, and Memory, Input and Output Devices.	4	1
	1.2	Storage Devices: HDDs, SSDs, and External Drives, Introduction to Peripheral Devices. Tools and Equipment for Hardware Maintenance.	4	1
	1.3	Building a Computer System: Step-by-Step Assembly, Disassembly and Troubleshooting Procedures, Cable Management Best Practices, Basic BIOS/UEFI Configuration.	7	1
2	2.1	Hardware Troubleshooting and Diagnostics Introduction to Troubleshooting Methodologies, Common Hardware Issues and Error Codes.	5	2
	2.2	Diagnostic Tools and Software, System Recovery and Backup Strategies, Remote Troubleshooting Techniques.	5	2
	2.3	Connecting and Configuring External Devices, Troubleshooting Common External Device Issues.	5	2
3	3.1	Preventive Maintenance and Security Importance of Preventive Maintenance, Cleaning and Cooling Systems, Security Measures for Hardware.	5	3
	3.2	Understanding Anti-virus and Anti-malware Software.	2	3
	3.3	Overview of External Devices: Peripherals and Expansion Cards, Types of External Devices: Input (e.g., keyboards, mice), Output (e.g., monitors, printers), Storage (e.g., external hard drives, USB drives).	8	3
4		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Lecture, Demonstration through Animations/Video
---------------------------------------	---

<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. MCQ</li> <li>3. Quiz</li> <li>4. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test(50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions(10 out of 12 Questions) - (10*3=30 Marks)</p>

**REFERENCES**

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design", Elsevier
2. Scott Mueller, "Upgrading and Repairing PCs", 4th Ed.

**SUGGESTED READINGS**

1. IT Essentials- PC Hardware and Software Companion Guide, 4th Ed., CISCO Networking Academy.

	<h2>Department of Computer Science</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
---	---

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Visualization Tools for Data Analytics</b>					
<b>Type of Course</b>	SEC					
<b>Course Code</b>	<b>24SACCSC4SE203</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course provides a comprehensive introduction to data visualization tools, covering popular platforms such as Tableau and Power BI, and enabling students to create interactive dashboards and visualizations.					
<b>Semester</b>	4	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>						

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Summarize the concepts of data visualization, kinds of data analytics, different tools for visualization, features of data visualization.	U	1
2	Demonstrate how to create interactive data visualization using Tableau.	U	1
3	Demonstrate how to create an interactive dashboard using Power BI.	U	1

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Introduction to Data Visualization			
	1.1	Benefits of Data Visualization Tools-Kinds of Data Analytics – Descriptive, Diagnostic, Predictive and Data Mining.	5	1
	1.2	Data Visualization Tools - Google Data Studio, Qlikview, Tableau, Power BI.	5	1
	1.3	Features- Common features of Data Visualization Tool, Salient features of popular data visualization tools.	5	1
2	Tableau - An Interactive Analytics platform			
	2.1	Tableau Product Suite. How to connect to a data source using Tableau interface. Tableau interface and basic terminologies.	4	2
	2.2	Create – Time series chart, Bullet chart, Area chart, Symbol map, Score cards.	3	2
	2.3	Heat Map – Introduction, Uses of Heat Map, Procedure to create heat map in Tableau.	5	
	2.4	Building interactive dashboards using Tableau.	5	2
3	Power BI - Unleash the power of business analytics			
	3.1	Introduction to Power BI, Preparing data with Power BI.	4	3
	3.2	Data visualization using Power BI- Creating simple visualization, Map Visualization, Combination Charts.	5	3
	3.3	Dashboard in Power BI - creating, sharing, Tiles in Dashboard.	6	3
4		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Lecture, Demonstration through ICT tools and video
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b>  <b>A. Continuous Comprehensive Assessment (CCA)</b>  <b>CCA for Theory: 25 Marks</b> 1. Written test 2. MCQ 3. Quiz 4. Assignments
	<b>B. Semester End examination</b>  <b>ESE for Theory: 50 Marks (1.5 Hrs)</b>  <b>Written Test (50 Marks)</b> Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions(10 out of 12 Questions) - (10*3=30 Marks)

## REFERENCES

1. Dr. S. Karpagavalli , “Introduction to Data Visualization Tools”, Blue Hill Publishers, 2020.
2. <https://www.tutorialspoint.com/tableau/index.htm>
3. [https://www.tutorialspoint.com/power\\_bi/power\\_bi\\_visualization\\_options.htm](https://www.tutorialspoint.com/power_bi/power_bi_visualization_options.htm)

## SUGGESTED READINGS

1. Alexander Loth, “Visual Analytics with Tableau”, Wiley, 2019.
2. Alberto Ferrari and Marco Russo, “Introducing Microsoft Power BI”, Microsoft Press, 2016.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Green Computing Techniques</b>					
<b>Type of Course</b>	VAC					
<b>Course Code</b>	<b>24SACCSC4VA201</b>					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	This course offers basic concepts of soft and Green Computing.					
<b>Semester</b>	4	<b>Credits</b>			3	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		3	0	0	0	45
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

<b>CO No.</b>	<b>Expected Course Outcome</b>	<b>Learning Domains *</b>	<b>PO No</b>
1	Understand the basic ideas of green computing.	U	1,8, 10
2	Understand the idea of green architecture and framework	A	1, 2, 9
3	Analyse the idea of protocols and standards related with the environment and sustainability	An	2, 5, 10

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Green computing: carbon foot print, scoop on power - Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.	8	1
	1.2	Paperless : Paper problems, Environment issues, Cost: Paper and office, Storage, Practicality, Going paperless, Organizational realities, Changing Over, Paperless billing, Handheld Computers vs. the Clipboard, Unified Communications, Intranets, What to Include, Building an Intranet, Electronic Data Interchange (EDI), Value Added Networks, Advantages & Disadvantages	7	1
2	2.1	Green Assets: Buildings, Data Centers, Networks and Devices - Green Information Systems: Design and Development Models - Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains	7	2
	2.2	Socio cultural aspects of Green IT – Green Enterprise Transformation Roadmap –Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.	8	2
3	3.1	Hardware Considerations: – Restriction of Hazardous Substances (RoHS) in IT, EPEAT, Energy Star, Computers, Servers, Consolidation, Products, Hardware Considerations, Planned Obsolescence, Packaging, Toxins, Other Factors	9	3
	3.2	Green Compliance: Protocols, Standards, UNFCCC, Copenhagen summit, Kyoto Protocol, ISO 14000:2004 Family of Standards, Government Initiatives.	6	3
4		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Lecture, Demonstration through ICT tools
---------------------------------------	--

<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. MCQ</li> <li>3. Quiz</li> <li>4. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test(50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions(10 out of 12 Questions) - (10*3=30 Marks)</p>

## REFERENCES

1. Bhuvan Unhelkar, —Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.

## SUGGESTED READINGS

1. Woody Leonhard, Katherine Murray, —Green Home computing for dummies, August 2012.
2. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journey, Shroff/IBM rebook, 2011. ason Harris, —Green Computing and Green IT Best Practices on regulations & industry, Lulu.com, 2008
3. John Lamb, —The Greening of IT, Pearson Education, 2009.
4. Carl speshocky, —Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), —Green computing: Large Scale energy efficiency, CRC Press.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Internship</b>					
<b>Type of Course</b>	INT					
<b>Course Code</b>	24SACCSC4IN201					
<b>Course Level</b>	<b>200</b>					
<b>Course Summary</b>	A key aspect of the new MGU UGP programme is induction into actual work situations. All Students will undergo internships in a firm, industry, or organization or training in labs with faculty and researchers in their own or other institutions during the summer vacation.					
<b>Semester</b>	4	Credits			2	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>	Basic knowledge of programming and understanding of computer science concepts.					

### COURSE OUTCOMES (CO)

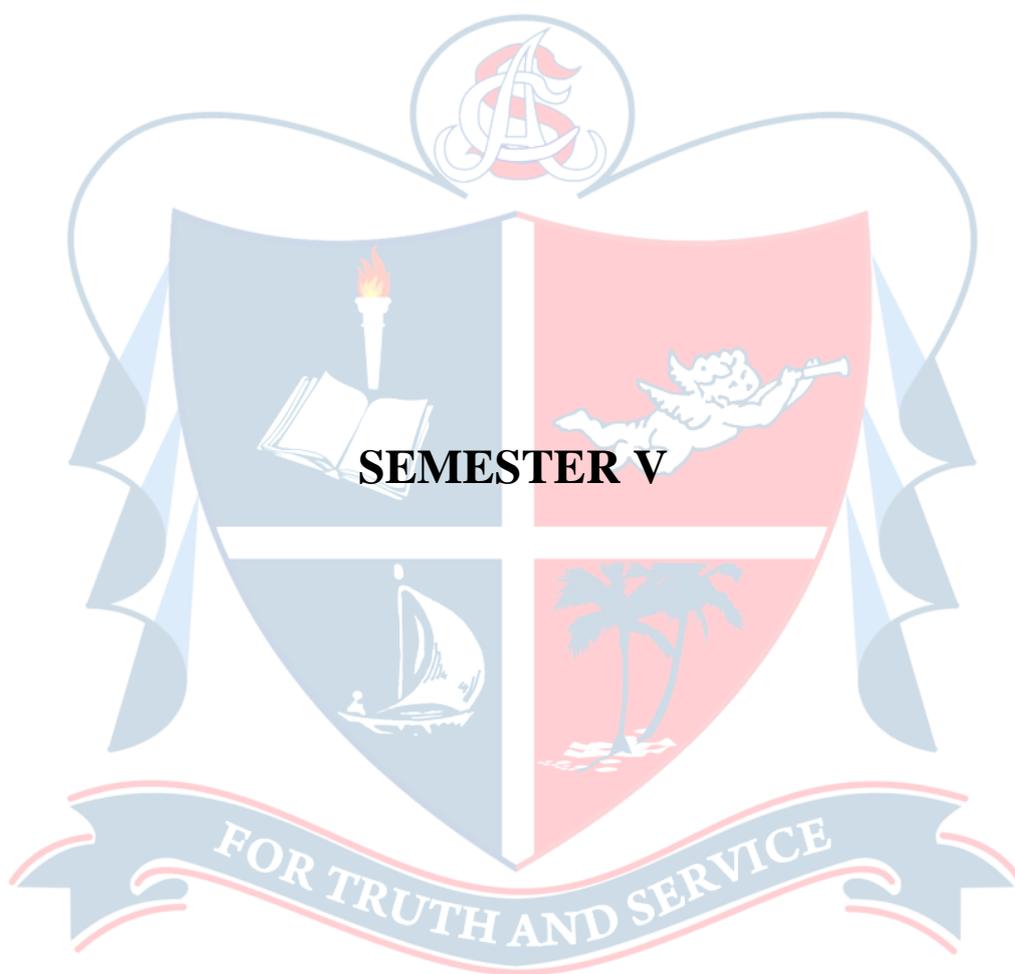
CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply technical knowledge effectively to assigned tasks and projects	An, A, S	1
2	Demonstrate critical thinking and problem-solving skills in various situations	C, S, E	1
3	Communicates clearly and effectively, both verbally and in writing	An, A, Ap	2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	All Students will undergo internships in a firm, industry, or organization or training in labs with faculty and researchers in their own or other institutions during the summer vacation.		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <p>No class room activity.            Done During Vacation            Discussions ·            Self-learning and Development</p>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA) - 15 marks</b></p> <p>1. Review 1            2. Review 2</p>
	<p><b>B. Semester End Examination - 35 marks</b></p> <p>1. Project Presentation -15            2. Viva - 10            3. Report - 10</p>



	<h2>Department of Computer Science</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
---	---

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Software Engineering</b>					
<b>Type of Course</b>	DSC					
<b>Course Code</b>	<b>24SACCSC5DA301</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course is designed to equip students with the knowledge and skills needed to design, build, and maintain high-quality software systems in a professional environment.					
<b>Semester</b>	5	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Familiarization with Computer Fundamentals.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe software engineering and the different software process models used in industry.	U	1
2	Explain software requirement analysis and requirement elicitation methods.	U	1
3	Analyse and compare various software design and testing methods.	An	2
4	Develop software project management skills.	A	2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

### COURSE CONTENT

#### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Software Engineering - Definition, Program Vs Software. Software Characteristics, brief introduction to product and process. Software Development Life Cycle (SDLC). Role of a Software Engineer, Ethics in Software Engineering.	3	1
	1.2	Overview of different life cycle models -Waterfall model, Increment process models- Iterative, RAD, and Evolutionary process models-Prototyping, Spiral, and Agile. Selection of a life cycle model.	9	1
2	2.1	Requirements Engineering - Software Requirement Analysis and Specification Requirements Engineering, Type of requirements, Feasibility Studies,	6	2
	2.2	Requirement Elicitation – Use Case, DFD, Data Dictionaries , Various steps for requirement analysis,	6	2
	2.3	Requirement documentation, SRS, Requirement validation.	6	2
3	3.1	Software Design & Testing - Definition, Various types, Objectives and importance of Design phase, Modularity, IEEE recommended practice for software design descriptions.SDD.	8	3
	3.2	Software Testing - Development testing, Test driven development, Release testing, User testing.	10	3
4	4.1	Managing Software Projects Introduction, Risk Management- Risk identification, Risk analysis, Risk planning, Risk monitoring.	3	4
	4.2	Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation Techniques-COCOMO.	3	4
	4.3	Quality Management - Software Reliability Definition, McCall software quality model, Capability Maturity Model.	3	4
	4.4	Configuration Management- Change Management, Version Management.	3	4
5		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Lecture, Classroom Discussions, Case study
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b>  <b>A. Continuous Comprehensive Assessment (CCA)</b>  <b>CCA for Theory: 30 Marks</b> 1. Written tests 2. Assignments
	<b>B. Semester End examination</b>  <b>ESE for Theory: 70 Marks (2 hrs)</b>  <b>Written Test(70 Marks)</b> Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)

**REFERENCES**

1. K K Aggarwal, Yogesh Singh - Software Engineering, Third Edition, New Age International Publications.
2. Ian Somerville - Software Engineering, Ninth Edition, Pearson Education.

**SUGGESTED READINGS**

1. Roger S Pressman - Software Engineering: A Practitioner's Approach, Sixth Edition, McGraw-Hill Higher Education.
2. Pankaj Jalote - An Integrated Approach to Software Engineering, Second Edition, Narosa Publishing Company.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Operating Systems</b>					
<b>Type of Course</b>	DSC					
<b>Course Code</b>	<b>24SACCSC5DA302</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	Operating Systems (OS) courses cover the essential concepts and functionalities of computer operating systems. Key topics include process management, memory management and file systems. Students learn about synchronization and communication between processes.					
<b>Semester</b>	5	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe essential aspects of operating systems	U	1, 2
2	Compare various process scheduling algorithms	U, A, An	1, 2
3	Describe the techniques for detecting, preventing deadlocks and deadlock management techniques.	U, A, An	1
4	Illustrate memory and storage management techniques.	U, A, An	1, 2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction: OS Definition, Functions, Types of OS	2	1
	1.2	User Operating System Interface	3	1
	1.3	System Calls, Types of System Calls.	5	1
2	2.1	Process: Basic Concepts.	2	2
	2.2	Types of schedulers, Operations on Processes	2	2
	2.3	Inter process communication	4	2
	2.4	Scheduling Criteria, Scheduling Algorithms.	7	2
3	3.1	Process Coordination: Synchronization, The Critical Section problem,. Deadlocks: Deadlock definition, Deadlock Characterization, Methods of handling Deadlocks- Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	2	3
	3.2	Semaphores, Classic Problems of Synchronization	5	3
	3.3	Deadlocks: Deadlock definition, Deadlock Characterization	2	3
	3.4	Methods of handling Deadlocks- Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	9	3
4	4.1	Memory Management: Memory Management Strategies - Swapping, Contiguous memory allocation, Paging, Segmentation.	7	4
	4.2	Virtual Memory Management- Demand paging,	2	4
	4.3	Page Replacement algorithms	3	4
	4.4	Storage Management: File System: - File Concept, Access Methods, Directory Structure	2	4
	4.5	File System Structure, Allocation Methods, Free Space Management.	3	4
4		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Lecture, Presentations Classroom Discussions Assignments
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b>  <b>A. Continuous Comprehensive Assessment (CCA)</b>  <b>CCA for Theory: 30 Marks</b>  1. Written tests 2. Assignments
	<b>B. Semester End examination</b>  <b>ESE for Theory: 70 Marks (2 hrs)</b>  <b>Written Test (70 Marks)</b> Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)

**REFERENCES**

1. Abraham Silberschatz, Peter B. Galvin, and Greg Gagne (2006). Operating System Principles (7th Edition). John Wiley & Sons

**SUGGESTED READINGS**

1. William Stallings - Operating Systems, Sixth Edition, Prentice Hall of India, Pearson
2. Milan Kovic – Operating Systems, 2nd Edition, (TMH )



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Computer Security</b>					
<b>Type of Course</b>	DSE					
<b>Course Code</b>	<b>24SACCSC5DE301</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course provides a comprehensive introduction to computer security, covering fundamental concepts, cryptographic techniques, system security measures, user authentication mechanisms, and basics of network security. Students will develop analytical and practical skills necessary for critical thinking in security, fostering problem-solving abilities crucial for scientific reasoning in cybersecurity.					
<b>Semester</b>	5	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	A basic understanding of computer systems, networks, and introductory programming concepts is recommended as a prerequisite for this course.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain security basics, approaches, principles, and types of attacks.	U	1
2	Apply cryptographic techniques and algorithms effectively.	A	2
3	Demonstrate proficiency in system security practices	U	1

4	Develop understanding of user authentication and network security mechanisms	U,A	1, 2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Concepts of security, Need for Security, Security Approaches, Security services and Mechanisms, Principles of Security, Types of Attacks, Sniffing and spoofing, Phishing, Pharming.	15	1
2	2.1	Cryptography Techniques: Cipher Methods: Caesar cipher, One time pad. Mono alphabetic Cipher, Play fair cipher. Poly alphabetic cipher, Vigenère Cipher, Transposition ciphers, Cryptographic Algorithms: Symmetric & Asymmetric- Basic idea of Cryptographic tools: PKI- Digital Signatures.	15	2
3	3.1	System Security: Intrusion Detection and Prevention Systems, Need of IDPS. Types of IDPS, Password Management, Counter measures, Access Controls and Authentication, Malware and Antivirus Techniques, Security Patching and Update.	15	3
4	4.1	User Authentication Mechanisms User Authentication Mechanisms -Authentication Basics, Passwords, Authentication tokens, Authentication token types, Biometric Authentication, Kerberos, Key distribution Center. Basics of Network Security: Introduction to TCP/IP, Firewalls, Types, IP Security, Virtual Private Network, VPN architecture.	15	4
5		<b>Teacher specific content</b>		





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Resource Optimization Techniques					
<b>Type of Course</b>	DSE					
<b>Course Code</b>	24SACCSC5DE302					
<b>Course Level</b>	300					
<b>Course Summary</b>	This course covers fundamental concepts in decision-making and optimization techniques. This enables the students to explore models, methods, and applications, understanding their advantages, limitations, and the interplay between operations research techniques and decision making processes across industries.					
<b>Semester</b>	5	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Solve linear programming problems effectively	U	1
2	Utilize simplex and dual methods proficiently	A	1
3	Implement transportation and assignment problem solving methods.	An	2
4	Solve sequencing and network routing problems effectively	S	2, 3

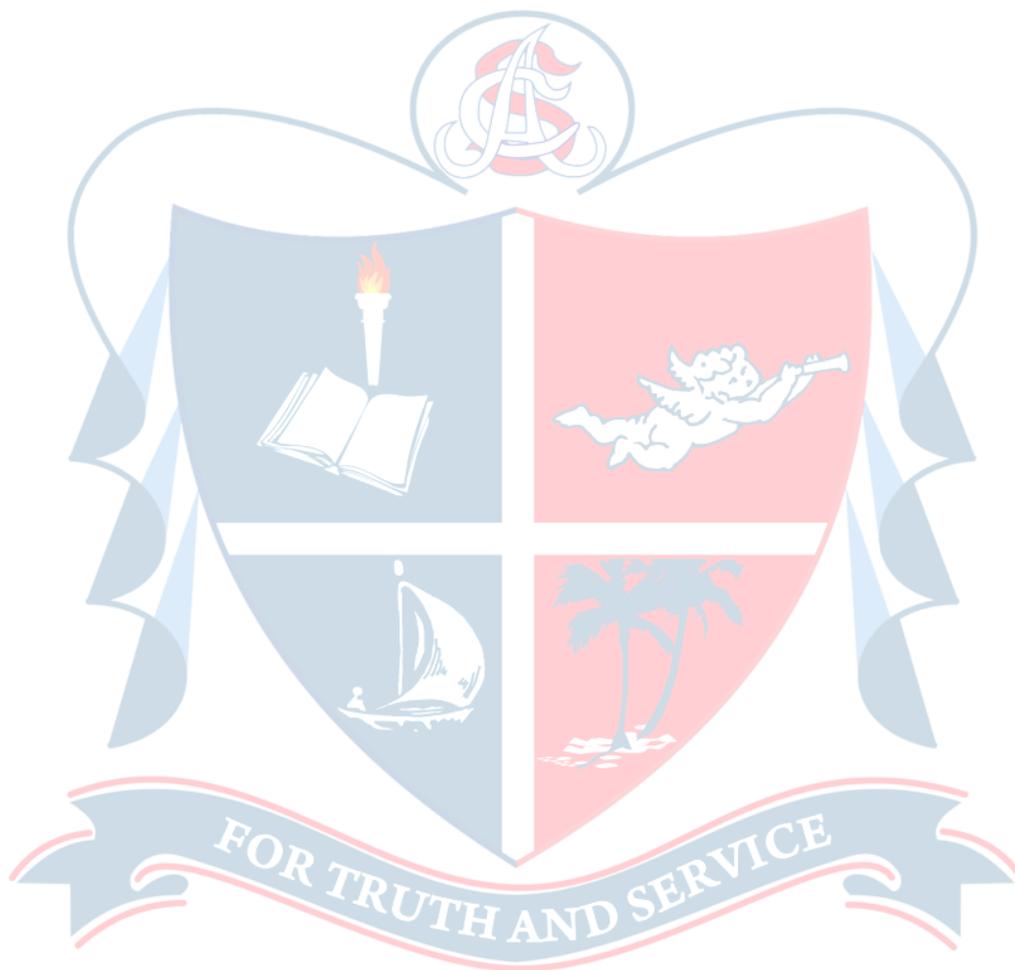
*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	OR:Introduction,origin and development,nature and features, scientific methods, modeling, Advantages and limitations of models,methodology, OR and decision making, applications, opportunities and shortcomings	8	1
	1.2	Linear Programming Problem:Mathematical formulation of LPP, Graphical solution method and exceptional cases, General LPP, Canonical and standard form of LPP	7	1
2	2.1	Simplex method-Introduction,properties,computational procedure of simplex method,Artificial variables	6	2
	2.2	Duality in Linear Programming:Introduction,general Primal-Dual pair, Formulation of dual problem,Dual Simplex Method.	9	2
3	3.1	Transportation Problem:Introduction,North West Corner method, Least Cost Method and Vogel's Approximation Method.	5	3
	3.2	Assignment Problems:Introduction,Solution using Hungarian Method, Prohibited Assignment Problems	10	3
4	4.1	Sequencing Problems:Introduction,Basic Terms, Processing n job through 2 machines, Processing n job through k machines, Processing 2 job through k machines and Maintenance Crew Scheduling	5	4
	4.2	Network Routing Problem:Introduction,Basic components, Logical sequencing, Rules, concurrent activities, Critical Path Analysis-CPM,PERT method,	10	4



3. K.V Mital and C.Mohan, Optimization methods in Operations Research and system Analysis, Third Edition, New Age International.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Artificial Intelligence (Data Science and Analytics Specialization)</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC5DE303</b>					
<b>Course Level</b>	300					
<b>Course Summary</b>	The course introduces the concept of artificial intelligence. The various knowledge representation and Knowledge Inference methods are introduced. The course introduces the application of AI in various fields.					
<b>Semester</b>	5	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Awareness of algorithmic approaches in Computer Science.					

### COURSE OUTCOMES (CO)

<b>CO No.</b>	<b>Expected Course Outcome</b>	<b>Learning Domains *</b>	<b>PO No</b>
1	Describe the fundamental concepts, applications and informed searching techniques in AI.	U	1,2
2	Analyze informed and uninformed search techniques for problem-solving.	A	1,2,3
3	Illustrate the knowledge representation in AI.	An	1,2
4	Appraise the application of the fuzzy logic and statistical machine learning in AI systems.	An	1,2

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill**

**(S), Interest (I) and Appreciation (Ap)****COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction: Basics of Artificial Intelligence- What is AI, Definition of AI through Problems, History of AI	2	1
	1.2	AI problems and techniques, Problem solving methods in AI- State space search, Production system, Problem Characteristics, Control Strategies	4	1
	1.3	Search Strategies- Uninformed Search Category- Depth First Search, Breadth First Search.	4	1
	1.4	Applications of AI in daily life including Health care, Education, Agriculture, Banking,	2	1
	1.5	Expert Systems- Examples of Expert systems. Problem Solving Examples-Expert system in Agriculture, Expert system in Environmental Management.	3	1
2	2.1	Uninformed Search Strategies- Generate and Test, Depth First Search, Breadth First Search	5	2
	2.2	Informed Searches:Hill Climbing, Best First Search and A* Search, Problem Reduction.	5	2
	2.3	Constraint Satisfaction with Inference.	5	2

3	3.1	Ontologies, Objects, Events, Representations and Mappings. Approaches to Knowledge Representation, Forward and Backward Chaining	7	3
	3.2	Logic in Artificial Intelligence- Propositional Logic, First Order Predicate Logic.	7	3
4	4.1	Basics of Fuzzy Logic and Applications- Introduction, Set Theory, Fuzzy set theory Fuzzy sets and Crisp set	5	4
	4.2	Membership Functions, Linguistic Variable, Fuzzification and Defuzzification	6	4
	4.3	Statistical Machine Learning -Statistical Reasoning, Probability Axioms, Bayes Rules, Bayesian Network.	5	4
5	5.1	<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● Lecturing</li> <li>● Problem Solving</li> <li>● Presentations</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p>

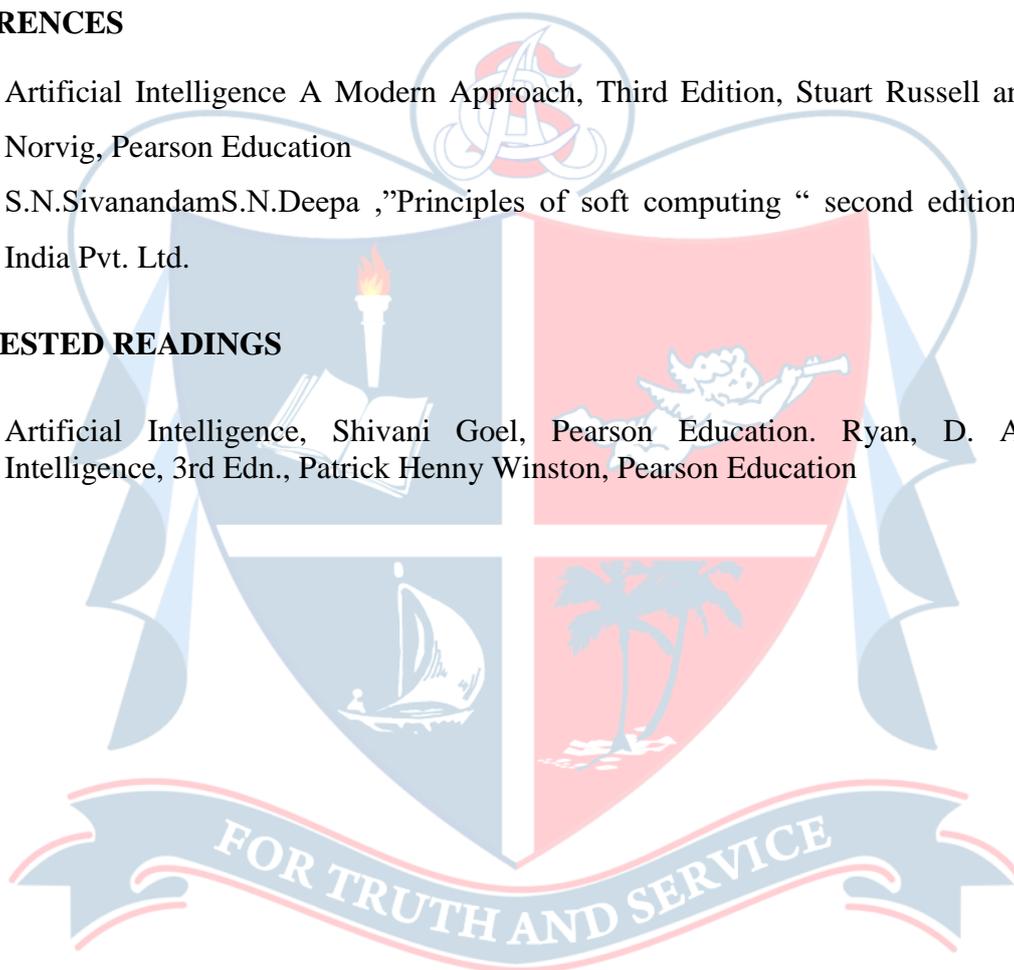
	<p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>
--	---

## REFERENCES

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education
2. S.N.SivanandamS.N.Deepa ,”Principles of soft computing “ second edition, Wiley India Pvt. Ltd.

## SUGGESTED READINGS

1. Artificial Intelligence, Shivani Goel, Pearson Education. Ryan, D. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Web Designing using PHP</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC5DE304</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course introduces students to the principles and practices of web development using PHP. The focus is on building dynamic and interactive web applications with databases. Students will gain the skills and knowledge to install and use an integrated PHP/MySQL environment.					
<b>Semester</b>	5	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamental concepts and components of web development.	U	1
2	Apply intermediate-level web development techniques	A	1,2
3	Design interactive web forms with data exchange	A	1,2

	between pages		
4	Integrate database to web application using PHP-MYSQL database connection	An	1,2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to web, WWW architecture	1	1
	1.2	Fundamentals of HTML, text formatting tags- text formatting tag, FONT tag, header tags.	4	1
	1.3	Inserting images, links, lists, marquee	3	1
	1.4	Creating tables, working with form elements.	4	1
2	2.1	CSS introduction, <link> and <style> elements, CSS properties, Controlling Fonts, Text formatting, Text- pseudo classes, Selectors, Links, Backgrounds, lists.	7	2
	2.2	Introduction to PHP, server-side scripting, XAmPP, role of web server software, php comments, variables, echo and print, PHP operators, data types.	5	2
3	3.1	PHP branching statements and looping statements	5	3

	3.2	arrays in PHP-numeric array, associative array, multidimensional array	5	3
	3.3	array functions in PHP- push, pop, shift, unshift, array_search, in_array, sort(), rsort, asort, arsort, ksort, krsort	5	3
	3.4	PHP form:\$_GET,\$_POST,\$_SERVER, \$_REQUEST, \$_GLOBALS, include and require function	4	3
	4.1	Basic MYSQL commands CRUD	5	4
4	4.2	PHP- MYSQL database connectivity using procedure oriented methods-mysqli_connect, mysqli_close.	6	4
	4.3	Mysqli_query, mysqli_fetch_row, mysqli_fetch_assoc, mysqli_fetch_array	6	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Lecture, Demonstration through ICT tools
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b>  <b>A.Continuous Comprehensive Assessment (CCA)</b> <b>CCA for Theory: 30 Marks</b> 1. Written tests 2. Assignments
	<b>B. Semester End Examination</b> <b>ESE for Theory: 70 Marks (2 Hrs)</b> <b>Written Test (70 Marks)</b>

	<p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>
--	---

## REFERENCES

1. Ivan Bayross - "HTML, DHTML, JavaScript, Pearl & CGI ", BPB Publication. (Module 1,2)
2. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi- "Beginning PHP5", Wiley Publishing, Inc (Module 3)
3. Adrian W. West, Steve Prettyman, Practical PHP 7, MySQL 8, and MariaDB Website Databases, A Simplified Approach to Developing Database-Driven Websites, Second Edition, Apress (Module 4)

## SUGGESTED READINGS

1. Thomas A. Powell- "HTML & CSS: The Complete Reference", 5th Edition, McGraw Hill
2. Mike O'Kane, Essential Algorithms, Syntax, and Control Structures Using PHP, HTML, and MariaDB/MySQL, Carolina Academic Press, Fourth Edition.
3. Julie C. Meloni, Teach Yourself PHP, MySQL® and Apache All in One, Fifth Edition.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Design Principles of User Computer Interaction</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC5DE305</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course provides comprehensive coverage of Human-Computer Interaction (HCI) fundamentals, design principles, and evaluation methods, integrating psychological insights, interaction models, usability testing, and advanced topics such as augmented reality and security considerations to create user-centric applications across various domains.					
<b>Semester</b>	5	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the basic concepts of human, computer interactions and create the processes of human computer interaction life cycle	K	1
2	Analyze and design the various interaction design models	An	2
3	Apply the interface design standards/guidelines for	A	2

	evaluating the developed interactions		
4	Apply product usability evaluations and testing methods and demonstrate the principles of human computer interactions	A	2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Input–output channels, Human memory and cognition, Emotional aspects in design, Individual differences in user behaviour	5	1
	1.2	Psychological principles in interactive system design, Various input devices: keyboards, touchscreens, etc., Display technologies and interfaces	5	1
	1.3	Applications: Designing mobile interfaces for elderly users. Use Case: Developing a navigation app for visually impaired individuals	5	1
2	2.1	Model Human Processor and GOMS models, State transition networks and Fitts' Law, Heuristic evaluation and usability testing, Contextual evaluation techniques.	5	2
	2.2	Applications: Designing a social media platform interface. Use Case: Usability testing of a task management application.	5	2

3	3.1	Shneiderman's eight golden rules, Norman's model of interaction, Nielsen's ten heuristics,	5	3
	3.2	Dialog design notations and semantics, Face-to-face and Text-based Communication in HCI.	5	3
	3.3	Applications: Designing an e-commerce website interface. Use Case: Analyzing user feedback for a video conferencing tool.	5	3
4	4.1	Human Factors in Interaction Design, Security Considerations in HCI, Groupware and Collaboration, Frameworks for groupware Implementation,	10	4
	4.2	Augmented and Virtual Reality. Application: Designing a Health Monitoring Wearable Device. Use Case: Evaluating User Privacy Concerns in a Social Networking Site	10	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● ICT enabled Classroom Lectures</li> <li>● Interactive sessions</li> <li>● Discussions</li> </ul>
<b>Assessment Types</b>	<p style="text-align: center;"><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>

	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>
--	--

## REFERENCES

1. DA Dix, Janet Finlay, G D Abowd, R Beale.(2008). Human-Computer Interaction(3rd Edition).Pearson Publishers.

## SUGGESTED READINGS

1. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2010.
2. Hans-Jorg Bullinger, "Human-Computer Interaction", Lawrence Erlbaum Associates, Publishers
3. Jakob Nielsen,"Advances in Human-computer Interaction",Ablex Publishing Corporation
4. Thomas S. Huang," Real-Time Vision for Human-Computer Interaction", Springer
5. Preece et al, Human-Computer Interaction, Addison-Wesley, 1994.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	B.Sc. (Honours) Computer Science					
<b>Course Name</b>	Advanced Cryptography & Network Security					
<b>Type of Course</b>	DSE					
<b>Course Code</b>	24SACCSC5DE306					
<b>Course Level</b>	300					
<b>Course Summary</b>	The objective of the course is to provide a basic understanding of the various issues related to information systems security (security). The course will present an overview of the risks encountered in information systems security, and the tools used for resolving these risks.					
<b>Semester</b>	5	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Basics of networks.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the basics of Cryptography and Network Security.	K	PO1
2	To familiarize the students with cryptography and its applications. The students will be able to develop basic understanding of cryptographic mechanisms.	U	PO2

3	To understand various protocols for network security to protect against the threats in the networks.	U	PO3
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
		<b>Foundations of Cryptography and Network Protocols</b>		
1	1.1	Introduction to Cryptography and Network Security, Types of Computer Networks, Reference Models: ISO-OSI and TCP/IP.	2	1
	1.2	Network Layer: Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP).	1	1
	1.3	Transport Layer: User Datagram Protocol (UDP), Transmission Control Protocol (TCP).	1	1
	1.4	Application Layer: HyperText Transfer Protocol (HTTP).	1	1
	1.5	Cryptographic Basics: Substitution Cipher and Transposition Cipher, Simple XOR and One-Time Pads,	4	1

		Communication Using Symmetric Cryptography, One Way Functions and Hash Functions, Communication Using Public Key Cryptography, Digital Signatures, Random and Pseudo-Random Sequence Generation.		
<b>Computer and Network Security Concepts</b>				
	2.1	Security Fundamentals: Computer Security Concepts, OSI Security Architecture, Security Attacks, Services, and Mechanisms.	3	3
2	2.2	Key Exchange and Authentication Protocols: Basic Protocols for Key Exchange, Authentication Protocols, Authentication and Key Exchange, Formal Analysis of Authentication and Key Exchange Protocols, Multiple Key Public Key Cryptography, Secret Splitting and Secret Sharing, Intermediate Protocols, Timestamp Services, Subliminal Channel.	5	1,3
<b>Symmetric and Asymmetric Cryptography</b>				

3	3.1	Symmetric Cryptography: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms.	4	2
	3.2	Asymmetric Cryptography: Public-Key Cryptography Principles, Public-Key Cryptography Algorithms.	5	2
	3.3	Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Key Distribution Using Asymmetric Encryption, Public-Key Infrastructure	4	2
	3.4	Advanced Cryptographic Protocols: Zero Knowledge Proofs and Zero Knowledge Proofs of Identity, Blind Signatures, Identity-Based Public Key Cryptography, Digital Certified Mail, Secure Multiparty Computation, Anonymous Multiparty Computation, Anonymous Message Broadcast, Digital Cash	6	2
<b>Advanced Security Mechanisms and Cryptographic Techniques</b>				

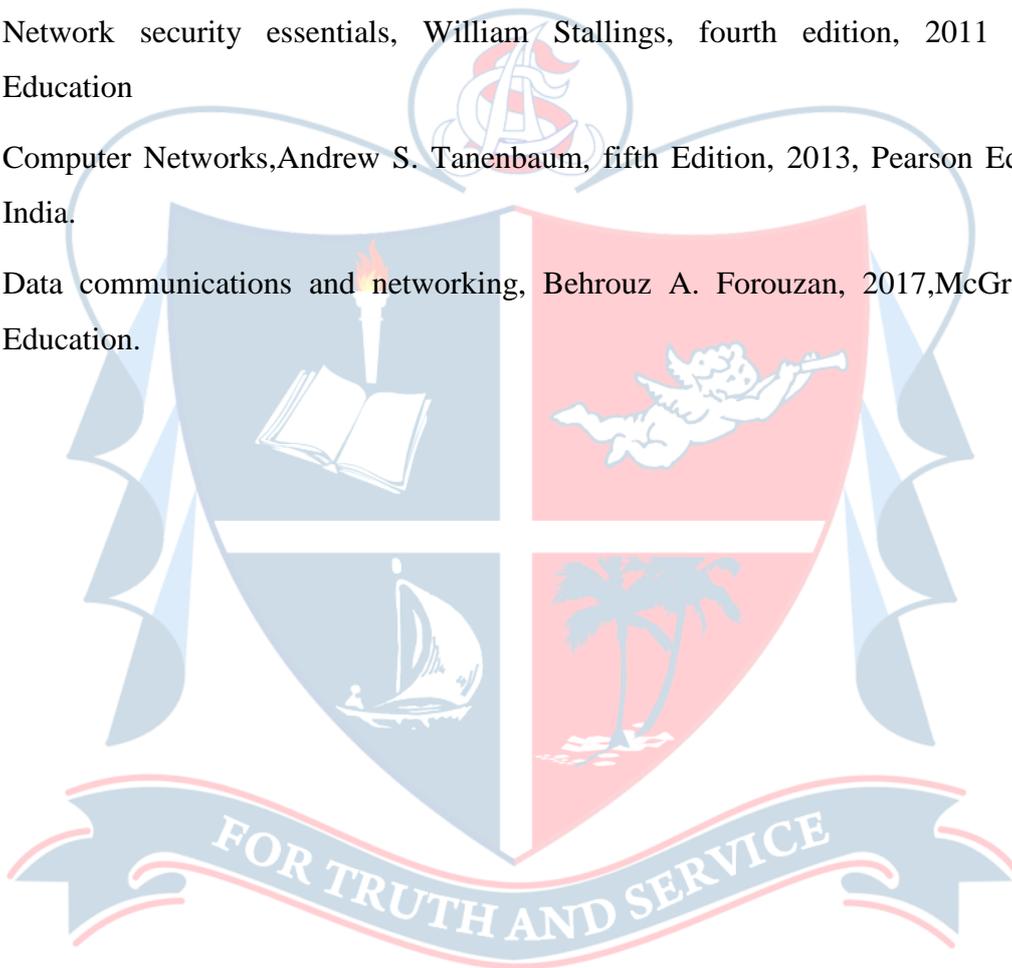
4	4.1	Transport-Level Security: Secure Socket Layer (SSL) and Transport Layer Security (TLS), Hypertext Transfer Protocol Secure (HTTPS), Secure Shell (SSH)	2	3
	4.2	IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload (ESP), Internet Key Exchange (IKE)	2	2,3
	4.3	Electronic Mail Security: Pretty Good Privacy (PGP), Secure/Multipurpose Internet Mail Extensions (S/MIME)	2	2, 3
	4.4	Intrusion Detection and Prevention: Intruders and Intrusion Detection, Password Management	2	2, 3
	4.5	Firewalls: Need for Firewalls, Firewall Characteristics, Types of Firewalls	1	2, 3
<b>Lab Practice</b>				
5	5.1	Windows network commands.	4	3
	5.2	Linux network commands.	4	3

	5.3	Network analyzing tools and Packet capturing tools.	10	3
	5.5	Vulnerability testing tools.	12	2, 3

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>• Lectures</li> <li>• Seminars</li> <li>• Discussions</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <p>Written tests</p> <p>Assignments</p> <p><b>CCA for Practical: 5 Marks</b></p>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions)</p> <p>- (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p>

## References

1. . Bruce Schneier, “Applied Cryptography: Protocols, Algorithms, and Source Code in C” John Wiley & Sons, Inc, 2nd Edition, 1996. 2
2. Cryptography and Network Security: Principles and Practice, William Stallings, sixth edition, 2013, Pearson.
3. Network security essentials, William Stallings, fourth edition, 2011 Pearson Education
4. Computer Networks,Andrew S. Tanenbaum, fifth Edition, 2013, Pearson Education India.
5. Data communications and networking, Behrouz A. Forouzan, 2017,McGraw Hill Education.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Software Development Lab 1</b>					
<b>Type of Course</b>	<b>SEC</b>					
<b>Course Code</b>	<b>24SACCSC5SE301</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course has been introduced to make students capable of developing software applying the concepts and techniques learned. This course provides a platform for developing their communication and presentation skills.					
<b>Semester</b>	5	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		1	0	2	0	75
<b>Pre-requisites, if any</b>	Must have learnt any one of Python, Java, PHP or C, Require knowledge in Software Engineering Techniques					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply Software Engineering concepts in project development	A	1,2
2	Plan, analyse, design a project using any selected technique.	C,Ap	3,2,8
3	Demonstrate independent and group learning through project implementation	A,S	4
4	Demonstrate and document software product.	A,S	5,9

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

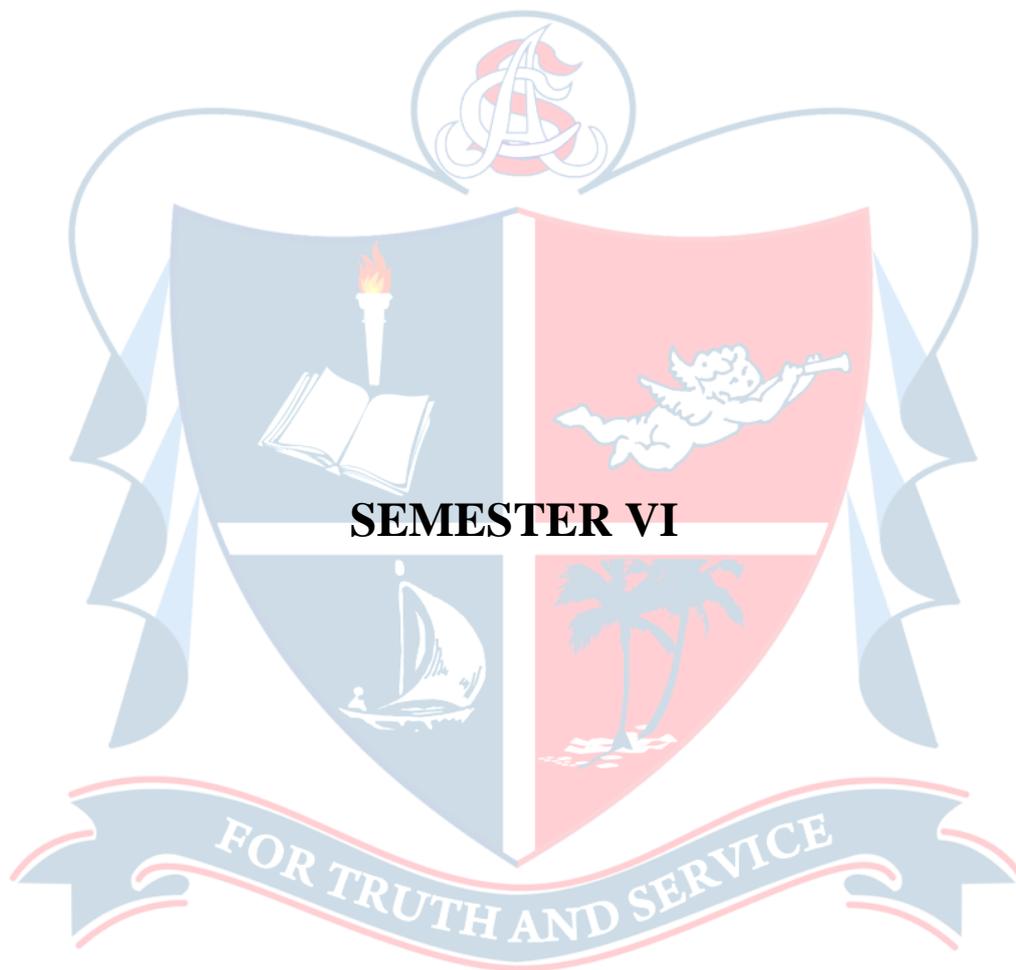
**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Discussion on Software Development life cycle, Design principles and techniques, Documentation	15	1,2,3,4
2	2.1	<p>Develop a complete Software using Python/Java/PHP/C. Apply software engineering concepts in the development. Projects can be individual or group wise. Maximum number of students allowed in a group is two. The internal and external evaluation include project demonstration and viva. A project report should be submitted at the end of the semester. Project must be done in the college lab under the guidance of a faculty from the department.</p> <ul style="list-style-type: none"> <li>Students opting for the 'Web and Mobile Technologies' track are required to utilize PHP programming language for software development purposes.</li> </ul>	60	1,2,3,4

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>Discussions</li> <li>Presentations</li> <li>Project Development</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p>

	<p style="text-align: center;"><b>CCA for Theory: 15 Marks</b></p> <ol style="list-style-type: none"><li>1. Viva</li><li>2. Review</li></ol> <p style="text-align: center;"><b>CCA for Practical: 15 Marks</b></p> <ol style="list-style-type: none"><li>1. Review</li><li>2. Demonstration</li><li>3. Report</li><li>4. Viva</li></ol>
	<p style="text-align: center;"><b>B. Semester End examination</b></p> <p style="text-align: center;"><b>ESE for Theory: 35 Marks</b></p> <ol style="list-style-type: none"><li>1. Viva - 25 Marks</li><li>2. Report - 10 Marks</li></ol> <p style="text-align: center;"><b>ESE for Practical: 35 Marks</b></p> <ol style="list-style-type: none"><li>1. Project demonstration and Presentation - 25 marks</li><li>2. Report - 10 marks</li></ol>







## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc(Honours) Computer Science					
<b>Course Name</b>	Cloud Computing					
<b>Type of Course</b>	DSC					
<b>Course Code</b>	24SACCSC6DA301					
<b>Course Level</b>	300					
<b>Course Summary</b>	Analyse the fundamentals of Cloud Computing and Virtualization Technologies, exploring their evolution, characteristics, and implementation levels. Investigate Cloud Architecture, Services, and Deployment Models, including Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). Examine leading Cloud Service Providers and their applications in various industries, such as Amazon Web Services, Google AppEngine, and Microsoft Azure.					
<b>Semester</b>	6	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Understanding of computer science fundamentals, networking principles.					

**COURSE OUTCOMES (CO)**

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe Cloud Computing fundamentals, including characteristics and on-demand provisioning.	U	1
2	Analyze Virtualization: Types, Implementation Levels, Structures, Tools, and Mechanisms.	An	2
3	Describe Cloud Architecture, NIST reference, and various service models.	U	1
4	Analyze different cloud service providers and cloud applications	An	2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing	7	1
	1.2	Cloud Characteristics – Advantages and Challenges	8	1
2	2.1	Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization	7	2
	2.2	Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices	8	2
3	3.1	Layered Cloud Architecture Design – cloud services-Software as a Service Platform as a Service.	8	3

	3.2	Infrastructure as a Service. Cloud deployment models public private, community, hybrid	7	3
4	4.1	Cloud Platforms in Industry: Amazon Web Services, Google AppEngine, Microsoft Azure	8	4
	4.2	Cloud Applications: Scientific Applications, Business and Consumer Applications	7	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <p>Lecturing and Discussion</p>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions)</p> <p style="text-align: right;">- (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>

**REFERENCES**

1. Toby Velte, Anthony Velte, Robert Elsenpeter(2009). "Cloud Computing -A Practical Approach".Tata Mcgraw Hill.

**SUGGESTED READINGS**

1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012
3. Rittinghouse, JohnW., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Software Development Lab 2</b>					
<b>Type of Course</b>	<b>DSC</b>					
<b>Course Code</b>	<b>24SACCSC6DA302</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course has been introduced to make students capable of developing a software applying the concepts and techniques learned. This course provide a platform for developing their communication and presentation skills.					
<b>Semester</b>	6	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		1	0	3	0	105
<b>Pre-requisites, if any</b>	Must have learnt programming, Require knowledge in Software Engineering Techniques.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Conduct research to acquire a thorough understanding of current industry requirements.	A	1,2
2	Build a software product by applying Software Engineering methods.	C,Ap	3,2,8
3	Demonstrate the skills to communicate effectively and to present ideas clearly and coherently to in both the written and oral forms	A,S	4
4	Demonstrate independent learning skills.	A,S	5,9

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Discussion on Software Development life cycle, Design principles and techniques, Documentation	15	1,2,3,4
2	2.1	Develop a complete Software choosing any areas of current industry requirement, using latest packages / languages running on appropriate platforms (Except the tools used in Software Development Lab 1), so that the student becomes industry ready. A hard bound project report should be submitted that is complete in all aspects. For internal evaluation, the progress of the student shall be systematically assessed through various stages of evaluation at periodic intervals. Projects should be individual.	90	1,2,3,4

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● Discussions</li> <li>● Presentations</li> <li>● Project Development</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 15 Marks</b></p> <ol style="list-style-type: none"> <li>1. Viva</li> <li>2. Review</li> </ol> <p><b>CCA for Practical: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Review</li> <li>2. Demonstration</li> <li>3. Report</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 35 Marks</b></p> <ol style="list-style-type: none"> <li>1. Viva - 25 Marks</li> <li>2. Report - 10 Marks</li> </ol> <p><b>ESE for Practical: 50 Marks</b></p> <ol style="list-style-type: none"> <li>1. Project Presentation and Demonstration - 30 Marks</li> <li>2. Viva Voce - 10</li> <li>3. Report - 10 marks</li> </ol>



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Big Data Analytics</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC6DE301</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course introduces Big Data concepts and the Hadoop ecosystem, covering data classification, Hadoop features, HDFS, MapReduce, and frameworks like Pig and Hive for Big Data applications. Students will gain practical experience with Hadoop tools and techniques for processing and analyzing large datasets.					
<b>Semester</b>	6	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Basic knowledge in Data Base Management Systems.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental characteristics of big data, and differentiate between structured, semi-structured, and unstructured data.	U	1
2	Explain the advantages and features of Hadoop technology.	A	1,2
3	Understand and implement MapReduce programming, including job execution, handling failures, and optimizing	U,A	1,2

	performance.		
4	Compare and contrast Pig and Hive for big data processing	A	2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Classification of digital data - structured, semistructures, unstructured data-Characteristics of data- Definition of big data-evolution, challenges with big data	8	1
	1.2	Three Vs of big data- Other characteristics.-Business Intelligence versus Big Data-Hadoop Environment-why big data.	7	1
2	2.1	Features of Hadoop-Key Advantages of Hadoop-Versions of Hadoop-Overview of Hadoop Ecosystems-Hadoop Distributions-Hadoop versus SQL-RDBMS versusHadoop	7	2
	2.2	Hadoop Overview-Hadoop Use case-Managing Resources with YARN. Hadoop Distributed File System(HDFS)- HDFS Daemons-Anatomy of File Read and Write-Working with HDFS Commands-Special Features of HDFS	8	2

3	3.1	MapReduce, Daemons-Working-Example.MapReduce Programming-Mapper,Reducer, Combiner, Partitioner	8	3
	3.2	Anatomy of a Map Reduce Job runFailures-Job SchedulingShuffle and Sort – Task execution - Map Reduce InputOutput Types and Formats- Map Reduce Features	7	3
4	4.1	Applications on Big Data Using Pig- Pig Latin OverviewOperators-Data Types- Pig Latin Running ModesRelational Operators-AVG, MAX, COUNT- Complex Data Types- Word Count example using Pig.	8	4
	4.2	Introduction to Hive-Architecture- Data Types- File Formats- HiveQL. Difference between RDBMS and Hadoop, MapReduce versus Pig, Pig versus Hive	7	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● ICT enabled Lecture</li> <li>● Interactive sessions</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b> <b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>

	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>
--	--

## REFERENCES

1. Seema Acharya, Subhasini Chellappan(2015). "Big Data Analytics". Wiley. (Module I,2,3,4).
2. Tom White(2012). " Hadoop: The Definitive Guide"(Third Edition). O'reilly Media. (Module 3)

## SUGGESTED READINGS

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
3. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
4. Pete Warden, "Big Data Glossary", O'Reilly, 2011.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Internet of Things</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC6DE302</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course provides a comprehensive understanding of the fundamentals of the Internet of Things (IoT), covering key concepts, technologies, and applications. The syllabus is organized into four units, each addressing crucial aspects of IoT.					
<b>Semester</b>	6	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Basic knowledge of Computer Networks.					

### COURSE OUTCOMES (CO)

<b>CO No.</b>	<b>Expected Course Outcome</b>	<b>Learning Domains *</b>	<b>PO No</b>
1	Demonstrate Knowledge of IoT Fundamentals	U	1
2	Understand and implement sensor networks and IoT development boards, including Arduino, Raspberry Pi, and RFID systems.	U,A	1,2
3	Understand and apply wireless sensor networks and IoT wireless technologies	U,A	1,2
4	Analyze and evaluate IP-based IoT protocols , edge	An,E	2,3

	connectivity, IoT applications		
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT	3	1
	1.2	IoT Architectures, Physical & Logical Design of IoT	4	1
	1.3	Enabling Technologies in IoT, History of IoT, The Identifiers in IoT	4	1
	1.4	About the Internet in IoT, IoT frameworks, IoT and M2M.	4	1
2	2.1	Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working	8	2
	2.2	IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit,RFIDPrinciples and components,	7	2
3	3.1	Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	7	3
	3.2	Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART,NFC, Z-Wave, BLE, Bacnet, Modbus.	8	3
4	4.1	IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.	3	4
	4.2	Edge connectivity and protocols	2	4
	4.3	Applications of IoT: Home Automation, Smart Cities, Energy Logistics, Agriculture, Health and Lifestyle, Industrial IoT Retail	10	4

		Management, Legal challenges IoT design Ethics, IoT in Environmental Protection		
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>• ICT enabled Lectures</li> <li>• Interactive sessions</li> <li>• Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>

## REFERENCES

1. Vijay Madiseti and Arshdeep Bahga (2014). "Internet of Things (A Hands-on Approach)"(1st Edition). VPT.

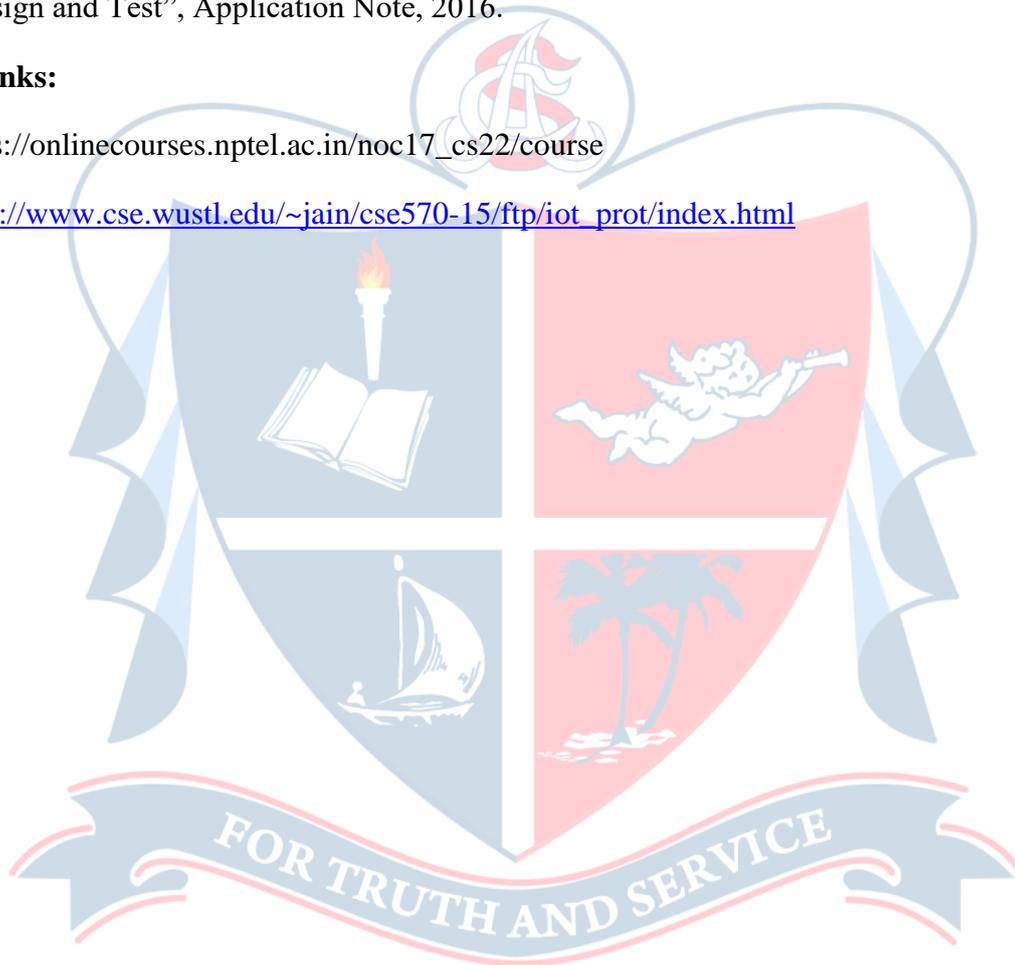
## SUGGESTED READINGS

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. Hakima Chaouchi, — “The Internet of Things Connecting Objects to the Web” ISBN : 978-1-84821-140-7, Wiley Publications
4. Olivier Hersent, David Boswarthick, and Omar Elloumi, — “The Internet of Things: Key Applications and Protocols”, Wiley Publications
5. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016. Keysight Technologies, “The Internet of Things: Enabling Technologies and Solutions for Design and Test”, Application Note, 2016.

**Web links:**

1. [https://onlinecourses.nptel.ac.in/noc17\\_cs22/course](https://onlinecourses.nptel.ac.in/noc17_cs22/course)
2. [http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot\\_prot/index.html](http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html)





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc(Honours) Computer Science</b>					
<b>Course Name</b>	<b>Understanding MP and MC Architecture</b>					
<b>Type of Course</b>	<b>DSE</b>					
<b>Course Code</b>	<b>24SACCSC6DE303</b>					
<b>Course Level</b>	300					
<b>Course Summary</b>	Understanding the operating concepts and programming of 8086 microprocessor					
<b>Semester</b>	6	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Knowledge about digital fundamentals.					

### COURSE OUTCOMES (CO)

<b>CO No.</b>	<b>Expected Course Outcome</b>	<b>Learning Domains *</b>	<b>PO No</b>
1	Describe the fundamental concepts of microprocessor architecture	U	1
2	Develop assembly language programs for the 8086 microprocessor.	A	1,2
3	Demonstrate proficiency in assembly language programming, integrating strings, procedures, and macros for efficient optimization and recursion.	U	1

4	Demonstrate proficiency in programming and understanding microcontrollers, including 8031 and PIC.	U	1
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Microprocessor architecture and its operations – concept of clock pulse-basic operations of microprocessor – read ,write operations. Opcode and operands - accumulator and flags- . 8086 Internal architecture.	5	1
	1.2	Basic 8086 microcomputer system - 8086 bus, Read machine cycle,Write machine cycle. .Operating modesRegister organization ,.	5	1
	1.3	Memory segmentation, Instruction sequencing. 8086 interrupts	5	1
2	2.1	Assembly language programming – program development steps, 8086 instructions – data transfer instructions, arithmetic instructions, bit manipulation instructions, string instructions,	8	2
	2.2	Program development steps- program execution, Sample programs	7	2
3	3.1	Strings , Procedures and Macros – 8086 string instructions,	5	3

	3.2	writing and using procedures, CALL and RET instructions, stack, using PUSH and POP to save register contents, passing parameters, reentrant and recursive procedures,	5	3
	3.3	writing and using macros.	4	3
4	4.1	Microcontrollers -- 8031 -- Basic architecture and components of a typical microcontroller -CPU, memory, input/output ports, timers, and serial communication modules	8	4
	4.2	Programming basics -Writing assembly and C-language programs for the microcontroller -Architecture diagram pins- instructions. Comparison with microprocessors. New micro controllers.- PIC - other examples.	8	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>• ICT enabled Lectures</li> <li>• Interactive sessions</li> <li>• Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b>  <b>A. Continuous Comprehensive Assessment (CCA)</b> <b>CCA for Theory: 30 Marks</b> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>

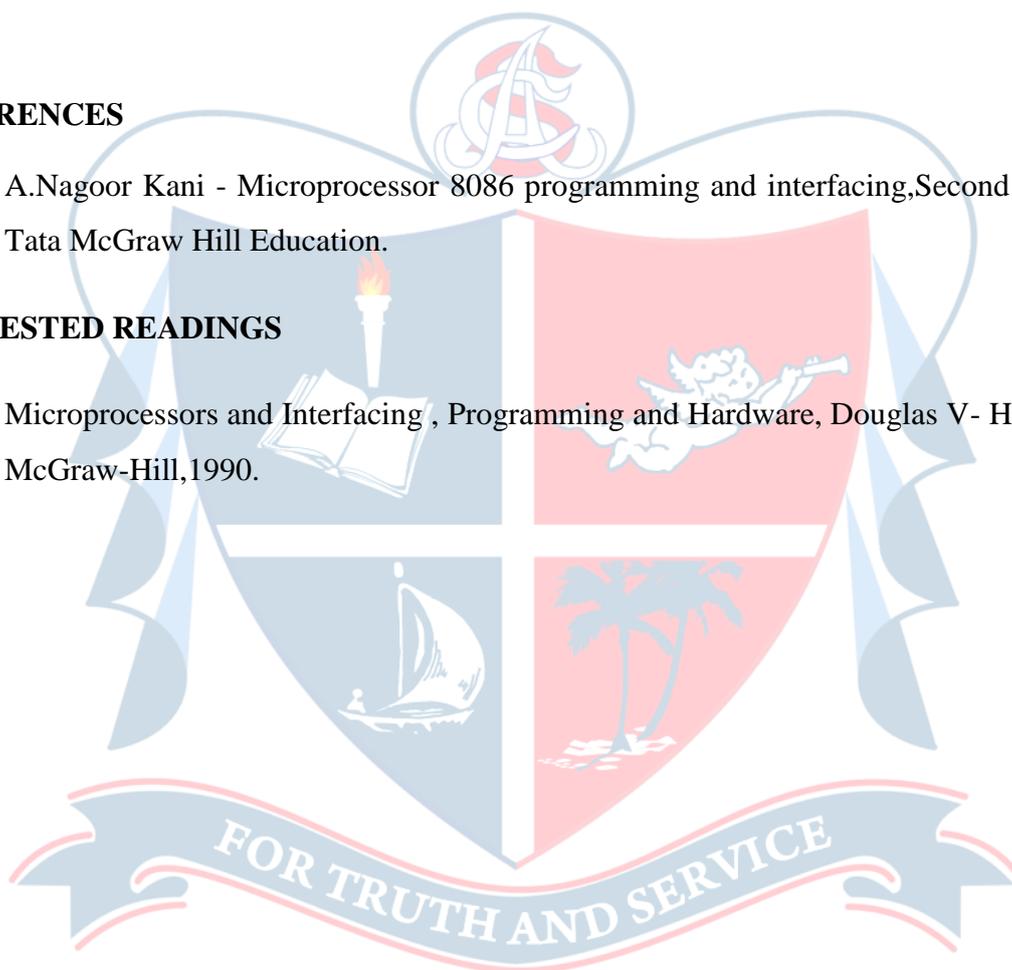
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>
--	--

### REFERENCES

1. A.Nagoor Kani - Microprocessor 8086 programming and interfacing, Second edition, Tata McGraw Hill Education.

### SUGGESTED READINGS

1. Microprocessors and Interfacing , Programming and Hardware, Douglas V- Hall. Tata McGraw-Hill, 1990.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	B.Sc. (Honours) Computer Science					
<b>Course Name</b>	Digital Image Processing					
<b>Type of Course</b>	DSE					
<b>Course Code</b>	24SACCSC6DE304					
<b>Course Level</b>	300					
<b>Course Summary</b>	The Digital Image Processing involves techniques and algorithms designed to analyze, enhance, and optimize an image's characteristics.					
<b>Semester</b>	6	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>	Fundamental concepts of image processing.					
		3	0	1	0	75

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	The students should able to understand the fundamental concepts of a digital image processing system.	K, U	PO1
2	The students should able to evaluate the techniques for image enhancement.	E	PO1,PO2
3	The students should able to analyze images in the	An	PO3

	frequency domain using various transforms.		
4	The students should able to study the image restoration and compression procedures.	A	PO2
5	The students will able to interpret image segmentation and representation techniques.	An	PO2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Fundamentals of Image Processing –Definition of Image, Digital Image and Digital Image Processing	1	1
	1.2	Examples of fields that use Digital Image Processing	2	1
	1.3	Fundamental steps in image processing		1
	1.4	Components of Image Processing system	1	1
	1.5	Elements of Visual perception	1	1
	1.6	Image sensing and acquisition, Image sampling and quantization	1	1
	1.7	Relationships between pixels	2	1
	1.8	Color image fundamentals, Color Models-RGB, CMY, HIS	2	1
2	2.1	Image Enhancement in spatial domain, Basic Intensity transformation functions Image	4	1, 2

		Negatives, Log Transformations		
	2.2	Power Law Transformations, Piecewise Linear Transformations	2	1, 2
	2.3	Histogram processing	2	2
	2.4	Fundamentals of spatial filtering ,Smoothing spatial Filters.	4	2
3	3.1	Image Enhancement in Frequency domain	2	2, 3
	3.2	Introduction to Fourier transform: 1- D, 2 -D DFT and its Inverse Transform	2	2, 3
	3.3	Properties of 2-D DFT	1	2, 3
	3.4	Image Smoothing and Sharpening using Frequency Domain Filters- Ideal, Butterworth and Gaussian filters	4	2, 3
	3.5	Homomorphic filtering	2	2, 3
4	4.1	Image restoration and Compression: A Model of Image degradation and restoration process	1	4
	4.2	Noise models-Gaussian Noise, Rayleigh Noise, Gamma Noise, Exponential Noise, Impulse Noise	2	4
	4.3	Restoration using Mean Filters, Order Statistics filters, Adaptive filters.	2	4
	4.4	Compression- Need for data compression	1	4
	4.5	Huffman encoding	2	4
	4.6	Run Length Encoding	1	4
	4.7	Arithmetic coding	1	4

	4.8	JPEG standard & MPEG	2	4
5	Lab Practice			
	5.1	Program to input gray scale image and color image, convert image to array of numbers and perform rotations on the image.	6	5
	5.2	Program for conversion between colour spaces RGB, CMY, HSI.	8	5
	5.3	Program to find histogram value and display histogram of a grayscale and color image.	7	5
	5.4	Program to apply basic intensity transformations.	9	5

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Lectures</li> <li>● Seminars</li> <li>● Assignments</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <p>3. Written tests</p> <p>4. Assignments</p> <p><b>CCA for Practical: 5 Marks</b></p>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p>

	<p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"><li>1. Logic &amp; Successful Compilation - 5 Marks</li><li>2. Output - 5 Marks</li><li>3. Viva - 5 Marks</li><li>1. Record - 5 Mark</li></ol>
--	--

### References

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Third Edition, 2014.
2. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
3. Anil K Jain, Fundamentals of Digital Image Processing, Prentice Hall, Fourth Edition, 1989.
4. William K. Pratt, Digital Image Processing, John Wiley, Fourth Edition, New York, 2002.
5. Milan Sonka et al, Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House.

	<h2 style="margin: 0;">Department of Computer Science</h2> <h3 style="margin: 0;">St. Albert's College (Autonomous)</h3> <h3 style="margin: 0;">Ernakulam</h3>
---	--

<b>Programme</b>	<b>B.Sc. (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Social Media Mining</b>					
<b>Type of Course</b>	DSE					
<b>Course Code</b>	<b>24SACCSC6DE305</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	The social media mining theory paper delves into the foundational principles of extracting insights from social media data. Covering data collection, pre-processing, and ethical considerations, the course provides a theoretical understanding of social media mining. It equips students with knowledge in machine learning applications and social network analysis for informed decision-making in the digital landscape.					
<b>Semester</b>	6	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Nil					

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Students should be able to Explain graph essentials	K,U	PO1
2	Students should be able to Outline the concept of network measures	K,U	PO2
3	Students should be able to Classify supervised and	U	PO2

	unsupervised algorithms		
4	Students should be able to Categorize Infusion diffusion	U, An	PO1
5	Students should be able to Examine Recommendation system and behaviour analysis in social media	U, An	PO3
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

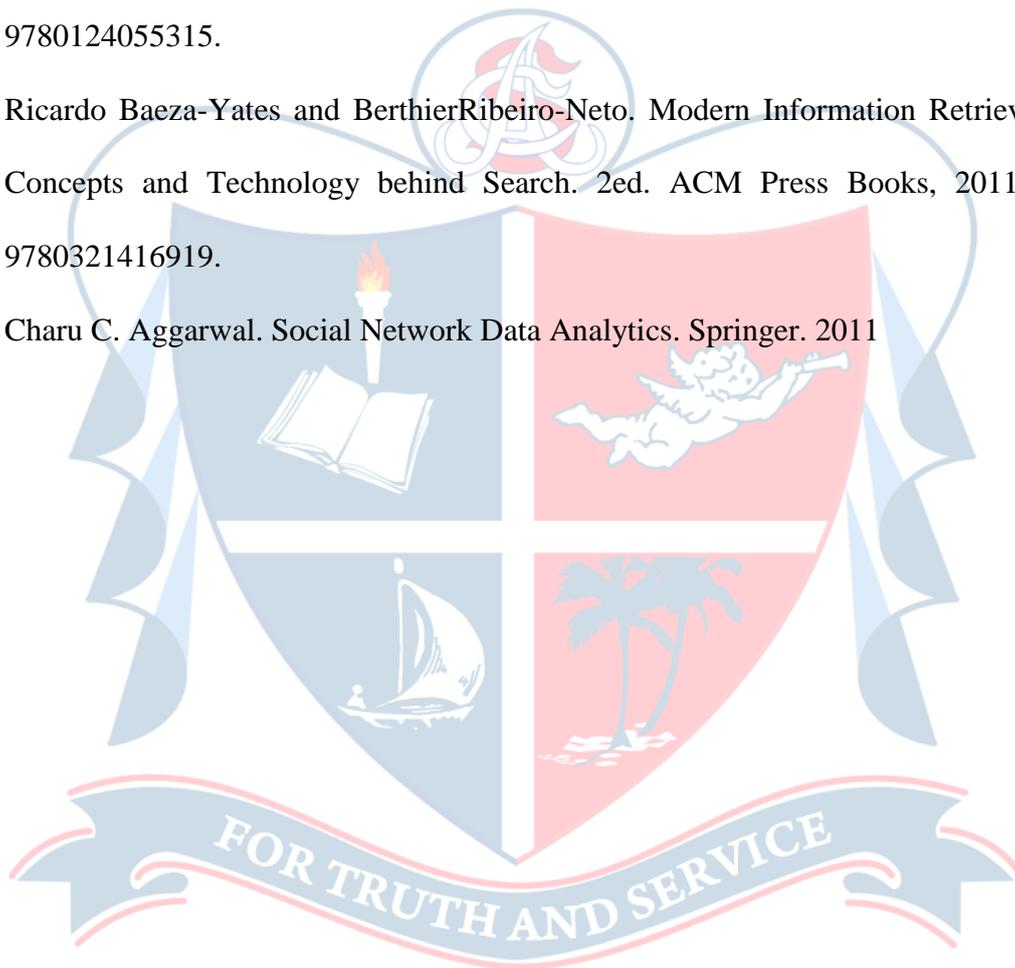
Module	Units	Course description	Hrs	CO No.
1	1.1	What is social media mining – New challenges for mining. Graph Essentials: Graph basics – Graph representation	2	1
	1.2	Types of graphs – Connectivity in graphs – Special graphs	2	1
	1.3	Graph algorithms-DFS,BFS, Prims algorithm	5	1
2	2.1	Network Measures: Centrality – Transitivity	4	2
	2.2	Reciprocity – Balance and status	4	2
	2.3	Similarity	4	2
3	3.1	Data Mining Essentials: Data Preprocessing	4	3
	3.2	Supervised Learning Algorithms	4	3
	3.3	Unsupervised Learning Algorithms	5	3

4	4.1	Information Diffusion: Herd behaviour	4	4
	4.2	Information cascades	4	4
	4.3	Diffusion of innovations	4	4
	4.4	Epidemics	2	4
5	5.1	Recommendation in Social media: Challenges – Classical recommendation algorithms	4	5
	5.2	Recommendation using social context	4	5
	5.3	Behaviour Analysis: Individual behaviour	2	5
	5.4	Collective behaviour.	2	5

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>Lecture</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p>CCA for Theory: 30 Marks</p> <ol style="list-style-type: none"> <li>Written tests</li> <li>Assignments</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)</p>

**References**

1. Reza Zafarani, Mohammad Ali Abbasi, and Huan Liu. *Social Media Mining: An Introduction*, Cambridge University Press, 2014.
2. Matthew A. Russell. *Mining the Social Web*. 2nd Edition. O'Reilly Media. 2013.
3. Jennifer Golbeck. *Analyzing the Social Web*. Morgan Kaufmann. 2013. ISBN 9780124055315.
4. Ricardo Baeza-Yates and Berthier Ribeiro-Neto. *Modern Information Retrieval: The Concepts and Technology behind Search*. 2ed. ACM Press Books, 2011. ISBN 9780321416919.
5. Charu C. Aggarwal. *Social Network Data Analytics*. Springer. 2011





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Machine Learning using Python					
<b>Type of Course</b>	SEC					
<b>Course Code</b>	24SACCSC6SE301					
<b>Course Level</b>	300					
<b>Course Summary</b>	This course deals with various algorithms to enable computers to learn data without being explicitly programmed. An insight into various types of machine learning algorithms, strategies for model generation and evaluation are given in this course.					
<b>Semester</b>	6	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
<b>Pre-requisites, if any</b>	Basic knowledge of Python Programming					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the basics, applications, types, and techniques of machine learning.	U	1,2
2	Describe and evaluate regression and classification techniques in machine learning.	U, E	1,2
3	Illustrating an understanding of neural networks, classifier metrics, overfitting, and ensemble learning is the aim.	U, An	1,2

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Machine Learning, Examples of Machine Learning applications, Types of learning: supervised, unsupervised, semi-supervised learning, learning associations	8	1
	1.2	Regression, Classification, Training versus testing. Model Selection and Generalization, Data Preprocessing, Feature Selection, Feature Extraction	7	
2	2.1	Regression: Simple Linear Regression, Multiple Linear Regression, Ridge Regression, Lasso Regression, Metrics for evaluating regression problems – MAE, MSE, RMSE, MAPE, $R^2$	8	2
	2.2	Classification- Logistic Regression, KNN, Decision Trees- Entropy, Information Gain, Tree construction, Issues in Decision Tree learning	7	
3	3.1	Neural Networks- The Perceptron, Activation Functions, Feed Forward Networks, Multi-layer neural networks, Back Propagation.	7	3
	3.2	Measuring classifier performance- Accuracy, Precision, recall, F1 score, ROC curves Problem of Overfitting, Regularization, Cross validation hyperparameter tuning. Introduction to Ensemble Learning, Introduction to Deep Learning.	8	
4		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● ICT enabled Lectures</li> <li>● Interactive sessions</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <b>A. Continuous Comprehensive Assessment (CCA)</b>

	<p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)</p>

### REFERENCES

1. Ethem Alpaydın(2004). Introduction to Machine Learning (Adaptive Computation and Machine Learning). MIT Press.
2. Jake Vander Plas(2016).Python Data Science Handbook.O'Reilly Media.

### SUGGESTED READINGS

1. Han, Jiawei, Jian Pei, and Mic



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Natural Language Processing					
<b>Type of Course</b>	SEC					
<b>Course Code</b>	24SACCSC6SE302					
<b>Course Level</b>	300					
<b>Course Summary</b>	This course provides a comprehensive foundation for understanding and applying natural language processing techniques. It covers language fundamentals, linguistics resources, and advanced NLP topics, including part-of-speech tagging, parsing, semantics, word sense disambiguation, information retrieval, and practical applications like machine translation and automatic speech recognition.					
<b>Semester</b>	6	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the various levels of linguistic analysis.	U	2
2	Distinguish between various NLP techniques for managing and analyzing linguistic data.	U	1
3	Compare and contrast various aspects of natural language structure and analysis.	An	2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction- Human languages, models, ambiguity, processing paradigms. Levels of language analysis-Syntax, Semantics, Pragmatics.	5	1
	1.2	Phonetics- Speech Sounds and Phonetic, Articulatory Phonetics, Prosody. Text representation in computers, encoding schemes.	4	1
	1.3	Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML	5	2
2	2.1	Management of linguistic data with the help of GATE, NLTK. Regular expressions, Finite State Automata, word recognition, lexicon.	5	2
	2.2	Morphology, acquisition models, Finite State Transducer. N-grams, smoothing, entropy, HMM, ME, SVM, CRF.	6	2
	2.3	Part of Speech tagging- Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions.	6	3
3	3.1	A survey on natural language grammars, lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax	7	3
	3.2	Parsing-Unification, probabilistic parsing, TreeBank. Semantics- Meaning representation, semantic analysis, lexical semantics, WordNet.	5	3
	3.3	Word Sense Disambiguation- Selectional restriction, machine learning approaches, dictionary-based approaches. Discourse- Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure	10	4
	3.4	Applications of NLP-Machine Translation, Information Retrieval and Extraction, Text Categorization and Summarization, Automatic Speech Recognition, Text to Speech.	7	4

<b>Teaching and Learning Approach</b>	<p>Classroom Procedure (<b>Mode of transaction</b>)</p> <ul style="list-style-type: none"> <li>● ICT enabled Lectures</li> <li>● Interactive session</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<p style="text-align: center;"><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)</p>

## REFERENCES

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2e, Pearson Education, 2009

## SUGGESTED READINGS

1. James Allen, Natural Language Understanding, 2e, The Benjamin/Cummings Publishing Company Inc., Redwood City, CA.
2. U. S. Tiwary and Tanveer Siddiqui. Natural language processing and Information retrieval, OUP, 2008

	<h2>Department of Computer Science</h2> <h3>St. Albert's College (Autonomous), Ernakulam</h3>
---	---

<b>Programme</b>	B.Sc. (Honours) Computer Science					
<b>Course Name</b>	Data Analytics for Business					
<b>Type of Course</b>	SEC					
<b>Course Code</b>	24SACCSC6SE303					
<b>Course Level</b>	300					
<b>Course Summary</b>	Data analytics for business courses typically aim to equip students with the analytical skills and knowledge required to analyze, interpret, and leverage data in business settings.					
<b>Semester</b>	6	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
<b>Pre-requisites, if any</b>						

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To foster an ability to critically analyse, synthesize and solve complex unstructured business problems	U	PO1
2	To encourage an aptitude for business improvement, innovation and entrepreneurial action.	A	PO2
3	To encourage the sharing of experiences to enhance	A	PO1, PO3

	the benefits of collaborative learning.		
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Overview of descriptive and predictive analytics	1	1
	1.2	Sales forecasting using Linear Regression	1	1
	1.3	Customer sentiment analysis	1	1
	1.4	Social Media Analytics	1	1
	1.5	Market Basket Analysis.	2	1
	1.6	Lab-Case Study on Marketing analytics	6	2
2	2.1	Relevance of analytics in healthcare.	1	2
	2.2	Understanding modelling techniques in patient risk profiling	1	1, 2
	2.3	OP time optimization	1	2
	2.4	Patient diagnostics	2	1, 2
	2.5	Claim Denials (US Insurance)	2	2
	2.6	Case Study on Healthcare Analytics	6	2
3	3.1	Understanding role of analytics in HR Function	1	2

	3.2	Identify KPI's of importance to HR function	1	2
	3.3	Modelling Attrition - Understanding how modelling attrition helps an organization.	2	2
	3.4	Model Building, Model Diagnostics and evaluation.	2	2
	3.5	Head count Analytics, evaluate social networks.	1	2
	3.6	Case Study on HR Analytics	6	2
4	4.1	Understanding role of analytics in finance.	1	1
	4.2	Customer profiling using clustering techniques	2	2
	4.3	Applied Credit Card Fraud detection using classification and regression techniques.	2	2
	4.4	Case Study on Finance Analytics	6	2
5	5.1	Understanding role of analytics in Operations – Introduction Distribution channel development- using predictive analytics in setting up distribution centers	2	1
	5.2	Machine error alerts - Understand modelling techniques to Predict failures in systems	2	2, 3
	5.3	Usage of Predicting modelling in demand and capacity management.	2	2, 3
	5.4	Case Study on Operations Analytics	5	2, 3

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Class Lectures</li> <li>● Lab Assignments</li> <li>● Seminar</li> <li>● Case Study</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p>CCA for Theory: 15 Marks</p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p>CCA for Practical: 15 Marks</p>
	<p><b>B. Semester End examination</b></p> <p>ESE for Theory: 35 Marks</p> <p>ESE for Practical: 35 Marks</p>

### References

1. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning By – James V Stone
2. Artificial Intelligence and Machine Learning By – Chandra S.S.V
3. Cutting Edge Marketing Analytics – RajKumar Venkatesan, Paul Farris and Ronald T Wilcox

	<h2>Department of Computer Science</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
---	---

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	User Centric Computing and Software Standards					
<b>Type of Course</b>	VAC					
<b>Course Code</b>	24SACCSC6VA301					
<b>Course Level</b>	300					
<b>Course Summary</b>	This course is designed for user centric tools and software standards in computer industry					
<b>Semester</b>	6	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
<b>Pre-requisites, if any</b>						

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the historical evolution, challenges, and evaluation techniques of user-centric design.	U	1, 8, 10
2	Apply knowledge of assistive technologies and ICT to address various disabilities and enhance accessibility.	A	1, 2, 9
3	Illustrate software quality concepts and quality management frameworks	An, S	2, 5, 10

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

#### COURSE CONTENT

**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to user centric design: historical evolution, issues and challenges and current trend – User centric computing	5	1
	1.2	User centric design evaluation: overview of evaluation techniques, expert evaluation, user evaluation, model-based evaluation with case studies	6	1
	1.3	Introduction to alternative augmentative communication (AAC) – Team based approach	4	1
2	2.1	Introduction to Assistive technologies - Assistive Devices - Information and Communication technology (ICT) - History of assistive technologies	5	2
	2.2	Benefits of ICT - ICT Used at institution level: Online education, Teleconferencing, Mobilephone based education, E-resources	3	2
	2.3	ICT for different disabilities: Intellectual disability, locomotor impairment and cerebral palsy, hearing impairment, Visual impairment, and autism - Comparison of present and future of ICT	7	2
3	3.1	Software Quality Concepts: Quality, Quality Control, Quality Assurance; Cost of Quality	5	3
	3.2	Software Reliability and Quality Management: ISO 9000, ISO 9001 Certification - SEI Capability Maturity Model - ISO 9000 certification vs SEI/CMM	7	3
	3.3	Applicability of SEI CMM to organization - Personal software process - Levels of PSP	3	3
4		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● ICT enabled Lectures</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <b>A. Continuous Comprehensive Assessment (CCA)</b>

	<p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (2 out of 3 Questions) - - (2*10=20 Marks)</p>

## REFERENCES

1. Dr.Samit Bhattacharya, Human Computer Interaction
2. Narsimhan N, E. Accessibility Policy handbook for persons with disabilities. Hemkunt Publishers

## SUGGESTED READINGS

1. Singh J P, Technology for the blind concept and context, Kanishka Publishers
2. Dr. Hemlata, Technology for inclusion of persons with disabilities, Kanishka Publishers.
3. Software Engineering: A Practitioner's Approach, 9th edition – Roger S Pressman, Bruce R Maxim; McGraw Hill



## Department of Computer Science St. Albert's College (Autonomous), Ernakulam

<b>Programme</b>	<b>B.Sc. (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Introduction to Cyber Crimes, Forensics &amp; Cyber Laws</b>					
<b>Type of Course</b>	VAC					
<b>Course Code</b>	<b>24SACCSC6VA302</b>					
<b>Course Level</b>	<b>300</b>					
<b>Course Summary</b>	This course is designed to introduce the participant to the cybercrime prevention, detection and incident management processes, policies, procedures and cybercrime governance activities. It therefore focusses on cybercrime management standards, guidelines and procedures as well as the implementation and governance of these activities. In addition, the present course provides participants with an understanding of the new and advanced digital investigation techniques for machines, systems and networks since new technologies are opening today the door to new criminal approaches.					
<b>Semester</b>	6	Credits			3	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
<b>Pre-requisites, if any</b>	Nil					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Learn, structure, mechanics and evolution of various	K	PO1

	crime threats .Learn to protect information systems from external attacks by developing skills in enterprise security, wireless security and computer forensics.		
2	To provide an understanding of computer forensics fundamentals.	U	PO1
3	Enable students to understand, explore and acquire a critical understanding in Cybercrimes and Cyber Laws	U	PO1
4	To analyze various computer forensics technologies.	An	PO1, PO2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Cyber Forensic and Computer Crimes, Introduction to Cyber Crime	1	1
	1.2	Reasons for Cyber Crime	1	1
	1.3	Distinction between Conventional and Cyber Crime	1	1
	1.4	Cyber Criminal Mode and Manner of Committing Cyber Crime	2	1
	1.5	Computer Crime Prevention Measures	1	1,2
	1.6	Crimes targeting Computers: Unauthorized Access, Packet Sniffing, Malicious Codes	2	1,2
2	2.1	<b>Cyber Crimes-What is Cyber Crime</b> <b>Crime Types</b> Basics of SQL Injections, Theft of FTP	4	1, 2

		password, Cross-site scripting, Viruses, Worms, Logical bombs, E-mail bombing, DoS attack, Spamming, Web jacking, Identity theft, Data diddling, Salami attacks, Phishing, Cyber stalking, Spoofing, Pornography, Defamation, Computer vandalism, Cyber terrorism, Cyber warfare, Hacking, Social Engineering,		
	2.2	Financial Crimes, ATM and Card Crimes	1	2
	2.3	Commercial espionage and Commercial Extortion online	1	1, 2
	2.4	Software and Hardware Piracy, Money Laundering	1	2
3	3.1	Introduction to Cyber forensics: Information Security Investigations, Corporate Cyber Forensics, Scientific method in forensic analysis, investigating large scale Data breach cases. Analyzing malicious software.	2	2
	3.2	Types of Computer Forensics Technology, Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology	2	2
	3.3	Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption	2	2

		Methods and Vulnerabilities		
	3.4	Protecting Data from Being Compromised Internet Tracing Methods, Security and Wireless Technologies, Avoiding Pitfalls with Firewalls Biometric Security Systems	2	2
	3.5	Types of Computer Forensics Systems: Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems	4	2
4	4.1	Evidence Collection and Data Seizure: Why Collect Evidence, Collection Options Obstacles	2	2, 3
	4.2	Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection	4	2, 4
	4.3	Controlling Contamination: The Chain of Custody, Reconstructing the Attack, The digital crime scene, Investigating Cybercrime, Investigating Web attacks, Investigating network Traffic	4	3
	4.4	Identification of Data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events.	1	2

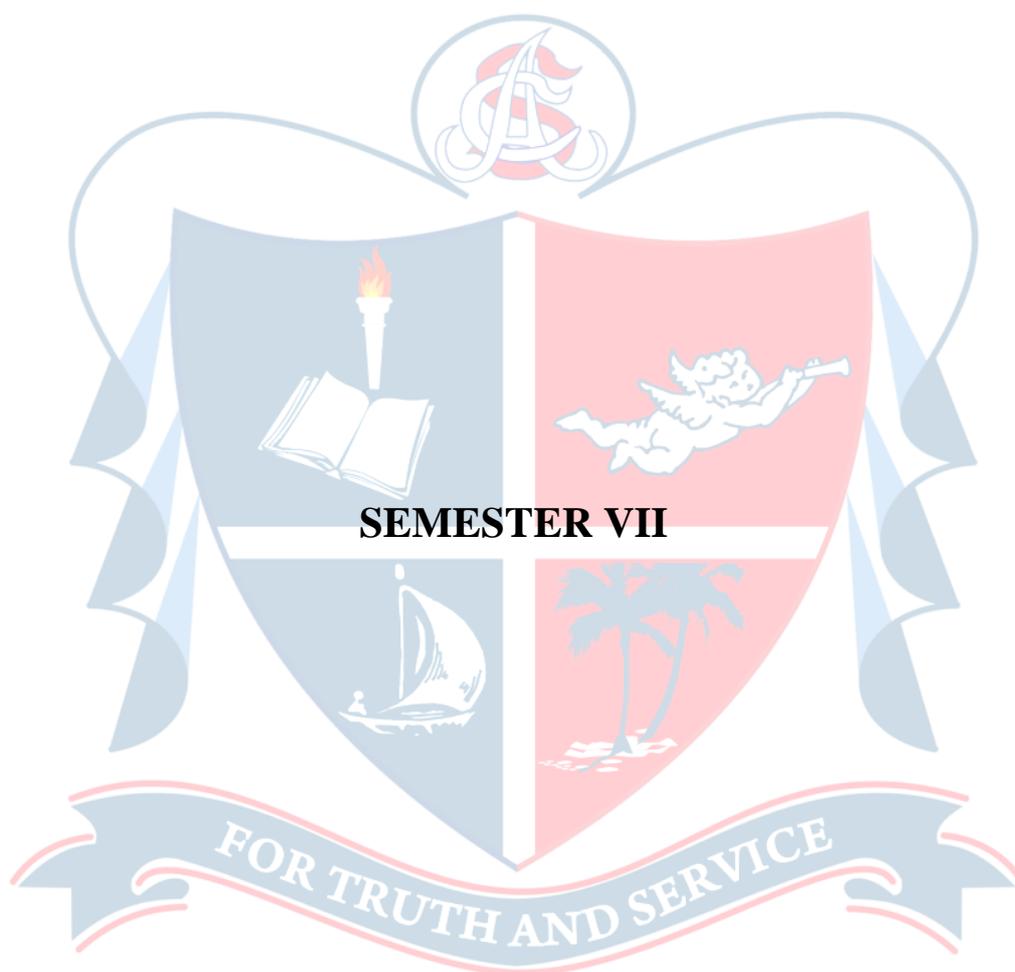
5	5.1	<b>Cyber Laws</b> -Defining Cyber Law, Concept and scope of Jurisprudence	1	1
	5.2	Basics of Cyber Space, Basics of IPC and CrPC	1	2
	5.3	Indian Evidence Act.	1	3
	5.4	<b>IT Act 2000</b> -Introduction to IT Act 2000, Amendment in IT Act,	1	2, 3
	5.5	Different Offences under IT Act 2000- Sections: S.65,S.66, S.66A, S.66B, S.66C, S.66D, S.66 E, S.67, S.67A,S.67B,S.67C.	2	2, 3
	5.6	Plagiarism Issues, Tools to detect Plagiarism, Plagiarism Tools : Turnitin, Viper	1	2

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Lectures</li> <li>● Class Room discussions</li> <li>● Seminars</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Case study reports</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: Very Short Answer Questions (Answer all) - (10*1=10</p>

	Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)
--	--

## References

1. Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, John R. Vacca, Charles River Media, 2005
2. Cyber Forensics - Concepts and Approaches, Ravi Kumar & B Jain, 2006, icfai University press
3. Understanding Cryptography: A Textbook for Students and Practitioners, Christof Paar, Jan Pelzl, 2010, Second Edition, Springer's.
4. Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, First edition, 2009
5. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010
6. "Internet Complete Reference, Harley Hahn, second Edition, 1996, Osborne/McGrawHill
7. Internet and Web design, Ramesh Bangia Firewall Media, (An imprint of Lakshmi Publications Pvt. Ltd. ). Second Edition 2006.
8. Cyber Law Crimes, Barkhs and U. Rama Mohan, Third Edition, 2017, Asia Law House
9. Cyber Laws Simplified, Viveek Sood, Fourth reprint 2008, McGraw Hill.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Advanced Java Programming					
<b>Type of Course</b>	DCC					
<b>Course Code</b>	24SACCSC7CC401					
<b>Course Level</b>	400					
<b>Course Summary</b>	Understanding the advanced features of Java					
<b>Semester</b>	7	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	73
<b>Pre-requisites, if any</b>	Knowledge about basic JAVA					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply JDBC architecture, drivers, SQL, and ResultSet interfaces effectively	A	2,3
2	Develop robust servlets and JavaServer Pages (JSP) for dynamic web applications.	A	2,8
3	Apply networking concepts in application programs	A	1.2
4	Implement database connectivity, networking, RMI and web applications	A	1.2

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	JDBC – Components of JDBC, JDBC architecture, various kinds of JDBC drivers	5	1
	1.2	The Structured Query Language, The Connection Interface, The Statement Interface, The Prepared Statement Interface	5	1
	1.3	Scrollable and Updatable ResultSets, RowSets, Transactions	5	1
2	2.1	Servlets-The life cycle of a servlet, creation of a simple servlet.	4	2
	2.2	The servlet API-javax.servlet package and javax.servlet.http package	4	2
	2.3	reading servlet parameters. Handling HTTP GET and HTTP POST requests.	4	2
	2.4	Java Server Pages(JSP)-overview, syntax and semantics, expressions and scriptlets, implicit objects, declarations, directives-include directive, page directive, tag lib directive.Session and cookies concept	4	2
	2.5	Java collections,JMS,Java beans, Java server Faces, JDBC	4	2
3	3.1	Networking basics-Networking classes and interfaces, InetAddress class-TCP/IP Client Sockets, URL Connection, TCP/IP Server Sockets.	5	3
	3.2	RMI-basic concepts-A simple client/server application using RMI.	5	3
4		<ol style="list-style-type: none"> <li>1. Implementing JDBC Connectivity: Develop a Java application that connects to a relational database using JDBC. Perform basic CRUD operations (Create, Read, Update, Delete) on database tables.</li> <li>2. Creating Servlets: Build a simple web application using servlets to handle HTTP requests and responses. Implement servlets for user authentication, data retrieval, and form submission.</li> <li>3. JavaServer Pages (JSP) Development: Create dynamic web pages using JSP to interact with servlets and display data retrieved from a database. Implement features like user authentication, session management, and form validation.</li> </ol>	30	4

		<p>4. Networking Basics: Develop a Java application to demonstrate network programming concepts such as TCP/IP client-server communication using sockets. Implement a chat application or a file transfer program.</p> <p>5. Remote Method Invocation (RMI): Create a distributed application using RMI to allow communication between Java</p>		
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● ICT enabled Lectures</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercises</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>C. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>D. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) (4*5=20 Marks)</p> <p>Part C: Essay Questions ( 1 out of 2 Questions) (1*10=10 Marks)</p>

	<p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"><li>1. Logic &amp; Successful Compilation - 5 Marks</li><li>2. Output - 5 Marks</li><li>3. Viva - 5 Marks</li><li>4. Record - 5 Marks</li></ol>
--	---

## REFERENCES

1. Uttam K Roy, ADVANCED JAVA PROGRAMMING. Oxford University Press; UK edition

## SUGGESTED READINGS

1. Herbert Schildt Java 2 The Complete Reference, Tata McGraw Hill (5th Edn.)
2. DT Editorial Services, Java 8 Programming Black Book, Dreamtech Press.
3. James. P. Cohoon, Programming java 5.0, Jack. W. Davison (Tata McGraw Hill)
4. C Thomas Wu, An introduction to Object Oriented Programming with Java, Tata McGraw Hill, (2006)
5. Wigglesworth and McMillan, Java Programming: Advanced Topics, Cengage Learning India, 3rd Edn.
6. Bernard Van Haecke, JDBC: Java Database Connectivity, IDG Books India (2000)



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Advanced Database Management Systems					
<b>Type of Course</b>	DCC					
<b>Course Code</b>	24SACCSC7CC402					
<b>Course Level</b>	400					
<b>Course Summary</b>	This course builds upon the foundational concepts of database management systems and SQL. It covers advanced topics, including Object-Oriented Database Management Systems (OODBMS), NoSQL databases, and MongoDB. Students will gain a deep understanding of advanced database concepts and technologies.					
<b>Semester</b>	7	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Basic understanding of relational database and SQL					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate transaction processing, Concurrency Control and Object-oriented Concepts in database management systems	U	1,2
2	Apply XML in Database Systems.	A	1,2,3
3	Analyse distributed and NoSQL databases	An	1,2
4	Apply shell operations and querying on MongoDB databases. A 2,3 *Remember (K), Und	A	2,3

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Transaction Processing: Transaction and System Concepts, Characterizing Schedules based on Recoverability and Seriability	3	1
	1.2	Two-Phase Locking Technique for Concurrency Control, Recovery Concepts	4	1
	1.3	Overview of Object-Oriented Database Concepts, Object-Oriented Data Modelling, Object Definition Language (ODL), Object Query Language	4	1
	1.4	Object-Relational Mapping (ORM)	2	1
	1.5	Case Studies and Applications of OODBMS	2	1
2	2.1	XML: Extensible Markup Language-Structured, Semi-structured, and Unstructured Data, XML Hierarchical (Tree) Data Model	5	2
	2.2	XML Schema Definition, Storing and Extracting XML Documents from Databases	5	2
	2.3	Querying XML Data (XPath and XQuery)	5	2
3	3.1	Distributed Databases and NoSQL Databases: Distributed Database Concepts, Data Fragmentation	4	3
	3.2	Replication and Allocation Technique for Distributed Database Design, Overview of Transaction Management in Distributed Databases	4	3
	3.3	Introduction to NoSQL databases, Characteristics of NoSQL Systems	4	3
	3.4	Categories of NoSQL Systems, Consistency and CAP Theorem.	3	3
4	4.1	Introduction to MongoDB-advantages, features, documents, collections, dynamic schemas, naming, databases	4	4
	4.2	MongoDB Shell, MongoDB client, create, read, update, delete	2	4

	4.3	Data types, arrays, embedded documents, objectids	2	4
	4.4	insert method, remove, updating documents	3	4
	4.5	Basic querying	4	4
<b>5</b>		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● Lecture</li> <li>● Problem Solving</li> <li>● Presentation</li> <li>● Discussions</li> <li>● Case Studies</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b>  <b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions)  (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions)  (2*10=20 Marks)</p>

## REFERENCES

1. Ramez Elmasri and Shamkant B. Navathe. DATABASE SYSTEMS (Sixth Edition). Pearson Education. (Module 1,2,3)
2. Kristina Chodorow. MongoDB: The Definitive Guide (Second Edition). O'Reilly Media. (Module 4)

### **SUGGESTED READINGS**

1. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems, Third edition, Mc Graw Hill International Edition.
2. Andreas Meier, Michael Kaufmann, - SQL & NoSQL Databases-Models, Languages, Consistency, Options and Architectures for Big Data Management.
3. <https://www.mongodb.com/docs/manual/MongoDB-manual.pdf>



	<h2>Department of Computer Science</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
---	---

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Advanced Data Structures					
<b>Type of Course</b>	DCC					
<b>Course Code</b>	24SACCSC7CC403					
<b>Course Level</b>	400					
<b>Course Summary</b>	This course offers a thorough understanding of data structures and algorithms, covering algorithmic analysis, array implementation, sorting, searching, linked lists, trees, graphs, and hashing for effective data management and retrieval.					
<b>Semester</b>	7	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Basic knowledge of Data Structure Concepts					

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate a comprehensive understanding of advanced sorting and searching algorithms	U	1
2	Analyze and compare AVL trees, Red-Black trees, and B-Trees.	A	2
3	Describe and analyze graph representations and traversal algorithms.	An	1,2
4	Describe the implementation and applications of Minimum Spanning Trees and Network Flow Algorithms.	U	2,3

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Advanced Sorting Algorithms: Merge sort, quicksort, heap sort, radix sort, external sorting techniques.	5	1
	1.2	Searching Algorithms: Binary search trees, balanced search trees (such as AVL trees), hash tables, bloom filters	5	1
	1.3	Advanced Search Techniques: Binary search on sorted arrays, interpolation search, exponential search, Fibonacci search.	5	1
2	2.1	AVL Trees: Introduction, balancing operations, rotations, insertion, and deletion algorithms.	5	2
	2.2	Red-Black Trees: Properties, insertion, and deletion algorithms, balancing operations.	8	2
	2.3	B-Trees and B+ Trees: Structure, insertion, and deletion operations, applications in databases and file systems.	9	2
3	3.1	Graph Representation: Adjacency matrix, adjacency list, and adjacency set representations.	3	3
	3.2	Graph Traversal: Depth-First Search (DFS), Breadth-First Search (BFS), applications in graph connectivity and cycle detection	3	3
	3.3	Shortest Path Algorithms: Dijkstra's algorithm, BellmanFord algorithm, Floyd-Warshall algorithm.	7	3
4	4.1	Minimum Spanning Trees: Prim's algorithm, Kruskal's algorithm, applications in network design and clustering	5	4
	4.2	Network Flow Algorithms: Ford-Fulkerson algorithm, Edmonds-Karp algorithm, applications in network optimization and flow analysis.	5	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● ICT enabled Lectures</li> <li>● Interactive sessions</li> <li>● Class discussions</li> </ul>
---------------------------------------	--

<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <p>1. Written test</p> <p>2. Assignments</p>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) -(20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) (2*10=20 Marks)</p>

**REFERENCES**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. "Introduction to Algorithms" (Third Edition). The MIT Press, Cambridge, Massachusetts London, England.

**SUGGESTED READINGS**

1. "Advanced Data Structures" by Peter Brass, 1st Edition, Cambridge University Press
2. "Algorithm Design" by Jon Kleinberg and Éva Tardos, 1st Edition, Pearson Education
3. "Approximation Algorithms" by Vijay V. Vazirani, 1st Edition, Springer
4. "Algorithms" by Robert Sedgewick and Kevin Wayne, 4th Edition, Addison-Wesley Professional



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	BSc (Honours) Computer Science					
<b>Course Name</b>	Advanced Operating System Concepts					
<b>Type of Course</b>	DCE					
<b>Course Code</b>	24SACCSC7DE401					
<b>Course Level</b>	400					
<b>Course Summary</b>	To provide a comprehensive understanding of advanced topics and prepare students for research, development, or advanced system administration roles and to introduce students to the Mobile application development ecosystem					
<b>Semester</b>	7	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Basic knowledge in Operating System concepts.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyze distributed, database, and multiprocessor operating systems intricacies	An	1,2
2	Evaluate real-time systems applications and justify design choices.	E	1,2,3
3	Compare and contrast Linux and Windows operating systems	U	1
4	Develop proficiency in Android operating system	A	1

*\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
		Distributed, Database & Multiprocessor operating systems	20hrs	
1	1.1	Distributed Operating Systems: System Architectures Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms Distributed Deadlock detection.	6	1
	1.2	Database Operating Systems: Requirements of Database OS – Transaction process model –Synchronization primitives Concurrency control algorithms.	7	1
	1.3	Multiprocessor Operating Systems: System Architectures Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation memory management.	7	1
		Real Time & Mobile Operating Systems	15hrs	
2	2.1	Basic Model of Real Time Systems – Characteristics Applications of Real Time Systems – Real Time Task Scheduling Handling Resource Sharing	7	2
	2.2	Mobile Operating Systems –Microkernel Design Client Server Resource Access – Processes and Threads Memory Management File system.	8	2
		Case study on Linux OS and Windows OS	15hrs	
3	3.1	Case Study on Linux: History of Unix and Linux, Linux Overview, Processes in Linux, Memory management in Linux, I/O in Linux, Linux file system, security in Linux.	8	3
	3.2	Case Study on Windows: History of windows through Windows 10, programming windows, system structure, processes and threads in windows, memory management, caching in windows, I/O in windows, Windows NT file system, Windows power management, Security in windows.	7	3
		Android OS	15hrs	
4	4.1	History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture	5	4

	4.2	Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating an android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.	5	
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>● ICT enabled Lectures</li> <li>● Interactive sessions</li> <li>● Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) (2*10=20 Marks)</p>

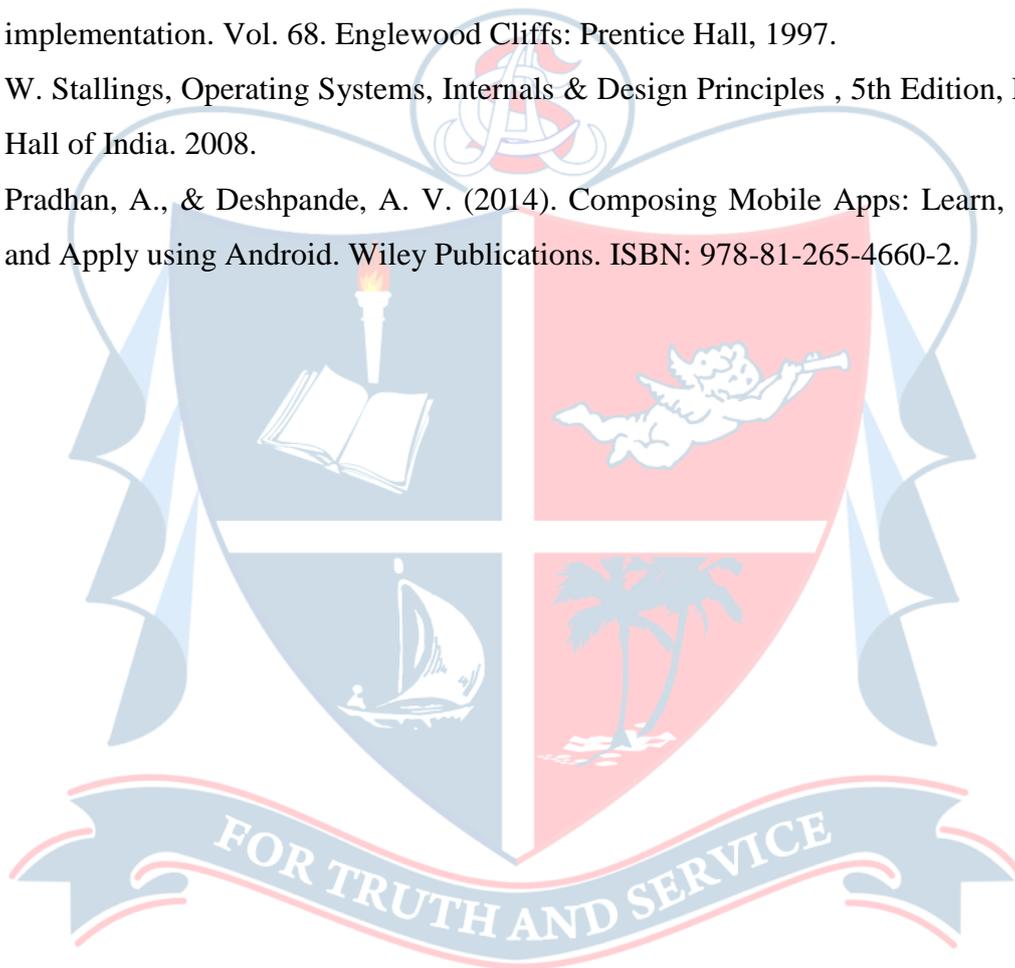
## REFERENCES

1. Mukesh Singhal, Niranjana G.( 2001). Shivaratri Advanced Concepts In Operating Systems: Distributed Database And Multiprocessor Operating Systems. Tata McGrawHill Edition,. (Module 1)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne(2018). Operating System Concepts(10th Edition). John Wiley & Sons. ISBN: 9781118063330.(Module 2)
3. Sheusi, J. C. (2013). Android Application Development for Java Programmers. Cengage Learning. - Module-4

4. Stevens, W. R., & Rago, S. A. (2013). Advanced Programming in the UNIX® Environment (3rd ed.). Addison-Wesley. - Module 3
5. John A.(2020).Understanding Windows Operating Systems". TechPress. - Module 3

### SUGGESTED READINGS

1. Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education, 2006.
2. Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.
3. W. Stallings, Operating Systems, Internals & Design Principles , 5th Edition, Prentice Hall of India. 2008.
4. Pradhan, A., & Deshpande, A. V. (2014). Composing Mobile Apps: Learn, Explore and Apply using Android. Wiley Publications. ISBN: 978-81-265-4660-2.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Digital Image Computing</b>					
<b>Type of Course</b>	DCE					
<b>Course Code</b>	<b>24SACCSC7DE402</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	The course imparts a comprehensive knowledge about the digital image processing techniques					
<b>Semester</b>	7	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyze digital images, processing steps, acquisition, sampling, quantization, color models.	An	1,2
2	Apply spatial domain techniques for image enhancement effectively	A	2
3	Analyze and utilize frequency domain transformations for image enhancement.	An	2
4	Implement image restoration and segmentation techniques proficiently.	A	2

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Digital Image and Digital Image Processing	2	1
	1.2	Fundamental steps in Digital Image Processing	1	1
	1.3	Components of Image Processing system.	2	1
	1.4	Image sensing and acquisition	2	1
	1.5	Image sampling and quantization	2	1
	1.6	Relationships between pixels	2	1
	1.7	Color image fundamentals	2	1
	1.8	Color Models-RGB, CMY, HSI	2	1
2	2.1	Basic Intensity transformation functions - Image Negatives, Log Transformations, Power Law Transformations, Piecewise Linear Transformations,	3	2
	2.2	Histogram processing	3	2
	2.3	Spatial filtering – Spatial correlation and convolution	3	2
	2.4	Smoothing Spatial Filters	3	2
	2.5	Sharpening Spatial Filters - Laplacian Filter - Unsharp masking - High Boost Filter. Gradient operators	3	2
3	3.1	Introduction to Fourier transform: 1- DFT, 2 –D DFT and its Inverse Transform,	3	3

	3.2	Properties of 2-D DFT	3	3
	3.3	2-D Convolution theorem	3	3
	3.4	Filtering in the frequency domain	3	3
	3.5	Image Smoothing and Sharpening using Frequency Domain Filters- Ideal, Butterworth and Gaussian filters	3	3
4	4.1	Noise models-Gaussian Noise, Rayleigh Noise, Gamma Noise, Exponential Noise, Impulse Noise	2	4
	4.2	Restoration using Mean Filters, Order Statistics filters, Adaptive filters	2	4
	4.3	Edge models	2	4
	4.4	Edge Detection - Gradient operator, canny edge detector	3	4
	4.5	Thresholding- Global Thresholding using otsu's method	3	4
	4.6	Region based segmentation – Region growing, Region splitting and merging, watershed segmentation	3	4
5		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>• Lecturing</li> <li>• Collaborative learning</li> <li>• Self-directed learning</li> <li>• ICT enabled Lectures</li> </ul>
---------------------------------------	--

<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) -(20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)</p>

## REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods.(2010). Digital Image Processing(Third Edition).Pearson.

## SUGGESTED READINGS

1. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002.
2. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
3. William K. Pratt, Digital Image Processing, John Wiley, Fourth Edition, New York, 2002.
4. Milan Sonka et al, Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, Fourth edition, 2007.
5. AzrielRosenfield, Avinash C. Kak, "Digital Picture Processing", Morgan Kaufmann, 2nd Ed., 1982.
6. Bernd Jahne, "Digital Image Processing", Springer, 6th Ed., 2005.

	<h2>Department of Computer Science</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
---	---

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Big Data Management using R</b>					
<b>Type of Course</b>	DCE					
<b>Course Code</b>	<b>24SACCSC7DE403</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	The course provides a comprehensive exploration of big data analytics, covering fundamental concepts, the data analytics lifecycle, advanced tools, and practical skills in R programming for data analysis and visualization. Students will gain a deep understanding of the analytics process, from discovery to project operationalization, and develop proficiency in utilizing key technologies and methodologies in the field.					
<b>Semester</b>	7	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		34	0	0	0	60
<b>Pre-requisites, if any</b>						

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand big data analytics fundamentals, ecosystems, and key roles for successful analytics projects.	U	1
2	Navigate through the data analytics lifecycle, from discovery to operationalizing projects.	A	1,2
3	Describe the fundamental concepts and functionalities in R programming	U	2

4	Illustrate various data visualization techniques in R	U	2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Big Data Analytics: Big Data Overview –Data Structures - Analyst Perspective on Data Repositories - State of the Practice in Analytics	5	1
	1.2	BI versus Data Science - Current analytical architecture -Emerging big data Ecosystem - Key Roles for the New Big Data Ecosystem.	5	1
2	2.1	Data Analytics Lifecycle: Data Analytics Lifecycle Overview – Key roles for a successful Analytics project.	5	2
	2.2	Background and overview of data analytics life cycle.Phase 1: Discovery, Phase 2: Data Preparation, Phase 3:Model Planning, Phase 4: Model Building, Phase 5:Communicate Results, Phase 6: Operationalize. (Phases indetail by including all sub topics.)	10	2
3	3.1	Introduction to R – Basics - RStudio - R Data Types - Operators - Basic Read and Write functions	5	3
	3.2	R Objects: Vector, Matrix, Array, Data Frame, Factor, List()– Decision Making Statements – Control Structures	5	3
	3.3	Functions - Import and export Data into and from R: CSV, Text file, Excel file	5	3
	3.4	Exception Handling – Progress and Timing	5	3
4	4.1	Data Visualization in R: Scatter Plot, Boxplot, Bar Chart, Histogram, Box and Whiskers plot	5	4
	4.2	Using plots with Coordinate vector – Graphical Parameters – Adding Points, Lines and Text to an existing plot	5	4

	4.3	The ggplot2 package - R dplyr package - Data Manipulation commands: select, filter, arrange.	5	4
<b>5</b>		<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>• Lecturing</li> <li>• Collaborative learning</li> <li>• Self-directed learning</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <b>A. Continuous Comprehensive Assessment (CCA)</b> <b>CCA for Theory: 30 Marks</b> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol>
	<b>B. Semester End Examination</b> <b>ESE for Theory: 70 Marks(2 Hrs)</b> <b>Written Test (70 Marks)</b> Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions)- (6*5=30 Marks) Part C: Essay Questions (2 out of 4 Questions) -(2*10=20 Marks)

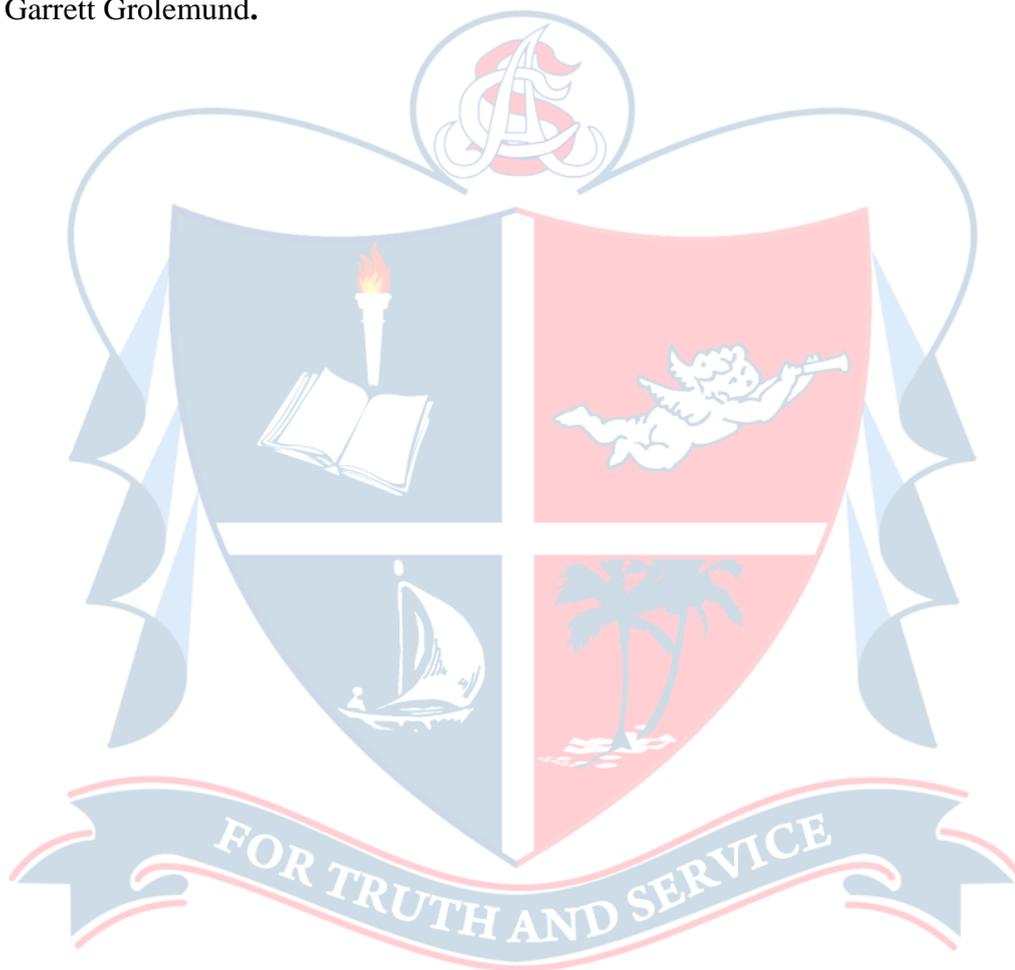
## REFERENCES

1. EMC Education Services. "Data Science and Big Data Analytics", WILEY
2. Tilman M. Davies.(2016). " The Book of R". No Starch Press
3. Seema Acharya.(2018). "Data Analytics Using R". McGraw Hill Education
4. "R for Data Science" by Hadley Wickham and Garrett Golemund.

## SUGGESTED READINGS

1. "Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier.

2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett.
3. "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die" by Eric Siegel.
4. "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services.
5. "Hands-On Programming with R: Write Your Own Functions and Simulations" by Garrett Golemund.



	<h2 style="margin: 0;">Department of Computer Science</h2> <h3 style="margin: 0;">St. Albert's College (Autonomous)</h3> <h3 style="margin: 0;">Ernakulam</h3>
---	--

<b>Programme</b>	B.Sc. (Honours) Computer Science					
<b>Course Name</b>	Block Chain Technology					
<b>Type of Course</b>	DSE					
<b>Course Code</b>	24SACCSC7DE404					
<b>Course Level</b>	400					
<b>Course Summary</b>	Able to build an awareness of block chain technology and how it can be used to process cryptocurrency transactions. By the end of the course, participants will gain a comprehensive understanding of block chain technology and its implications for decentralized systems.					
<b>Semester</b>	7	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>	Nil					60

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Familiarise Block chain Technology, definition of block chain.	U	PO1
2	Analyse the mining process.	An	PO2
3	Compare cryptocurrencies and Bitcoin.	E	PO2
4	Make use of the knowledge of blockchain components	A	PO1

	to describe the consensus mechanism.		
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Foundations of Blockchain Technology (Definition and Historical Evolution)	4	1
	1.2	Basics of Decentralized Systems and Components of Blockchain	4	1
	1.3	Cryptographic Principles in Blockchain	3	1
	1.4	Security in Blockchain Networks and Conclusion	3	1, 2
2	2.1	Blockchain: Architecture, Versions, Variants	3	1, 2, 3
	2.2	Use cases, Life use cases of blockchain	4	1
	2.3	Introduction to cryptocurrencies, Types, Applications.	4	1, 2
	2.4	Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.	4	1
3	3.1	Concept of Double Spending, Hashing, Proof of work.	5	1
	3.2	Bitcoin Network and payments, Bitcoin network, Wallets, Bitcoin payments	3	1, 2

	3.3	Innovation in Bitcoin, Bitcoin Clients and APIs.	3	1, 2
4	4.1	Introduction to Blockchain Platforms: Ethereum, Hyperledger, IOTA, EOS, Multichain and their Advantages and Disadvantages	3	1, 2
	4.2	Difference between block chain & bitcoin	3	1, 2, 3
5	5.1	Scalability Challenges and Solutions	3	1, 2
	5.2	Applications of Blockchain in Supply Chain Management	3	1, 2, 3
	5.3	Blockchain in Finance, Banking, Healthcare, and Voting Systems	4	2, 3
	5.4	Challenges, Regulations, and Future Trends	4	3

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>Lecture</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 30 Marks</b></p> <p>Written Test / Seminar / Viva/ Assignments</p>
	<b>B. Semester End Examination</b> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions)- (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) -(2*10=20 Marks)</p>

## References

1. "Mastering Bitcoin: Unlocking Digital Cryptocurrencies" by Andreas M. Antonopoulos, second edition, published in 2017. The publisher is O'Reilly Media.
2. "Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher, 2nd edition in 2022, published by St. Martin's Press.
3. "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World" by Don Tapscott and Alex Tapscott, published by Penguin Random House. The book was first published in 2016.
4. "Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations" by Henning Diedrich, Publisher Wildfire Publishing, 2016.
5. "Blockchain by Example: Decentralized applications using Bitcoin, Ethereum, and Hyperledger" by Bellaj Badr and Richard Horrocks published by Packt Publishing on November 30, 2018.
6. "Blockchain Applications: A Hands-On Approach" by Arshdeep Bahga and Vijay Madiseti., Publisher Arshdeep Bahga, 2017.

## SUGGESTED READINGS

1. "Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher, Edition: 2nd Edition, Publisher: Apress
2. "Mastering Bitcoin: Unlocking Digital Cryptocurrencies" by Andreas M. Antonopoulos, Edition: 2nd Edition, Publisher: O'Reilly Media
3. "Mastering Ethereum: Building Smart Contracts and DApps" by Andreas M. Antonopoulos and Gavin Wood, Edition: 2nd Edition, Publisher: O'Reilly Media
4. "Blockchain Applications: A Hands-On Approach" by Arshdeep Bahga and Vijay Madiseti, Edition: 1st Edition, Publisher: VPT
5. "Blockchain and Cryptocurrency Explained" by David Chismon, Edition: 1st Edition, Publisher: Wiley
6. "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World" by Don Tapscott and Alex Tapscott, Edition: 1st Edition, Publisher: Portfolio

	<h2>Department of Computer Science</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
---	---

<b>Programme</b>	B.Sc. (Honours) Computer Science					
<b>Course Name</b>	Web Security					
<b>Type of Course</b>	DSE					
<b>Course Code</b>	24SACCSC7DE405					
<b>Course Level</b>	400					
<b>Course Summary</b>	This course deals with web security issues, such as SQL injection, cross site scripting, and other web vulnerabilities – along with how to detect, defend and protect against such attacks.					
<b>Semester</b>	7	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
<b>Pre-requisites, if any</b>	Nil					

#### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Be able to evaluate a Web-based system with respect to its security requirements.	K,U	PO1
2	Understand the process of developing secure networked systems.	K,U	PO2
3	Understand the fundamental mechanisms of securing a Web-based system.	U	PO2

4	Be able to implement security mechanisms to secure a Web-server.	U, An	PO1
5	Understand security issues and common controls in Cloud Security.	U, An	PO3
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Application Level security- Key Problem factors – Core defence mechanisms	2	1
	1.2	Web Application Technologies – HTTP Protocol- Web Functionality- Encoding schemes- web spidering – User Directed spidering- Discovering hidden content	2	1
	1.3	Bypassing Client-Side Controls – Hidden form fields – HTTP cookies – URL parameters – Handling client side data securely.	5	1
	1.4	Attacking authentication – design flaws in authentication mechanisms –securing authentication.	4	1
	1.5	Attacking Users: Other Techniques – Client-Side Injection Attacks – Local Privacy Attacks.	5	1
2	2.1	SQL Injection: Attacks and Defence – Introduction: SQL Injection- How it happens - Dynamic string building - Insecure Database Configuration - finding SQL injection	4	2
	2.2	Exploiting SQL injection – Common techniques – identifying the database – Non-Blind fingerprint – UNION statements – Preventing SQL injection	4	2

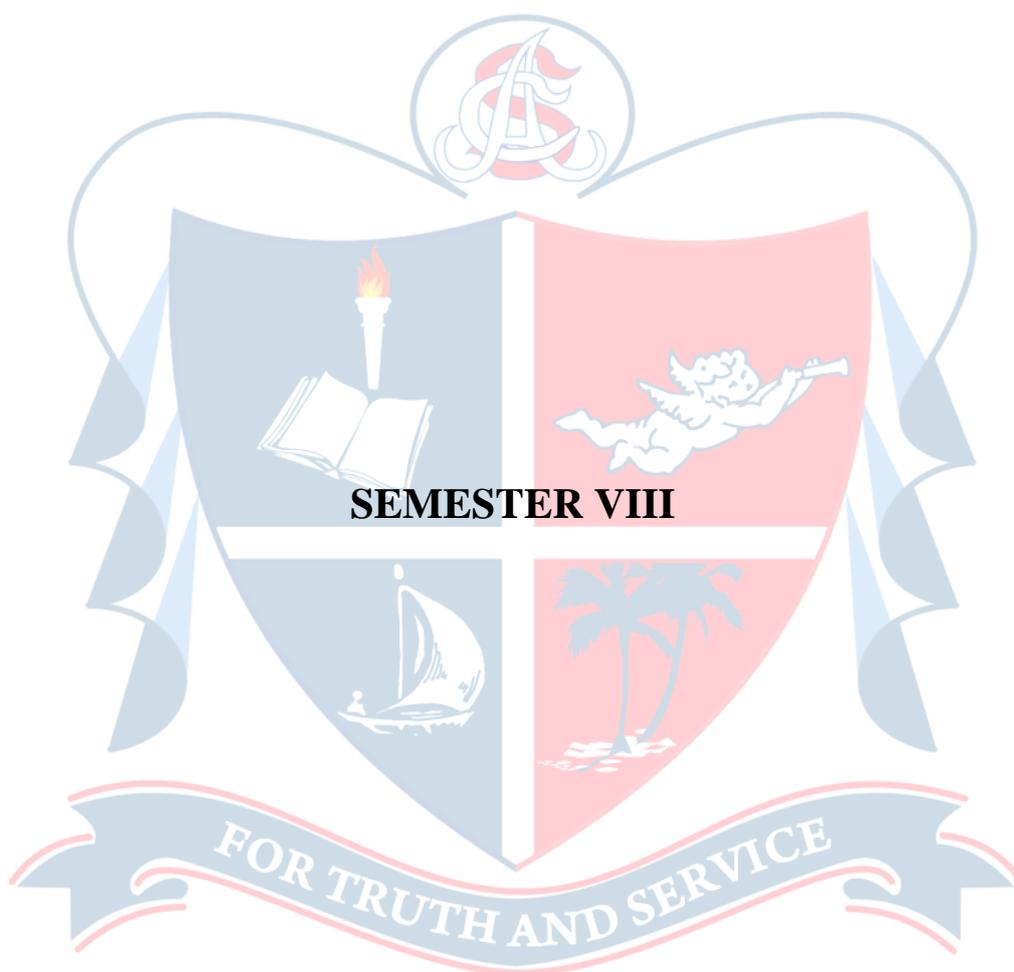
	2.3	Platform level defences - Using run time protection - web application Firewalls - Using ModSecurity	4	2
	2.4	Intercepting filters- Web server filters - application filters – AOP, IDSs- securing the database – Locking down the application data – Locking down the Database server.	6	
3	3.1	Mod Security –Virtual Patching- Creating a Virtual Patch- Blocking common attacks	4	3
	3.2	HTTP finger printing– Blocking proxied requests – Cross-site scripting–Cross-site request forgeries	4	3
	3.3	Shell command execution attempts – Null byte attacks – Blog spam – Website defacement – Chroot Jails-ModSecurity to create a Chroot Jail-REMO– rules Protecting a Web Application	6	3
4	4.1	Web server Hacking–Footprinting-Internet Footprinting-Source code disclosure– Canonicalization attacks–DoS – Web application hacking – Web crawling- Database Hacking	5	4
5	5.1	Cloud Security–Service Models-IaaS-PaaS-SaaS-Cloud Security ServicesSecure Cloud Software Testing-Cloud Penetration Testing.	5	4

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>• Lecture</li> </ul>
---------------------------------------	---

<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p>CCA for Theory: 30 Marks</p> <p>a. Written tests</p> <p>b. Assignments</p>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 70 Marks (2 Hrs)</b></p> <p><b>Written Test (70 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks)</p> <p>Part C: Essay Questions (2 out of 4 Questions) - (2*10=20 Marks)</p>

### References

1. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook, 2nd Edition, Wiley Publishing, Inc, 2011.
2. Justin Clarke, SQL Injection Attacks and Defense, Syngress Publication Inc, 2009.
3. Magnus Mischel, ModSecurity 2.5, Packt Publishing, 2009.
4. Stuart McClure Joel, ScambRay, George Kurtz, Hacking Exposed7: Network Security Secrets & Solutions, Seventh Edition, The McGraw-Hill Companies, 2012.
5. Ronald L. Krutz and Russell Dean Vines Cloud Security- A Comprehensive Guide to Secure Cloud Computing, Wiley Publishing, Inc, 2010.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Advanced Computer Networks</b>					
<b>Type of Course</b>	DCC					
<b>Course Code</b>	<b>24SACCSC8CC401</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	This advanced course focuses on the theoretical foundations and practical applications of networking algorithms and real-world network administration strategies. Students will delve into the complexities of network routing, congestion control, traffic management, and network security. They will gain hands-on experience in configuring and managing network devices using CCNA and CompTIA standards.					
<b>Semester</b>	8	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Preferably completed course on Networking Fundamentals					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the principles and importance of high-performance switching and routing in network architectures.	U	1
2	Apply Software-Defined Networking (SDN) and Network Function Virtualization (NFV) concepts in practical scenarios.	A	2
3	Evaluate the effectiveness and challenges of Information-Centric Networking (ICN) architectures in modern networks..	E	3
4	Create and design simulated network configurations	S	3

	integrating SDN, NFV, and Data Center Networking concepts.		
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	High Performance Switching and Routing ,Introduction to High Performance Switching and Routing, Performance considerations and IP address lookup.Algorithms and Optimization	7	1
	1.2	Hardware implementation of address lookup and optimization techniques.Packet Classification and QoS , Packet Classification Fundamentals , Methods and importance of packet classification.Quality of Service (QoS), Traffic shaping, differentiation, and QoS implementations.	8	1
2	2.1	Network Softwarization , Introduction to Network Softwarization, Overview of SDN, NFV, and programmable networks. Deep Dive into SDN and NFV, Software Defined Networking (SDN), Northbound and Southbound interfaces, SDN controllers, Mininet lab exercises	7	2
	2.2	Network Function Virtualization (NFV) , Architecture, concepts, and practical applications. Data Center Networking (DCN), Introduction to DCN. Understanding DCN and various network topologies. DCN Deep Dive , Container Network Interfaces (CNIs) and advanced DCN concepts.	8	2
3	3.1	Information-Centric Networking (ICN), Content Distribution and Architectures for ICN Principles and architectures of ICN.	7	3
	3.2	Advanced ICN Topics. Content Naming, Routing, Caching. In-depth study of content naming, routing, caching in ICN. Security in ICN Security aspects and challenges in ICN.	8	3

4	Practical Exercises in Switching, Routing, SDN, NFV, DCN, and ICN  Hands-on implementation, simulations, and lab exercises covering the course topics.	30	4
5	<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>• Collaborative learning</li> <li>• Self-directed learning</li> <li>• ICT enabled Lectures</li> </ul>
<b>Assessment Types</b>	<p style="text-align: center;"><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks</b></p> <ol style="list-style-type: none"> <li>1. Demonstration - 10 Marks</li> <li>2. Viva - 5 Marks</li> <li>3. Record - 5 Mark</li> </ol>

## REFERENCES

1. H. Jonathan Chao, Bin Liu, (2007). High Performance Switches and Routers. John Wiley & Sons, Inc. ISBN-10: 0-470-05367-4(Module 1)
2. Gabriel M. de Brito, Pedro B. Velloso, Igor M. Moraes, Wiley-ISTE.(2013). Information-Centric Networks: A New Paradigm for the Internet (Focus Series in Networks and Telecommunications).(1st edition).ISBN: 9781848214491(Module 2)
3. B. Wissingh, C. Wood, A. Afanasyev, L. Zhang, D. Oran and C. Tschudin, RFC 8793.(2020). Information-Centric Networking (ICN): Content Centric Networking (CCNx) and Named Data Networking (NDN) Terminology. (Module

## SUGGESTED READINGS

1. Software-Defined Networks: A Systems Approach, Peterson, Cascone, O'Connor, Vachuska, and Davie, Online Free Reference Book available at <https://sdn.systemsapproach.org/index.html>
2. Cloud Networking: Understanding Cloud-based Data Centre Networks, Gary Le (Author), Morgan Kaufmann (Publisher), 2014,ISBN-139780128007280



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Computational Research Methodology</b>					
<b>Type of Course</b>	DCC					
<b>Course Code</b>	<b>24SACCSC8CC402</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	The course in Research Methodology and Ethics for Computer Science provides a comprehensive understanding of fundamental research concepts, data analysis methods, and historical developments in computing research. Students will acquire analytical skills through hands-on applications of parametric tests and interdisciplinary research approaches. The curriculum emphasizes ethical considerations in research, addressing issues such as plagiarism, data misuse, and intellectual property rights. By the end of the course, students will be equipped with the knowledge and skills necessary to conduct ethical and rigorous research in the field of computer science					
<b>Semester</b>	8	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Basic understanding of computer science concepts and familiarity with academic writing and research principles					

### COURSE OUTCOMES (CO)

<b>CO No.</b>	<b>Expected Course Outcome</b>	<b>Learning Domains *</b>	<b>PO No</b>
1	Describe research methodology, including objectives, types, approaches, and significance	U,A	1,2
2	Explain the comprehensive framework of research methodology and scientific method	U	2
3	Describe the historical evolution of computing ideas, explore research methods, and analyze the application of computers in research.	U, An	3,6

4	Apply computer science research methodology to prepare a research paper	A	2
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Meaning, Objectives, Motivation, Types, Approaches and Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process,	5	1
	1.2	Reading and Reviewing-Research literature, Finding Research Papers, Critical Reading, Developing a literature Review,	5	1
	1.3	Guidelines for Research Skills and Awareness, Validity of Research, Criteria of Good Research.	5	1
2	2.1	Data analysis in Research: Introduction, Need for Data Collection, Methods of Data Collection	2	2
	2.2	Principles for Accessing Research Data, Data Processing, Data Analysis, Presentation of Data,	2	2
	2.3	Error Analysis, Scientific Models. Scientific Methodology - Introduction Rules and Principles of Scientific Method	3	2
	2.4	Hypothesis, Testing of Hypothesis, Basic concepts, Procedure, Important parametric tests: z-test, t-test, $\chi^2$ - square test, F test	4	2
	2.5	Ethics in Research, Technical Reports-Bibliography referencing and footnotes.	4	2
	2.6	Research in Practice- Literature Review, Journals, Conference Proceedings, journal Impact Factor, citation Index, h Index.	4	2
3	3.1	History of ideas in computing, Evolution of Computing Research	2	3
	3.2	Overview of Research Methods: Measurements based research methods - Deductive Methods - Inductive Methods.	3	3

	3.3	The significance of Interdisciplinary research for Computer Science	3	3
	3.4	Application of Computer in Research --MS office and its application in Research, Use of Internet in Research – Websites, search Engines, E-journal and E-Library	3	3
4	4.1	Prepare a research paper by applying the principles of literature review, hypothesis formulation, data collection, analysis, and ethical considerations in the context of computer science.	30	4
5		<b>Teacher specific content</b>		

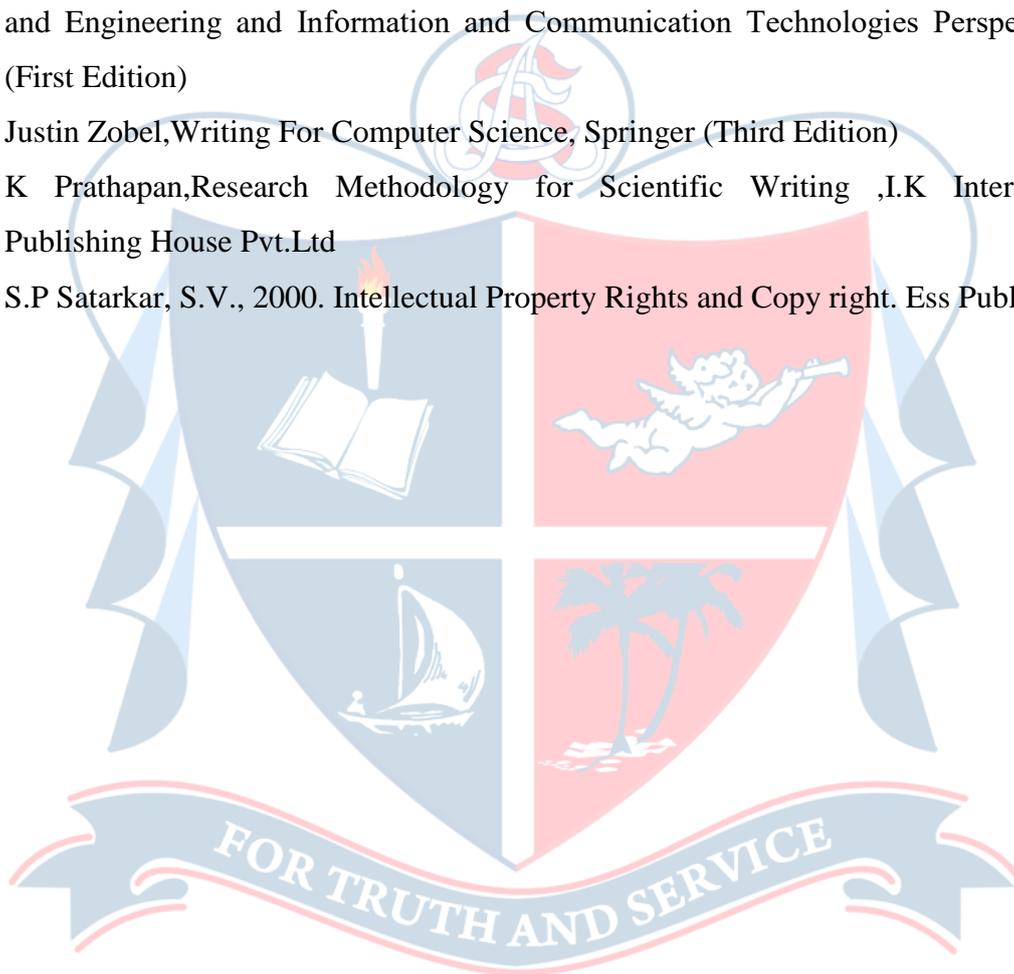
<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Presentations</li> <li>• Interactive sessions</li> <li>• Class discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written tests</li> <li>2. Assignments</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Literature Review</li> <li>2. Review Report</li> <li>3. Viva</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks</b></p> <ol style="list-style-type: none"> <li>1. Paper publication - 20 marks</li> <li>2. Viva - 5 marks</li> </ol>

## REFERENCES

1. Kothari, C.R.(1990). Research Methodology: Methods and Techniques. New Age International. Publishers( Second revised edition)

## SUGGESTED READINGS

1. Krishnan Nallaperumal, "Engineering Research Methodology : A Computer Science and Engineering and Information and Communication Technologies Perspective. " (First Edition)
2. Justin Zobel, Writing For Computer Science, Springer (Third Edition)
3. K Prathapan, Research Methodology for Scientific Writing ,I.K International Publishing House Pvt.Ltd
4. S.P Satarkar, S.V., 2000. Intellectual Property Rights and Copy right. Ess Publication





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Neural Networks and Deep Learning</b>					
<b>Type of Course</b>	DCE					
<b>Course Code</b>	<b>24SACCSC8DE401</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	Neural Networks and deep learning course covers fundamental concepts and practical skills in neural networks, CNNs, RNNs, GANs, and reinforcement learning using TensorFlow and PyTorch. Participants will gain hands-on experience in image processing, NLP, generative models, and unsupervised learning, fostering the ability to apply deep learning to real-world problems.					
<b>Semester</b>	8	<b>Credits</b>			4	<b>Total Hours</b>
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Others</b>	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Programming Knowledge, Basic Understanding of Artificial Intelligence and machine Learning					

### COURSE OUTCOMES (CO)

<b>CO No.</b>	<b>Expected Course Outcome</b>	<b>Learning Domains *</b>	<b>PO No</b>
1	Understand neural networks, activation functions, and backpropagation.	U	2,3
2	Design and implement CNN and RNN, apply transfer learning techniques, and utilize reinforcement learning algorithms for complex tasks.	A,An	1,2,3
3	Understand and apply GANs, including DCGAN and WGAN, as well as clustering and dimensionality reduction techniques.	U,A	1,2,3
4	Design and implement neural networks, CNNs, GANs, reinforcement learning algorithms, clustering algorithms, and dimensionality reduction techniques	A	2,3

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S),**

**Interest (I) and Appreciation (Ap)****COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	Basics of Neural Networks:-Neurons and their mathematical representation.	2	1
	1.2	Activation functions (e.g., sigmoid, ReLU). Feedforward process and the role of weights and biases	2	1
	1.3	Backpropagation algorithm for training neural networks	2	1
	1.4	Deep Learning Frameworks:-Introduction to TensorFlow and PyTorch.	2	1
	1.5	Setting up the development environment, Overview of basic operations and syntax	2	1
2	2.1	Convolution and Pooling Layers:-Understanding convolutional and pooling operations. Stride, padding, and filter design. CNN Architectures:- In-depth study of popular architectures (LeNet, AlexNet, VGG, ResNet). Parameters and design choices.	7	2
	2.2	Transfer Learning:-Leveraging pre-trained models for specific tasks. Fine-tuning models for custom datasets.	6	2
	2.3	Basics of Recurrent Neural Networks:-Concept of sequential data processing. Vanishing gradient problem and solutions.LSTM and GRU:- In-depth study of advanced RNN architectures, Handling long-term dependencies	6	2
	2.4	Basics of Reinforcement Learning:-Markov Decision Processes (MDPs), Exploration-exploitation trade-off. Q-Learning and DQN:-Core algorithms for reinforcement learning, Deep Q Networks for handling complex state spaces.	6	2
3	3.1	Introduction to GANs:-Generative models and their applications, Understanding adversarial training. GAN.	5	3

	3.2	Architectures:- DCGAN (Deep Convolutional GAN), WGAN (Wasserstein GAN). Exploring variations and improvements. Unsupervised Learning:-Clustering algorithms (e.g., KMeans).Dimensionality reduction technique	5	3
4	4.1	Practical: 1. Implementing a basic neural network using TensorFlow or PyTorch. 2. Image Classification using CNNs, Generating Synthetic Images with GANs, Implementing RL algorithms on simple environments. 3. Implementing k-mean Clustering Algorithm, Apply PCA for a sample dataset and classify.	30	4
5		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Presentations</li> <li>• Demonstration</li> <li>• Discussions</li> </ul>
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> <li>3. Quiz</li> <li>4. Viva</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End Examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) -(4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p>

	<p><b>ESE for Practical: 20 Marks</b></p> <ol style="list-style-type: none"><li>1. Coding and Output - 10 Marks</li><li>2. Viva - 5 Marks</li><li>3. Record - 5 Marks</li></ol>
--	---

## REFERENCES

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville;[Module1]
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.[Module 1]
3. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani;[Module2]
4. "Deep Reinforcement Learning" by Pieter Abbeel and John Schulman.[Module 3]
5. "Generative Deep Learning" by David Foster; [Module4] Page 204 of 222
6. "Unsupervised Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.[Module 4]

## SUGGESTED READINGS

1. "Deep Learning with Python" by François Chollet.
2. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto;



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Pattern Recognition</b>					
<b>Type of Course</b>	DCE					
<b>Course Code</b>	<b>24SACCSC8DE402</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	Pattern recognition course provides a comprehensive exploration of fundamental concepts, including Bayesian Decision Theory, linear discriminant functions, and nonparametric techniques. Students will develop practical skills in applying these principles to real-world problems, mastering Bayesian parameter estimation, support vector machines, and stochastic/nonmetric methods for effective pattern recognition..					
<b>Semester</b>	8	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Must know programming, Basic Mathematics, fundamental knowledge of machine learning					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand Pattern Recognition Fundamentals and the principles of Bayesian Decision Theory	U	2,3
2	Analyse Bayesian Parameter Estimation and Nonparametric techniques	An	1, 2,3
3	Implement and analyze linear discriminant functions, support vector machines, multilayer neural networks, and various stochastic and nonmetric methods for classification and inference.	A, An	1,2,3
4	Implement Pattern Recognition techniques for solving Real	C	2,3

	World Problem.		
<b>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</b>			

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Pattern recognition systems: – The design cycle, Learning and Adaptation.	2	1
	1.2	Bayesian Decision theory:- two-category classification ,Minimum error rate classification.	3	1
	1.3	Classifiers, Discriminant functions and Decision Surfaces , The normal density.	5	1
		Discriminant Functions for the Normal Density, Error probabilities and Integrals, Discrete Features, Missing and Noisy Features.		
2	2.1	Bayesian Parameter estimation and Nonparametric Techniques:- Maximum likelihood estimation, Bayesian estimation	2	2
	2.2	Bayesian Parameter Estimation: Gaussian case and general theory.	2	2
	2.3	Nonparametric techniques: – Density estimation, Parzen Windows,	4	2
	2.4	kn-Nearest Neighbour Estimation, Nearest-Neighbour Rule, Fuzzy Classification.	7	2
3	3.1	Linear Discriminant Functions: - Linear discriminant functions and decision surfaces	2	3
	3.2	Generalized linear discriminant functions, Two-category linearly separable case.Non-separable behaviour, Linear programming algorithms, Support vector machines.	5	3
	3.3	Multilayer neural networks :- Feedforward operation and classification. Backpropagation algorithm, Error surfaces, Backpropagation as feature mapping.	2	3
	3.4	Stochastic methods and Nonmetric methods: – Stochastic search, Boltzmann learning.	9	3

		Nonmetric methods: - Decision trees ,CART, Other tree methods(ID3,C4.5) - Grammatical methods, Grammatical inference.		
	4.1	Practical Implement following Pattern Recognition Methods 1. Bayesian Decision Theory 2. Bayesian Parameter Estimation 3. Nearest Neighbour Rule 4. Fuzzy Classification 5. Support Vector Machine 6. Multilayer Neural Networks 7. Boltzmann Learning 8. Decision Trees 9. CART 10. ID3,C4.5	7	4
5		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> • Lecture • Demonstration • Presentation • discussions
<b>Assessment Types</b>	<b>MODE OF ASSESSMENT</b>  <b>A. Continuous Comprehensive Assessment (CCA)</b> <b>CCA for Theory: 25 Marks</b> 1. Written test 2. Assignments 3. Quiz 4. Viva  <b>CCA for Practical: 5 Marks</b> 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva

	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks )</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"><li>1. Coding and Output - 10 Marks</li><li>2. Viva - 5 Marks</li><li>3. Record - 5 Mark</li></ol>
--	--

#### REFERENCES

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, Second edition, John Wiley, 2006

#### SUGGESTED READINGS

1. S Thodoridis,K Koutroumbas, Pattern Recognition,Fourth Edition, ELSEVIER Publication.
2. Gonzalez R.C. & Thomson M.G., Syntactic Pattern Recognition - An Introduction, Addison Wesley.
3. Fu K.S., Syntactic Pattern Recognition And Applications, Prentice Hall
4. RajanShinghal, Pattern Recognition: Techniques and Applications, Oxford University Press, 2008.



## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>Generative AI</b>					
<b>Type of Course</b>	DCE					
<b>Course Code</b>	<b>24SACCSC8DE403</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	This course introduces students to the dynamic field of Generative Artificial Intelligence (Generative AI), covering foundational concepts, model architectures, and practical applications. The curriculum is structured into four modules, each addressing key aspects of Generative AI					
<b>Semester</b>	8	Credits			4	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
<b>Pre-requisites, if any</b>	Basic knowledge of machine learning.					

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe generative models' ethical usage, including bias and fairness.	U	1
2	Apply GANs and VAEs: Implementing architectures, training models, and exploring applications.	A	2
3	Explore recent advances in generative AI:	An	2
4	Apply generative models (GANs, VAEs) using	A	2

Python/TensorFlow.		
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)		

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Overview of Generative Models, Introduction to generative models and their role in artificial intelligence. Understanding the difference between generative and discriminative models	4	1
	1.2	Types of Generative Models, Probabilistic models: Gaussian Mixture Models (GMM), Hidden Markov Models (HMM). Variational Autoencoders (VAEs) and their applications.	3	1
	1.3	Introduction to Generative Adversarial Networks (GANs). Applications, Ethical Considerations and Privacy concerns related to generative models. Understanding bias and fairness in generative AI. Responsible use of generative models in various domains.	3	1
2	2.1	Introduction to GANs Core concepts of GANs: generator, discriminator, adversarial training. Historical development and key milestones in GAN research.	2	2
	2.2	Architectures and Variants of GANs, DCGAN, WGAN, and other variants. Conditional GANs and their applications	3	2
	2.3	Training and Stability Issues: Techniques for stable GAN	3	

		training. Dealing with mode collapse and other common issues.		
	2.4	Applications of GANs: Image-to-image translation using GANs. Super-resolution and style transfer.	3	2
	2.5	Introduction to VAEs: Understanding the encoder-decoder architecture. The role of variational inference in VAEs	3	2
	2.6	Training VAEs: The reparameterization trick and back propagation. Comparing VAEs to traditional auto encoders.	3	2
	2.7	Applications of VAEs: Image generation and reconstruction. Latent space exploration and manipulation. VAEs in semi-supervised learning.	3	2
3	3.1	Advanced Topics and Future Directions: Recent Advances in Generative AI Attention mechanisms in generative models. Self-supervised learning and its application in generative tasks	4	3
	3.2	Generative AI in Industry, Use cases and applications in various industries. Challenges and opportunities in deploying generative models.	4	3
	3.3	Research Trends and Future Directions, Cutting-edge research in generative AI. Potential breakthroughs and challenges on the horizon.	4	3
	3.4	Final Project and Capstone, Students work on a generative AI project of their choice. Presentation and discussion of project outcomes.	3	3
4	4.1	1: Introduction to Python and TensorFlow: Setting up TensorFlow environment, Basic operations in TensorFlow.	30	4

	<p>2: Fundamentals of Generative Models: Implementing basic probabilistic models (Gaussian Mixture Models, Hidden Markov Models) using Python. Hands-on exercise on Variational Auto encoders (VAEs).</p> <p>3: Introduction to Generative Adversarial Networks (GANs): Building a simple GAN model for generating synthetic data. Understanding the generator and discriminator networks. Training a GAN on a small dataset.</p> <p>4: Advanced GANs and Applications: Implementing conditional GANs for specific tasks. Exploring image-to-image translation using Pix2Pix or CycleGAN. Applying GANs in medical imaging or other domains.</p> <p>5: Variational Auto encoders (VAEs) in Depth: Building a VAE for image generation. Understanding the concept of latent space. Exploring applications in semi-supervised learning.</p> <p>6: Attention Mechanisms and Self-Supervised Learning: Implementing attention mechanisms in generative models. Hands-on with self-supervised learning techniques.</p>		
5	<b>Teacher specific content</b>		

<b>Teaching and Learning Approach</b>	<p><b>Classroom Procedure (Mode of transaction)</b></p> <ul style="list-style-type: none"> <li>● ICT Enabled lecture</li> <li>● Interactive sessions</li> <li>● Class discussions</li> <li>● Lab exercise</li> </ul>
---------------------------------------	--

<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>CCA for Theory: 25 Marks</b></p> <ol style="list-style-type: none"> <li>1. Written test</li> <li>2. Assignments</li> <li>3. Quiz</li> <li>4. Viva</li> </ol> <p><b>CCA for Practical: 5 Marks</b></p> <ol style="list-style-type: none"> <li>1. Practical assignments</li> <li>2. Lab Record</li> <li>3. Observation of practical skills</li> <li>4. Viva</li> </ol>
	<p><b>B. Semester End examination</b></p> <p><b>ESE for Theory: 50 Marks (1.5 Hrs)</b></p> <p><b>Written Test (50 Marks)</b></p> <p>Part A: MCQ (Answer all) - (20*1=20 Marks)</p> <p>Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)</p> <p>Part C: Essay Questions (1 out of 2 Questions) - (1*10=10 Marks)</p> <p><b>ESE for Practical: 20 Marks (1.5 Hrs)</b></p> <ol style="list-style-type: none"> <li>1. Coding and Output - 10 Marks</li> <li>2. Viva - 5 Marks</li> <li>3. Record - 5 Mark</li> </ol>

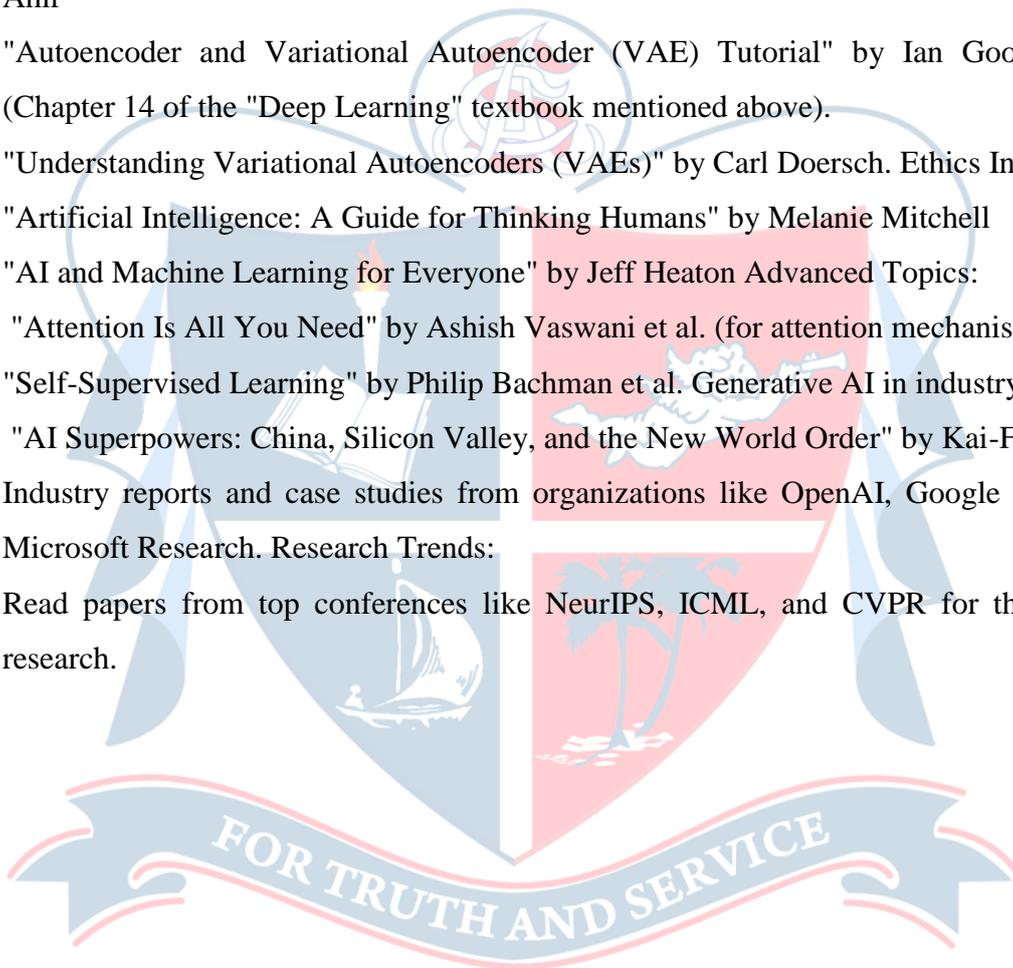
**REFERENCES**

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville(2016) . Deep Learning" . MIT Press
2. David Foster(2019)."Generative Deep Learning". O'Reilly Media

3. "Hands-On Generative Adversarial Networks with Keras" by Rajalingappaa Shanmugamani

### SUGGESTED READINGS

1. Generative Adversarial Networks(GANs):"GANs in Action" by Jakub Langr and Vladimir Bok
2. "Generative Adversarial Networks: Building Intelligent Applications" by Kailash Ahir
3. "Autoencoder and Variational Autoencoder (VAE) Tutorial" by Ian Goodfellow (Chapter 14 of the "Deep Learning" textbook mentioned above).
4. "Understanding Variational Autoencoders (VAEs)" by Carl Doersch. Ethics In AI.
5. "Artificial Intelligence: A Guide for Thinking Humans" by Melanie Mitchell
6. "AI and Machine Learning for Everyone" by Jeff Heaton Advanced Topics:
7. "Attention Is All You Need" by Ashish Vaswani et al. (for attention mechanisms).
8. "Self-Supervised Learning" by Philip Bachman et al. Generative AI in industry:
9. "AI Superpowers: China, Silicon Valley, and the New World Order" by Kai-Fu Lee
10. Industry reports and case studies from organizations like OpenAI, Google AI, and Microsoft Research. Research Trends:
11. Read papers from top conferences like NeurIPS, ICML, and CVPR for the latest research.





## Department of Computer Science St. Albert's College (Autonomous) Ernakulam

<b>Programme</b>	<b>BSc (Honours) Computer Science</b>					
<b>Course Name</b>	<b>PROJECT/Dissertation</b>					
<b>Type of Course</b>	PRJ					
<b>Course Code</b>	<b>24SACCSC8PR401</b>					
<b>Course Level</b>	<b>400</b>					
<b>Course Summary</b>	Students are required to take up research projects under the guidance of a faculty member. The students are required to complete the Research Project in the eighth semester					
<b>Semester</b>		Credits			12	Total Hours
<b>Course Details</b>	Learning Approach	Lecture	Tutorial	Practical	Others	
<b>Pre-requisites, if any</b>						

### COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Design research problem and align research objective	A	1,2,3,8
2	Demonstrate skills in literature review, data collection, analysis, interpretation, and reporting.	A	1,2,3
3	Appraise research design, methods and experiments used.	A	1,2,3
4	Interpret the findings in relation to research objective	A	1,2, 3
5	Communicates clearly and effectively, both verbally, visually and in writing	A	1,2,3,4

**\*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

**COURSE CONTENT****Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	1.1	The students who want to graduate as BSc (Honours with Research) are required to complete the Research Project in the eighth semester. Research Project must be done under the guidance of an eligible faculty.	8	1

<b>Teaching and Learning Approach</b>	<ul style="list-style-type: none"> <li>Classroom Procedure (Mode of transaction)</li> </ul>
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA) - (60 marks)</b></p> <p>i. Review 1: Problem statement (CO1)– (10 marks)</p> <p>ii. Review 2: Literature Review, Gap Analysis, Research Objectives (CO2) – (20 marks)</p> <p>iii. Review 3 (CO3): Methodology and Design- (20 marks)</p> <p>iv. Review 4 (CO4 &amp; CO5): (20 marks)</p> <p>a) Experiments and Results</p> <p>b) Presentation and Viva Voce</p>
	<p><b>B. Semester End examination (140 marks)</b></p> <p>i. Problem statement (CO1): 10 marks</p> <p>ii. Literature Review, Gap Analysis, Research Objectives – (CO2): 30 marks</p> <p>iii. Methodology and Design (CO3): 30 marks</p> <p>iv. Experiments and Results (CO4): 30 marks</p> <p>v. Thesis Presentation and Viva Voce (CO5): 25 marks</p> <p>vi. Publication (CO5):15 marks</p>